JMAP
REGENTS BY STATE
STANDARD: TOPIC

NY Algebra I Regents Exam Questions from Spring 2013
to January 2019 Sorted by State Standard: Topic

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1 When solving the equation $4(3x^2 + 2) - 9 = 8x^2 + 7$, Emily wrote $4(3x^2 + 2) = 8x^2 + 16$ as her first step. Which property justifies Emily's first step?
1) addition property of equality
2) commutative property of addition
3) multiplication property of equality
4) distributive property of multiplication over addition

2 A part of Jennifer's work to solve the equation $2(6x^2 - 3) = 11x^2 - x$ is shown below.
Given: $2(6x^2 - 3) = 11x^2 - x$
Step 1: $12x^2 - 6 = 11x^2 - x$
Which property justifies her first step?
1) identity property of multiplication
2) multiplication property of equality
3) commutative property of multiplication
4) distributive property of multiplication over subtraction

3 When solving the equation $12x^2 - 7x = 6 - 2(x^2 - 1)$, Evan wrote $12x^2 - 7x = 6 - 2x^2 + 2$ as his first step. Which property justifies this step?
1) subtraction property of equality
2) multiplication property of equality
3) associative property of multiplication
4) distributive property of multiplication over subtraction

4 Britney is solving a quadratic equation. Her first step is shown below.
Problem: $3x^2 - 8 - 10x = 3(2x + 3)$
Step 1: $3x^2 - 10x - 8 = 6x + 9$
Which two properties did Britney use to get to step 1?
I. addition property of equality
II. commutative property of addition
III. multiplication property of equality
IV. distributive property of multiplication over addition
1) I and III
2) I and IV
3) II and III
4) II and IV

5 Christopher looked at his quiz scores shown below for the first and second semester of his Algebra class.
Semester 1: 78, 91, 88, 83, 94
Semester 2: 91, 96, 80, 77, 88, 85, 92
Which statement about Christopher's performance is correct?
1) The interquartile range for semester 1 is greater than the interquartile range for semester 2.
2) The median score for semester 1 is greater than the median score for semester 2.
3) The mean score for semester 2 is greater than the mean score for semester 1.
4) The third quartile for semester 2 is greater than the third quartile for semester 1.
6 The two sets of data below represent the number of runs scored by two different youth baseball teams over the course of a season.
   Team A: 4, 8, 5, 12, 3, 9, 5, 2
   Team B: 5, 9, 11, 4, 6, 11, 2, 7
Which set of statements about the mean and standard deviation is true?
1) mean \( A \) < mean \( B \)
   standard deviation \( A \) > standard deviation \( B \)
2) mean \( A \) > mean \( B \)
   standard deviation \( A \) < standard deviation \( B \)
3) mean \( A \) < mean \( B \)
   standard deviation \( A \) < standard deviation \( B \)
4) mean \( A \) > mean \( B \)
   standard deviation \( A \) > standard deviation \( B \)

7 Corinne is planning a beach vacation in July and is analyzing the daily high temperatures for her potential destination. She would like to choose a destination with a high median temperature and a small interquartile range. She constructed box plots shown in the diagram below.
Which destination has a median temperature above 80 degrees and the smallest interquartile range?
1) Ocean Beach
2) Whispering Palms
3) Serene Shores
4) Pelican Beach

8 Noah conducted a survey on sports participation. He created the following two dot plots to represent the number of students participating, by age, in soccer and basketball.

Which statement about the given data sets is correct?
1) The data for soccer players are skewed right.
2) The data for soccer players have less spread than the data for basketball players.
3) The data for basketball players have the same median as the data for soccer players.
4) The data for basketball players have a greater mean than the data for soccer players.
9 Isaiah collects data from two different companies, each with four employees. The results of the study, based on each worker’s age and salary, are listed in the tables below.

<table>
<thead>
<tr>
<th>Company 1</th>
<th>Worker’s Age in Years</th>
<th>Salary in Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>30,000</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>32,000</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>35,000</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>38,000</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Company 2</th>
<th>Worker’s Age in Years</th>
<th>Salary in Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>29,000</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>35,500</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>37,000</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>65,000</td>
<td></td>
</tr>
</tbody>
</table>

Which statement is true about these data?

1) The median salaries in both companies are greater than $37,000.
2) The mean salary in company 1 is greater than the mean salary in company 2.
3) The salary range in company 2 is greater than the salary range in company 1.
4) The mean age of workers at company 1 is greater than the mean age of workers at company 2.

10 The students in Mrs. Lankford’s 4th and 6th period Algebra classes took the same test. The results of the scores are shown in the following table:

<table>
<thead>
<tr>
<th></th>
<th>$\bar{x}$</th>
<th>$\sigma$</th>
<th>n</th>
<th>min</th>
<th>$Q_1$</th>
<th>med</th>
<th>$Q_3$</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th Period</td>
<td>77.75</td>
<td>10.79</td>
<td>20</td>
<td>58</td>
<td>69</td>
<td>76.5</td>
<td>87.5</td>
<td>96</td>
</tr>
<tr>
<td>6th Period</td>
<td>78.4</td>
<td>9.83</td>
<td>20</td>
<td>59</td>
<td>71.5</td>
<td>78</td>
<td>88</td>
<td>96</td>
</tr>
</tbody>
</table>

Based on these data, which class has the larger spread of test scores? Explain how you arrived at your answer.
11 Santina is considering a vacation and has obtained high-temperature data from the last two weeks for Miami and Los Angeles.

<table>
<thead>
<tr>
<th>Miami</th>
<th>76</th>
<th>75</th>
<th>83</th>
<th>73</th>
<th>60</th>
<th>66</th>
<th>76</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>81</td>
<td>83</td>
<td>85</td>
<td>83</td>
<td>87</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Los Angeles</th>
<th>74</th>
<th>63</th>
<th>65</th>
<th>67</th>
<th>65</th>
<th>65</th>
<th>65</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>62</td>
<td>62</td>
<td>72</td>
<td>69</td>
<td>64</td>
<td>64</td>
<td>61</td>
</tr>
</tbody>
</table>

Which location has the least variability in temperatures? Explain how you arrived at your answer.

12 The table below shows the annual salaries for the 24 members of a professional sports team in terms of millions of dollars.

<table>
<thead>
<tr>
<th></th>
<th>0.5</th>
<th>0.5</th>
<th>0.6</th>
<th>0.7</th>
<th>0.75</th>
<th>0.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>1.0</td>
<td>1.1</td>
<td>1.25</td>
<td>1.3</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>1.8</td>
<td>2.5</td>
<td>3.7</td>
<td>3.8</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>4.6</td>
<td>5.1</td>
<td>6</td>
<td>6.3</td>
<td>7.2</td>
<td></td>
</tr>
</tbody>
</table>

The team signs an additional player to a contract worth 10 million dollars per year. Which statement about the median and mean is true?

1) Both will increase.  
2) Only the median will increase.  
3) Only the mean will increase.  
4) Neither will change.

13 The heights, in inches, of 12 students are listed below.

61, 67, 72, 62, 65, 59, 60, 79, 60, 61, 64, 63

Which statement best describes the spread of these data?

1) The set of data is evenly spread.  
2) The median of the data is 59.5.  
3) The set of data is skewed because 59 is the only value below 60.  
4) 79 is an outlier, which would affect the standard deviation of these data.
14 The 15 members of the French Club sold candy bars to help fund their trip to Quebec. The table below shows the number of candy bars each member sold.

<table>
<thead>
<tr>
<th>Number of Candy Bars Sold</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>45</td>
</tr>
<tr>
<td>68</td>
</tr>
</tbody>
</table>

When referring to the data, which statement is false?
1) The mode is the best measure of central tendency for the data.
2) The data have two outliers.
3) The median is 53.
4) The range is 120.

S.ID.B.5: FREQUENCY TABLES

15 A public opinion poll was taken to explore the relationship between age and support for a candidate in an election. The results of the poll are summarized in the table below.

<table>
<thead>
<tr>
<th>Age</th>
<th>For</th>
<th>Against</th>
<th>No Opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-40</td>
<td>30</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>41-60</td>
<td>20</td>
<td>40</td>
<td>15</td>
</tr>
<tr>
<td>Over 60</td>
<td>25</td>
<td>35</td>
<td>15</td>
</tr>
</tbody>
</table>

What percent of the 21-40 age group was for the candidate?
1) 15
2) 25
3) 40
4) 60

16 A radio station did a survey to determine what kind of music to play by taking a sample of middle school, high school, and college students. They were asked which of three different types of music they prefer on the radio: hip-hop, alternative, or classic rock. The results are summarized in the table below.

<table>
<thead>
<tr>
<th></th>
<th>Hip-Hop</th>
<th>Alternative</th>
<th>Classic Rock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle School</td>
<td>28</td>
<td>18</td>
<td>4</td>
</tr>
<tr>
<td>High School</td>
<td>22</td>
<td>22</td>
<td>6</td>
</tr>
<tr>
<td>College</td>
<td>16</td>
<td>20</td>
<td>14</td>
</tr>
</tbody>
</table>

What percentage of college students prefer classic rock?
1) 14%
2) 28%
3) 33%
4) 58%
17 Students were asked to name their favorite sport from a list of basketball, soccer, or tennis. The results are shown in the table below.

<table>
<thead>
<tr>
<th></th>
<th>Basketball</th>
<th>Soccer</th>
<th>Tennis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls</td>
<td>42</td>
<td>58</td>
<td>20</td>
</tr>
<tr>
<td>Boys</td>
<td>84</td>
<td>41</td>
<td>5</td>
</tr>
</tbody>
</table>

What percentage of the students chose soccer as their favorite sport?
1) 39.6%  
2) 41.4%  
3) 50.4%  
4) 58.6%

18 An outdoor club conducted a survey of its members. The members were asked to state their preference between skiing and snowboarding. Each member had to pick one. Of the 60 males, 45 stated they preferred to snowboard. Twenty-two of the 60 females preferred to ski. What is the relative frequency that a male prefers to ski?
1) 0.125  
2) 0.25  
3) 0.333  
4) 0.405

19 The school newspaper surveyed the student body for an article about club membership. The table below shows the number of students in each grade level who belong to one or more clubs.

<table>
<thead>
<tr>
<th></th>
<th>1 Club</th>
<th>2 Clubs</th>
<th>3 or More Clubs</th>
</tr>
</thead>
<tbody>
<tr>
<td>9th</td>
<td>90</td>
<td>33</td>
<td>12</td>
</tr>
<tr>
<td>10th</td>
<td>125</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>11th</td>
<td>87</td>
<td>22</td>
<td>18</td>
</tr>
<tr>
<td>12th</td>
<td>75</td>
<td>27</td>
<td>23</td>
</tr>
</tbody>
</table>

If there are 180 students in ninth grade, what percentage of the ninth grade students belong to more than one club?

20 A statistics class surveyed some students during one lunch period to obtain opinions about television programming preferences. The results of the survey are summarized in the table below.

<table>
<thead>
<tr>
<th>Programming Preferences</th>
<th>Comedy</th>
<th>Drama</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>70</td>
<td>35</td>
</tr>
<tr>
<td>Female</td>
<td>48</td>
<td>42</td>
</tr>
</tbody>
</table>

Based on the sample, predict how many of the school's 351 males would prefer comedy. Justify your answer.
21 A survey of 100 students was taken. It was found that 60 students watched sports, and 34 of these students did not like pop music. Of the students who did not watch sports, 70% liked pop music. Complete the two-way frequency table.

<table>
<thead>
<tr>
<th></th>
<th>Watch Sports</th>
<th>Don’t Watch Sports</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Like Pop</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Don’t Like Pop</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
22 The heights, in feet, of former New York Knicks basketball players are listed below.
6.4 6.9 6.3 6.2 6.3 6.0 6.1 6.3 6.8 6.2
6.5 7.1 6.4 6.3 6.5 6.5 6.4 7.0 6.4 6.3
6.2 6.3 7.0 6.4 6.5 6.5 6.5 6.0 6.2

Using the heights given, complete the frequency table below.

<table>
<thead>
<tr>
<th>Interval</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.0-6.1</td>
<td></td>
</tr>
<tr>
<td>6.2-6.3</td>
<td></td>
</tr>
<tr>
<td>6.4-6.5</td>
<td></td>
</tr>
<tr>
<td>6.6-6.7</td>
<td></td>
</tr>
<tr>
<td>6.8-6.9</td>
<td></td>
</tr>
<tr>
<td>7.0-7.1</td>
<td></td>
</tr>
</tbody>
</table>

Based on the frequency table created, draw and label a frequency histogram on the grid below.

Determine and state which interval contains the upper quartile. Justify your response.
23. Which statistic can **not** be determined from a box plot representing the scores on a math test in Mrs. DeRidder's algebra class?
   1) the lowest score
   2) the median score
   3) the highest score
   4) the score that occurs most frequently

24. The box plot below summarizes the data for the average monthly high temperatures in degrees Fahrenheit for Orlando, Florida.

   ![Box plot](image)

   The third quartile is
   1) 92
   2) 90
   3) 83
   4) 71

25. Robin collected data on the number of hours she watched television on Sunday through Thursday nights for a period of 3 weeks. The data are shown in the table below.

<table>
<thead>
<tr>
<th></th>
<th>Sun</th>
<th>Mon</th>
<th>Tues</th>
<th>Wed</th>
<th>Thurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>4</td>
<td>3</td>
<td>3.5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Week 2</td>
<td>4.5</td>
<td>5</td>
<td>2.5</td>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td>Week 3</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1.5</td>
<td>2.5</td>
</tr>
</tbody>
</table>

   Using an appropriate scale on the number line below, construct a box plot for the 15 values.
26 The dot plot shown below represents the number of pets owned by students in a class.

Which statement about the data is not true?
1) The median is 3.
2) The interquartile range is 2.
3) The mean is 3.
4) The data contain no outliers.

27 The scatter plot below shows the relationship between the number of members in a family and the amount of the family's weekly grocery bill.

The most appropriate prediction of the grocery bill for a family that consists of six members is
1) $100
2) $300
3) $400
4) $500

28 What type of relationship exists between the number of pages printed on a printer and the amount of ink used by that printer?
1) positive correlation, but not causal
2) positive correlation, and causal
3) negative correlation, but not causal
4) negative correlation, and causal

29 Which situation does not describe a causal relationship?
1) The higher the volume on a radio, the louder the sound will be.
2) The faster a student types a research paper, the more pages the paper will have.
3) The shorter the distance driven, the less gasoline that will be used.
4) The slower the pace of a runner, the longer it will take the runner to finish the race.

30 The data obtained from a random sample of track athletes showed that as the foot size of the athlete decreased, the average running speed decreased. Which statement is best supported by the data?
1) Smaller foot sizes cause track athletes to run slower.
2) The sample of track athletes shows a causal relationship between foot size and running speed.
3) The sample of track athletes shows a correlation between foot size and running speed.
4) There is no correlation between foot size and running speed in track athletes.
Beverly did a study this past spring using data she collected from a cafeteria. She recorded data weekly for ice cream sales and soda sales. Beverly found the line of best fit and the correlation coefficient, as shown in the diagram below.

Given this information, which statement(s) can correctly be concluded?
I. Eating more ice cream causes a person to become thirsty.
II. Drinking more soda causes a person to become hungry.
III. There is a strong correlation between ice cream sales and soda sales.

1) I, only
2) III, only
3) I and III
4) II and III
S.ID.B.6: REGRESSION

32 The table below shows the number of grams of carbohydrates, $x$, and the number of Calories, $y$, of six different foods.

<table>
<thead>
<tr>
<th>Carbohydrates ($x$)</th>
<th>Calories ($y$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>120</td>
</tr>
<tr>
<td>9.5</td>
<td>138</td>
</tr>
<tr>
<td>10</td>
<td>147</td>
</tr>
<tr>
<td>6</td>
<td>88</td>
</tr>
<tr>
<td>7</td>
<td>108</td>
</tr>
<tr>
<td>4</td>
<td>62</td>
</tr>
</tbody>
</table>

Which equation best represents the line of best fit for this set of data?

1) $y = 15x$
2) $y = 0.07x$
3) $y = 0.1x - 0.4$
4) $y = 14.1x + 5.8$

33 Emma recently purchased a new car. She decided to keep track of how many gallons of gas she used on five of her business trips. The results are shown in the table below.

<table>
<thead>
<tr>
<th>Miles Driven</th>
<th>Number of Gallons Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>7</td>
</tr>
<tr>
<td>200</td>
<td>10</td>
</tr>
<tr>
<td>400</td>
<td>19</td>
</tr>
<tr>
<td>600</td>
<td>29</td>
</tr>
<tr>
<td>1000</td>
<td>51</td>
</tr>
</tbody>
</table>

Write the linear regression equation for these data where miles driven is the independent variable. (Round all values to the nearest hundredth.)
34 The data table below shows the median diameter of grains of sand and the slope of the beach for 9 naturally occurring ocean beaches.

<table>
<thead>
<tr>
<th>Median Diameter of Grains of Sand, in Millimeters (x)</th>
<th>0.17</th>
<th>0.19</th>
<th>0.22</th>
<th>0.235</th>
<th>0.235</th>
<th>0.3</th>
<th>0.35</th>
<th>0.42</th>
<th>0.85</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope of Beach, in Degrees (y)</td>
<td>0.63</td>
<td>0.7</td>
<td>0.82</td>
<td>0.88</td>
<td>1.15</td>
<td>1.5</td>
<td>4.4</td>
<td>7.3</td>
<td>11.3</td>
</tr>
</tbody>
</table>

Write the linear regression equation for this set of data, rounding all values to the nearest thousandth. Using this equation, predict the slope of a beach, to the nearest tenth of a degree, on a beach with grains of sand having a median diameter of 0.65 mm.

35 Omar has a piece of rope. He ties a knot in the rope and measures the new length of the rope. He then repeats this process several times. Some of the data collected are listed in the table below.

<table>
<thead>
<tr>
<th>Number of Knots</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of Rope (cm)</td>
<td>64</td>
<td>58</td>
<td>49</td>
<td>39</td>
<td>31</td>
</tr>
</tbody>
</table>

State, to the nearest tenth, the linear regression equation that approximates the length, y, of the rope after tying x knots. Explain what the y-intercept means in the context of the problem. Explain what the slope means in the context of the problem.

36 The table below shows the attendance at a museum in select years from 2007 to 2013.

<table>
<thead>
<tr>
<th>Attendance at Museum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>Attendance (millions)</td>
</tr>
</tbody>
</table>

State the linear regression equation represented by the data table when x = 0 is used to represent the year 2007 and y is used to represent the attendance. Round all values to the nearest hundredth. State the correlation coefficient to the nearest hundredth and determine whether the data suggest a strong or weak association.
37 Erica, the manager at Stellarbeans, collected data on the daily high temperature and revenue from coffee sales. Data from nine days this past fall are shown in the table below.

<table>
<thead>
<tr>
<th>Day</th>
<th>High Temperature, t</th>
<th>Coffee Sales, f(t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>54</td>
<td>$2900</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
<td>$3080</td>
</tr>
<tr>
<td>3</td>
<td>62</td>
<td>$2500</td>
</tr>
<tr>
<td>4</td>
<td>67</td>
<td>$2380</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$2200</td>
</tr>
<tr>
<td>6</td>
<td>58</td>
<td>$2700</td>
</tr>
<tr>
<td>7</td>
<td>52</td>
<td>$3000</td>
</tr>
<tr>
<td>8</td>
<td>46</td>
<td>$3620</td>
</tr>
<tr>
<td>9</td>
<td>48</td>
<td>$3720</td>
</tr>
</tbody>
</table>

State the linear regression function, \( f(t) \), that estimates the day's coffee sales with a high temperature of \( t \). Round all values to the nearest integer. State the correlation coefficient, \( r \), of the data to the nearest hundredth. Does \( r \) indicate a strong linear relationship between the variables? Explain your reasoning.

38 The percentage of students scoring 85 or better on a mathematics final exam and an English final exam during a recent school year for seven schools is shown in the table below.

<table>
<thead>
<tr>
<th>Percentage of Students Scoring 85 or Better</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics, x</td>
</tr>
<tr>
<td>27</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>13</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>30</td>
</tr>
<tr>
<td>45</td>
</tr>
<tr>
<td>20</td>
</tr>
</tbody>
</table>

Write the linear regression equation for these data, rounding all values to the nearest hundredth. State the correlation coefficient of the linear regression equation, to the nearest hundredth. Explain the meaning of this value in the context of these data.

39 The data given in the table below show some of the results of a study comparing the height of a certain breed of dog, based upon its mass.

<table>
<thead>
<tr>
<th>Mass (kg)</th>
<th>4.5</th>
<th>5</th>
<th>4</th>
<th>3.5</th>
<th>5.5</th>
<th>5</th>
<th>5</th>
<th>4</th>
<th>4</th>
<th>6</th>
<th>3.5</th>
<th>5.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (cm)</td>
<td>41</td>
<td>40</td>
<td>35</td>
<td>38</td>
<td>43</td>
<td>44</td>
<td>37</td>
<td>39</td>
<td>42</td>
<td>44</td>
<td>31</td>
<td>30</td>
</tr>
</tbody>
</table>

Write the linear regression equation for these data, where \( x \) is the mass and \( y \) is the height. Round all values to the nearest tenth. State the value of the correlation coefficient to the nearest tenth, and explain what it indicates.
40 An application developer released a new app to be downloaded. The table below gives the number of downloads for the first four weeks after the launch of the app.

<table>
<thead>
<tr>
<th>Number of Weeks</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Downloads</td>
<td>120</td>
<td>180</td>
<td>270</td>
<td>405</td>
</tr>
</tbody>
</table>

Write an exponential equation that models these data. Use this model to predict how many downloads the developer would expect in the 26th week if this trend continues. Round your answer to the nearest download. Would it be reasonable to use this model to predict the number of downloads past one year? Explain your reasoning.

41 About a year ago, Joey watched an online video of a band and noticed that it had been viewed only 843 times. One month later, Joey noticed that the band’s video had 1708 views. Joey made the table below to keep track of the cumulative number of views the video was getting online.

<table>
<thead>
<tr>
<th>Months Since First Viewing</th>
<th>Total Views</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>843</td>
</tr>
<tr>
<td>1</td>
<td>1708</td>
</tr>
<tr>
<td>2</td>
<td>forgot to record</td>
</tr>
<tr>
<td>3</td>
<td>7124</td>
</tr>
<tr>
<td>4</td>
<td>14,684</td>
</tr>
<tr>
<td>5</td>
<td>29,787</td>
</tr>
<tr>
<td>6</td>
<td>62,381</td>
</tr>
</tbody>
</table>

a) Write a regression equation that best models these data. Round all values to the nearest hundredth. Justify your choice of regression equation.  
b) As shown in the table, Joey forgot to record the number of views after the second month. Use the equation from part a to estimate the number of full views of the online video that Joey forgot to record.
S.ID.C.8: CORRELATION COEFFICIENT

42 The table below shows 6 students' overall averages and their averages in their math class.

<table>
<thead>
<tr>
<th>Overall Student Average</th>
<th>92</th>
<th>98</th>
<th>84</th>
<th>80</th>
<th>75</th>
<th>82</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math Class Average</td>
<td>91</td>
<td>95</td>
<td>85</td>
<td>85</td>
<td>75</td>
<td>78</td>
</tr>
</tbody>
</table>

If a linear model is applied to these data, which statement best describes the correlation coefficient?
1) It is close to $-1$.  
2) It is close to 1.  
3) It is close to 0.  
4) It is close to 0.5.

43 The scatterplot below compares the number of bags of popcorn and the number of sodas sold at each performance of the circus over one week. 

Which conclusion can be drawn from the scatterplot?
1) There is a negative correlation between popcorn sales and soda sales.  
2) There is a positive correlation between popcorn sales and soda sales.  
3) There is no correlation between popcorn sales and soda sales.  
4) Buying popcorn causes people to buy soda.

44 Analysis of data from a statistical study shows a linear relationship in the data with a correlation coefficient of $-0.524$. Which statement best summarizes this result?
1) There is a strong positive correlation between the variables.  
2) There is a strong negative correlation between the variables.  
3) There is a moderate positive correlation between the variables.  
4) There is a moderate negative correlation between the variables.

45 Bella recorded data and used her graphing calculator to find the equation for the line of best fit. She then used the correlation coefficient to determine the strength of the linear fit. Which correlation coefficient represents the strongest linear relationship?
1) 0.9  
2) 0.5  
3) -0.3  
4) -0.8
46 The results of a linear regression are shown below.

\[ y = ax + b \]

\[ a = -1.15785 \]

\[ b = 139.3171772 \]

\[ r = -0.896557832 \]

\[ r^2 = 0.8038159461 \]

Which phrase best describes the relationship between \( x \) and \( y \)?
1) strong negative correlation
2) strong positive correlation
3) weak negative correlation
4) weak positive correlation

47 What is the correlation coefficient of the linear fit of the data shown below, to the nearest hundredth?

![Graph showing a linear fit with data points.]

1) 1.00
2) 0.93
3) −0.93
4) −1.00

48 A nutritionist collected information about different brands of beef hot dogs. She made a table showing the number of Calories and the amount of sodium in each hot dog.

<table>
<thead>
<tr>
<th>Calories per Beef Hot Dog</th>
<th>Milligrams of Sodium per Beef Hot Dog</th>
</tr>
</thead>
<tbody>
<tr>
<td>186</td>
<td>495</td>
</tr>
<tr>
<td>181</td>
<td>477</td>
</tr>
<tr>
<td>176</td>
<td>425</td>
</tr>
<tr>
<td>149</td>
<td>322</td>
</tr>
<tr>
<td>184</td>
<td>482</td>
</tr>
<tr>
<td>190</td>
<td>587</td>
</tr>
<tr>
<td>158</td>
<td>370</td>
</tr>
<tr>
<td>139</td>
<td>322</td>
</tr>
</tbody>
</table>

a) Write the correlation coefficient for the line of best fit. Round your answer to the nearest hundredth.
b) Explain what the correlation coefficient suggests in the context of this problem.
49. At Mountain Lakes High School, the mathematics and physics scores of nine students were compared as shown in the table below.

<table>
<thead>
<tr>
<th>Mathematics</th>
<th>55</th>
<th>93</th>
<th>89</th>
<th>60</th>
<th>90</th>
<th>45</th>
<th>64</th>
<th>76</th>
<th>89</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>66</td>
<td>89</td>
<td>94</td>
<td>52</td>
<td>84</td>
<td>56</td>
<td>66</td>
<td>73</td>
<td>92</td>
</tr>
</tbody>
</table>

State the correlation coefficient, to the nearest hundredth, for the line of best fit for these data. Explain what the correlation coefficient means with regard to the context of this situation.

S.ID.B.6: RESIDUALS

50. Which statistic would indicate that a linear function would not be a good fit to model a data set?
1) $r = -0.93$
2) $r = 1$
3) $r = 0.93$
4) $r = 0.1$

51. After performing analyses on a set of data, Jackie examined the scatter plot of the residual values for each analysis. Which scatter plot indicates the best linear fit for the data?
52 Use the data below to write the regression equation \((y = ax + b)\) for the raw test score based on the hours tutored. Round all values to the nearest hundredth.

<table>
<thead>
<tr>
<th>Tutor Hours, (x)</th>
<th>Raw Test Score</th>
<th>Residual (Actual-Predicted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>1.3</td>
</tr>
<tr>
<td>2</td>
<td>37</td>
<td>1.9</td>
</tr>
<tr>
<td>3</td>
<td>35</td>
<td>-6.4</td>
</tr>
<tr>
<td>4</td>
<td>47</td>
<td>-0.7</td>
</tr>
<tr>
<td>5</td>
<td>56</td>
<td>2.0</td>
</tr>
<tr>
<td>6</td>
<td>67</td>
<td>6.6</td>
</tr>
<tr>
<td>7</td>
<td>62</td>
<td>-4.7</td>
</tr>
</tbody>
</table>

Equation: ___________________________

Create a residual plot on the axes below, using the residual scores in the table above.

Based on the residual plot, state whether the equation is a good fit for the data. Justify your answer.
53  The table below represents the residuals for a line of best fit.

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>3</th>
<th>3</th>
<th>4</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residual</td>
<td>2</td>
<td>1</td>
<td>–1</td>
<td>–2</td>
<td>–3</td>
<td>–2</td>
<td>–1</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Plot these residuals on the set of axes below.

Using the plot, assess the fit of the line for these residuals and justify your answer.
54 The residual plots from two different sets of bivariate data are graphed below.

Explain, using evidence from graph A and graph B, which graph indicates that the model for the data is a good fit.

A.SSE.A.1: MODELING EXPRESSIONS

56 An expression of the fifth degree is written with a leading coefficient of seven and a constant of six. Which expression is correctly written for these conditions?

1) $6x^5 + x^4 + 7$
2) $7x^5 - 6x^4 + 5$
3) $6x^7 - x^5 + 5$
4) $7x^5 + 2x^2 + 6$

57 To watch a varsity basketball game, spectators must buy a ticket at the door. The cost of an adult ticket is $3.00 and the cost of a student ticket is $1.50. If the number of adult tickets sold is represented by $a$ and student tickets sold by $s$, which expression represents the amount of money collected at the door from the ticket sales?

1) $4.50as$
2) $4.50(a + s)$
3) $(3.00a)(1.50s)$
4) $3.00a + 1.50s$

58 Andy has $310 in his account. Each week, $w$, he withdraws $30 for his expenses. Which expression could be used if he wanted to find out how much money he had left after 8 weeks?

1) $310 - 8w$
2) $280 + 30(w - 1)$
3) $310w - 30$
4) $280 - 30(w - 1)$

EXPRESSIONS AND EQUATIONS

A.SSE.A.1: DEPENDENT AND INDEPENDENT VARIABLES

55 The formula for the surface area of a right rectangular prism is $A = 2lw + 2hw + 2lh$, where $l$, $w$, and $h$ represent the length, width, and height, respectively. Which term of this formula is not dependent on the height?

1) $A$
2) $2lw$
3) $2hw$
4) $2lh$
59 Konnor wants to burn 250 Calories while exercising for 45 minutes at the gym. On the treadmill, he can burn 6 Cal/min. On the stationary bike, he can burn 5 Cal/min. If \( t \) represents the number of minutes on the treadmill and \( b \) represents the number of minutes on the stationary bike, which expression represents the number of Calories that Konnor can burn on the stationary bike?

1) \( b \)
2) \( 5b \)
3) \( 45 - b \)
4) \( 250 - 5b \)

60 Mrs. Allard asked her students to identify which of the polynomials below are in standard form and explain why.

I. \( 15x^4 - 6x + 3x^2 - 1 \)
II. \( 12x^3 + 8x + 4 \)
III. \( 2x^5 + 8x^2 + 10x \)

Which student's response is correct?

1) Tyler said I and II because the coefficients are decreasing.
2) Susan said only II because all the numbers are decreasing.
3) Fred said II and III because the exponents are decreasing.
4) Alyssa said II and III because they each have three terms.

61 When multiplying polynomials for a math assignment, Pat found the product to be 
\(-4x + 8x^2 - 2x^3 + 5\). He then had to state the leading coefficient of this polynomial. Pat wrote down \(-4\). Do you agree with Pat's answer? Explain your reasoning.

A.REI.B.3: SOLVING LINEAR EQUATIONS

62 Which value of \( x \) satisfies the equation
\[
\frac{7}{3} \left( x + \frac{9}{28} \right) = 20
\]

1) 8.25
2) 8.89
3) 19.25
4) 44.92

63 What is the value of \( x \) in the equation
\[
\frac{x - 2}{3} + \frac{1}{6} = \frac{5}{6}
\]

1) 4
2) 6
3) 8
4) 11

64 An equation is given below.

\[
4(x - 7) = 0.3(x + 2) + 2.11
\]

The solution to the equation is

1) 8.3
2) 8.7
3) 3
4) -3

65 Which value of \( x \) satisfies the equation
\[
\frac{5}{6} \left( \frac{3}{8} - x \right) = 16
\]

1) -19.575
2) -18.825
3) -16.3125
4) -15.6875
66 The value of \( x \) which makes \[ \frac{2}{3} \left( \frac{1}{4} x - 2 \right) = \frac{1}{5} \left( \frac{4}{3} x - 1 \right) \] true is

1) \(-10\)
2) \(-2\)
3) \(-9.09\)
4) \(-11.3\)

67 The solution to \(-2(1 - 4x) = 3x + 8\) is

1) \(\frac{6}{11}\)
2) \(2\)
3) \(\frac{10}{7}\)
4) \(-2\)

68 What is the solution to the equation \[ \frac{3}{5} \left( x + \frac{4}{3} \right) = 1.04? \]

1) \(3.06\)
2) \(0.4\)
3) \(-0.48\)
4) \(-0.7093\)

69 Solve the equation below algebraically for the exact value of \( x \).

\[ 6 - \frac{2}{3} (x + 5) = 4x \]

A.CED.A.1-2: MODELING LINEAR EQUATIONS

70 A parking garage charges a base rate of $3.50 for up to 2 hours, and an hourly rate for each additional hour. The sign below gives the prices for up to 5 hours of parking.

<table>
<thead>
<tr>
<th>Parking Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 hours</td>
</tr>
<tr>
<td>3 hours</td>
</tr>
<tr>
<td>4 hours</td>
</tr>
<tr>
<td>5 hours</td>
</tr>
</tbody>
</table>

Which linear equation can be used to find \( x \), the additional hourly parking rate?

1) \(9.00 + 3x = 20.00\)
2) \(9.00 + 3.50x = 20.00\)
3) \(2x + 3.50 = 14.50\)
4) \(2x + 9.00 = 14.50\)
71 John has four more nickels than dimes in his pocket, for a total of $1.25. Which equation could be used to determine the number of dimes, x, in his pocket?
1) 0.10(x + 4) + 0.05(x) = $1.25
2) 0.05(x + 4) + 0.10(x) = $1.25
3) 0.10(4x) + 0.05(x) = $1.25
4) 0.05(4x) + 0.10(x) = $1.25

72 Kendal bought x boxes of cookies to bring to a party. Each box contains 12 cookies. She decides to keep two boxes for herself. She brings 60 cookies to the party. Which equation can be used to find the number of boxes, x, Kendal bought?
1) 2x − 12 = 60
2) 12x − 2 = 60
3) 12x − 24 = 60
4) 24 − 12x = 60

73 Donna wants to make trail mix made up of almonds, walnuts and raisins. She wants to mix one part almonds, two parts walnuts, and three parts raisins. Almonds cost $12 per pound, walnuts cost $9 per pound, and raisins cost $5 per pound. Donna has $15 to spend on the trail mix. Determine how many pounds of trail mix she can make. [Only an algebraic solution can receive full credit.]

74 A gardener is planting two types of trees:
   Type A is three feet tall and grows at a rate of 15 inches per year.
   Type B is four feet tall and grows at a rate of 10 inches per year.
Algebraically determine exactly how many years it will take for these trees to be the same height.

75 Ian is borrowing $1000 from his parents to buy a notebook computer. He plans to pay them back at the rate of $60 per month. Ken is borrowing $600 from his parents to purchase a snowboard. He plans to pay his parents back at the rate of $20 per month. Write an equation that can be used to determine after how many months the boys will owe the same amount. Determine algebraically and state in how many months the two boys will owe the same amount. State the amount they will owe at this time. Ian claims that he will have his loan paid off 6 months after he and Ken owe the same amount. Determine and state if Ian is correct. Explain your reasoning.

76 A cell phone company charges $60.00 a month for up to 1 gigabyte of data. The cost of additional data is $0.05 per megabyte. If d represents the number of additional megabytes used and c represents the total charges at the end of the month, which linear equation can be used to determine a user's monthly bill?
1) c = 60 − 0.05d
2) c = 60.05d
3) c = 60d − 0.05
4) c = 60 + 0.05d

77 A typical cell phone plan has a fixed base fee that includes a certain amount of data and an overage charge for data use beyond the plan. A cell phone plan charges a base fee of $62 and an overage charge of $30 per gigabyte of data that exceed 2 gigabytes. If C represents the cost and g represents the total number of gigabytes of data, which equation could represent this plan when more than 2 gigabytes are used?
1) C = 30 + 62(2 − g)
2) C = 30 + 62(g − 2)
3) C = 62 + 30(2 − g)
4) C = 62 + 30(g − 2)
78. Sandy programmed a website's checkout process with an equation to calculate the amount customers will be charged when they download songs. The website offers a discount. If one song is bought at the full price of $1.29, then each additional song is $0.99. State an equation that represents the cost, $C$, when $s$ songs are downloaded. Sandy figured she would be charged $52.77 for 52 songs. Is this the correct amount? Justify your answer.

A.CED.A.4: TRANSFORMING FORMULAS

79. The formula for blood flow rate is given by $F = \frac{p_1 - p_2}{r}$, where $F$ is the flow rate, $p_1$ the initial pressure, $p_2$ the final pressure, and $r$ the resistance created by blood vessel size. Which formula can not be derived from the given formula?

1) $p_1 = Fr + p_2$
2) $p_2 = p_1 - Fr$
3) $r = \frac{F(p_2 - p_1)}{p_1 - p_2}$
4) $r = \frac{p_1 - p_2}{F}$

80. The equation for the volume of a cone is $V = \frac{1}{3} \pi r^2 h$. The radius, $r$, of the cone may be expressed as $rac{V}{\pi h}$. The radius, $r$, of the cone may be expressed as $\frac{V}{\pi h}$. The radius, $r$, of the cone may be expressed as $\frac{V}{\pi h}$. The radius, $r$, of the cone may be expressed as $\frac{V}{\pi h}$.

81. The equation for the volume of a cylinder is $V = \pi r^2 h$. The positive value of $r$, in terms of $h$ and $V$, is

1) $r = \frac{V}{\pi h}$
2) $r = \frac{V}{\pi h}$
3) $r = \frac{2V}{\pi h}$
4) $r = \frac{V}{2\pi h}$

82. The distance a free falling object has traveled can be modeled by the equation $d = \frac{1}{2}at^2$, where $a$ is the acceleration due to gravity and $t$ is the amount of time the object has fallen. What is $r$, in terms of $a$ and $d$?

83. The formula for electrical power, $P$, is $P = IR$. The formula for $I$, the current, and $R$, the resistance, is

1) $I = \frac{P}{R}$
2) $I = \frac{P}{R}$
3) $I = \frac{P}{R}$
4) $I = \frac{P}{R}$
84. Michael borrows money from his uncle, who is charging him simple interest using the formula \( I = Prt \). To figure out what the interest rate, \( r \), is, Michael rearranges the formula to find \( r \). His new formula is

1) \( \frac{I-P}{t} \)
2) \( \frac{P-I}{t} \)
3) \( \frac{I}{Pt} \)
4) \( \frac{Pt}{I} \)

85. Boyle's Law involves the pressure and volume of gas in a container. It can be represented by the formula \( P_1 V_1 = P_2 V_2 \). When the formula is solved for \( P_2 \), the result is

1) \( \frac{P_1 V_1 V_2}{V_2} \)
2) \( \frac{V_2}{P_1 V_1} \)
3) \( \frac{P_1 V_1}{V_2} \)
4) \( \frac{P_1 V_2}{V_1} \)

86. Students were asked to write a formula for the length of a rectangle by using the formula for its perimeter, \( p = 2\ell + 2w \). Three of their responses are shown below.

I. \( \ell = \frac{1}{2} p - w \)
II. \( \ell = \frac{1}{2} (p - 2w) \)
III. \( \ell = \frac{p - 2w}{2} \)
Which responses are correct?
1) I and II, only
2) II and III, only
3) I and III, only
4) I, II, and III

87. The formula for the area of a trapezoid is \( A = \frac{1}{2} h(b_1 + b_2) \). Express \( b_1 \) in terms of \( A \), \( h \), and \( b_2 \). The area of a trapezoid is 60 square feet, its height is 6 ft, and one base is 12 ft. Find the number of feet in the other base.

88. The volume of a large can of tuna fish can be calculated using the formula \( V = \pi r^2 h \). Write an equation to find the radius, \( r \), in terms of \( V \) and \( h \). Determine the diameter, to the nearest inch, of a large can of tuna fish that has a volume of 66 cubic inches and a height of 3.3 inches.

89. The formula for the sum of the degree measures of the interior angles of a polygon is \( S = 180(n - 2) \). Solve for \( n \), the number of sides of the polygon, in terms of \( S \).
90 Solve the equation below for \( x \) in terms of \( a \).
\[
4(ax + 3) - 3ax = 25 + 3a
\]

91 Using the formula for the volume of a cone, express \( r \) in terms of \( V, h, \) and \( \pi \).

92 The formula \( F_g = \frac{GM_1M_2}{r^2} \) calculates the gravitational force between two objects where \( G \) is the gravitational constant, \( M_1 \) is the mass of one object, \( M_2 \) is the mass of the other object, and \( r \) is the distance between them. Solve for the positive value of \( r \) in terms of \( F_g, G, M_1, \) and \( M_2 \).

93 The formula for converting degrees Fahrenheit \( (F) \) to degrees Kelvin \( (K) \) is:
\[
K = \frac{5}{9}(F + 459.67)
\]
Solve for \( F \), in terms of \( K \).

95 Faith wants to use the formula \( C(f) = \frac{5}{9}(f - 32) \) to convert degrees Fahrenheit, \( f \), to degrees Celsius, \( C(f) \). If Faith calculated \( C(68) \), what would her result be?
1) 20° Celsius
2) 20° Fahrenheit
3) 154° Celsius
4) 154° Fahrenheit

96 The Utica Boilermaker is a 15-kilometer road race. Sara is signed up to run this race and has done the following training runs:
I. 10 miles
II. 44,880 feet
III. 15,560 yards
Which run(s) are at least 15 kilometers?
1) I, only
2) II, only
3) I and III
4) II and III

97 Peyton is a sprinter who can run the 40-yard dash in 4.5 seconds. He converts his speed into miles per hour, as shown below.
\[
\frac{40 \text{ yd}}{4.5 \text{ sec}} \cdot \frac{3 \text{ ft}}{1 \text{ yd}} \cdot \frac{5280 \text{ ft}}{1 \text{ mi}} \cdot \frac{60 \text{ sec}}{1 \text{ min}} \cdot \frac{60 \text{ min}}{1 \text{ hr}}
\]
Which ratio is incorrectly written to convert his speed?
1) \( \frac{3 \text{ ft}}{1 \text{ yd}} \)
2) \( \frac{5280 \text{ ft}}{1 \text{ mi}} \)
3) \( \frac{60 \text{ sec}}{1 \text{ min}} \)
4) \( \frac{60 \text{ min}}{1 \text{ hr}} \)
98 A construction worker needs to move 120 ft$^3$ of dirt by using a wheelbarrow. One wheelbarrow load holds 8 ft$^3$ of dirt and each load takes him 10 minutes to complete. One correct way to figure out the number of hours he would need to complete this job is

1) \[
\frac{120 \text{ ft}^3}{\text{1 load}} \cdot \frac{10 \text{ min}}{\text{1 load}} \cdot \frac{60 \text{ min}}{1 \text{ hr}} \cdot \frac{1 \text{ load}}{8 \text{ ft}^3}
\]

2) \[
\frac{120 \text{ ft}^3}{\text{1 load}} \cdot \frac{60 \text{ min}}{1 \text{ hr}} \cdot \frac{8 \text{ ft}^3}{10 \text{ min}} \cdot \frac{1}{1 \text{ load}}
\]

3) \[
\frac{120 \text{ ft}^3}{\text{1 load}} \cdot \frac{1 \text{ load}}{10 \text{ min}} \cdot \frac{8 \text{ ft}^3}{1 \text{ load}} \cdot \frac{1 \text{ hr}}{60 \text{ min}}
\]

4) \[
\frac{120 \text{ ft}^3}{\text{8 ft}^3} \cdot \frac{1 \text{ load}}{1 \text{ load}} \cdot \frac{10 \text{ min}}{1 \text{ hr}} \cdot \frac{60 \text{ min}}{1 \text{ hr}}
\]

99 The following conversion was done correctly:

\[
\frac{\text{3 miles}}{1 \text{ hour}} \cdot \frac{1 \text{ hour}}{60 \text{ minutes}} \cdot \frac{5280 \text{ feet}}{1 \text{ mile}} \cdot \frac{12 \text{ inches}}{1 \text{ foot}}
\]

What were the final units for this conversion?

1) minutes per foot
2) minutes per inch
3) feet per minute
4) inches per minute

100 Olivia entered a baking contest. As part of the contest, she needs to demonstrate how to measure a gallon of milk if she only has a teaspoon measure. She converts the measurement using the ratios below:

\[
\frac{4 \text{ quarts}}{1 \text{ gallon}} \cdot \frac{2 \text{ pints}}{1 \text{ quart}} \cdot \frac{2 \text{ cups}}{1 \text{ pint}} \cdot \frac{1}{4 \text{ cup}} \cdot \frac{3 \text{ teaspoons}}{1 \text{ tablespoon}}
\]

Which ratio is incorrectly written in Olivia's conversion?

1) \[
\frac{4 \text{ quarts}}{1 \text{ gallon}}
\]

2) \[
\frac{2 \text{ pints}}{1 \text{ quart}}
\]

3) \[
\frac{1}{4 \text{ cup}}
\]

4) \[
\frac{3 \text{ teaspoons}}{1 \text{ tablespoon}}
\]

101 A typical marathon is 26.2 miles. Allan averages 12 kilometers per hour when running in marathons. Determine how long it would take Allan to complete a marathon, to the nearest tenth of an hour. Justify your answer.

N.Q.A.2: USING RATE

102 Patricia is trying to compare the average rainfall of New York to that of Arizona. A comparison between these two states for the months of July through September would be best measured in

1) feet per hour
2) inches per hour
3) inches per month
4) feet per month
103 A two-inch-long grasshopper can jump a horizontal distance of 40 inches. An athlete, who is five feet nine, wants to cover a distance of one mile by jumping. If this person could jump at the same ratio of body-length to jump-length as the grasshopper, determine, to the nearest jump, how many jumps it would take this athlete to jump one mile.

A.CED.A.2: SPEED

104 The distance traveled is equal to the rate of speed multiplied by the time traveled. If the distance is measured in feet and the time is measured in minutes, then the rate of speed is expressed in which units? Explain how you arrived at your answer.

105 An airplane leaves New York City and heads toward Los Angeles. As it climbs, the plane gradually increases its speed until it reaches cruising altitude, at which time it maintains a constant speed for several hours as long as it stays at cruising altitude. After flying for 32 minutes, the plane reaches cruising altitude and has flown 192 miles. After flying for a total of 92 minutes, the plane has flown a total of 762 miles. Determine the speed of the plane, at cruising altitude, in miles per minute. Write an equation to represent the number of miles the plane has flown, \( y \), during \( x \) minutes at cruising altitude, only. Assuming that the plane maintains its speed at cruising altitude, determine the total number of miles the plane has flown 2 hours into the flight.

F.IF.B.6: RATE OF CHANGE

106 Loretta and her family are going on vacation. Their destination is 610 miles from their home. Loretta is going to share some of the driving with her dad. Her average speed while driving is 55 mph and her dad’s average speed while driving is 65 mph. The plan is for Loretta to drive for the first 4 hours of the trip and her dad to drive for the remainder of the trip. Determine the number of hours it will take her family to reach their destination. After Loretta has been driving for 2 hours, she gets tired and asks her dad to take over. Determine, to the nearest tenth of an hour, how much time the family will save by having Loretta’s dad drive for the remainder of the trip.

107 The Jamison family kept a log of the distance they traveled during a trip, as represented by the graph below.

During which interval was their average speed the greatest?
1) the first hour to the second hour
2) the second hour to the fourth hour
3) the sixth hour to the eighth hour
4) the eighth hour to the tenth hour
108 Firing a piece of pottery in a kiln takes place at different temperatures for different amounts of time. The graph below shows the temperatures in a kiln while firing a piece of pottery after the kiln is preheated to 200°F.

During which time interval did the temperature in the kiln show the greatest average rate of change?
1) 0 to 1 hour  
2) 1 hour to 1.5 hours  
3) 2.5 hours to 5 hours  
4) 5 hours to 8 hours

109 The graph below models the height of a remote-control helicopter over 20 seconds during flight.

Over which interval does the helicopter have the slowest average rate of change?
1) 0 to 5 seconds  
2) 5 to 10 seconds  
3) 10 to 15 seconds  
4) 15 to 20 seconds
110 A graph of average resting heart rates is shown below. The average resting heart rate for adults is 72 beats per minute, but doctors consider resting rates from 60-100 beats per minute within normal range.

111 Voting rates in presidential elections from 1996-2012 are modeled below.

Which statement does not correctly interpret voting rates by age based on the given graph?
1) For citizens 18-29 years of age, the rate of change in voting rate was greatest between years 2000-2004.
2) From 1996-2012, the average rate of change was positive for only two age groups.
3) About 70% of people 45 and older voted in the 2004 election.
4) The voting rates of eligible age groups lies between 35 and 75 percent during presidential elections every 4 years from 1996-2012.

Which statement about average resting heart rates is not supported by the graph?
1) A 10-year-old has the same average resting heart rate as a 20-year-old.
2) A 20-year-old has the same average resting heart rate as a 30-year-old.
3) A 40-year-old may have the same average resting heart rate for ten years.
4) The average resting heart rate for teenagers steadily decreases.
112 The graph below shows the distance in miles, $m$, hiked from a camp in $h$ hours.

Which hourly interval had the greatest rate of change?
1) hour 0 to hour 1  
2) hour 1 to hour 2  
3) hour 2 to hour 3  
4) hour 3 to hour 4

113 The table below shows the cost of mailing a postcard in different years. During which time interval did the cost increase at the greatest average rate?

<table>
<thead>
<tr>
<th>Year</th>
<th>1898</th>
<th>1971</th>
<th>1985</th>
<th>2006</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost (¢)</td>
<td>1</td>
<td>6</td>
<td>14</td>
<td>24</td>
<td>35</td>
</tr>
</tbody>
</table>

1) 1898-1971  
2) 1971-1985  
3) 1985-2006  
4) 2006-2012
114 The table below shows the year and the number of households in a building that had high-speed broadband internet access.

<table>
<thead>
<tr>
<th>Number of Households</th>
<th>11</th>
<th>16</th>
<th>23</th>
<th>33</th>
<th>42</th>
<th>47</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>2002</td>
<td>2003</td>
<td>2004</td>
<td>2005</td>
<td>2006</td>
<td>2007</td>
</tr>
</tbody>
</table>

For which interval of time was the average rate of change the smallest?
1) 2002 - 2004
2) 2003 - 2005
3) 2004 - 2006
4) 2005 - 2007

115 The table below shows the average diameter of a pupil in a person’s eye as he or she grows older.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Average Pupil Diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>4.7</td>
</tr>
<tr>
<td>30</td>
<td>4.3</td>
</tr>
<tr>
<td>40</td>
<td>3.9</td>
</tr>
<tr>
<td>50</td>
<td>3.5</td>
</tr>
<tr>
<td>60</td>
<td>3.1</td>
</tr>
<tr>
<td>70</td>
<td>2.7</td>
</tr>
<tr>
<td>80</td>
<td>2.3</td>
</tr>
</tbody>
</table>

What is the average rate of change, in millimeters per year, of a person’s pupil diameter from age 20 to age 80?
1) 2.4
2) 0.04
3) −2.4
4) −0.04

116 Joey enlarged a 3-inch by 5-inch photograph on a copy machine. He enlarged it four times. The table below shows the area of the photograph after each enlargement.

<table>
<thead>
<tr>
<th>Enlargement</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area (square inches)</td>
<td>15</td>
<td>18.8</td>
<td>23.4</td>
<td>29.3</td>
<td>36.6</td>
</tr>
</tbody>
</table>

What is the average rate of change of the area from the original photograph to the fourth enlargement, to the nearest tenth?
1) 4.3
2) 4.5
3) 5.4
4) 6.0
117 The graph below shows the variation in the average temperature of Earth's surface from 1950-2000, according to one source.

During which years did the temperature variation change the most per unit time? Explain how you determined your answer.

118 A manager wanted to analyze the online shoe sales for his business. He collected data for the number of pairs of shoes sold each hour over a 14-hour time period. He created a graph to model the data, as shown below.

The manager believes the set of integers would be the most appropriate domain for this model. Explain why he is incorrect. State the entire interval for which the number of pairs of shoes sold is increasing. Determine the average rate of change between the sixth and fourteenth hours, and explain what it means in the context of the problem.

119 A family is traveling from their home to a vacation resort hotel. The table below shows their distance from home as a function of time.

<table>
<thead>
<tr>
<th>Time (hrs)</th>
<th>0</th>
<th>2</th>
<th>5</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance (mi)</td>
<td>0</td>
<td>140</td>
<td>375</td>
<td>480</td>
</tr>
</tbody>
</table>

Determine the average rate of change between hour 2 and hour 7, including units.
120 The table below represents the height of a bird above the ground during flight, with $P(t)$ representing height in feet and $t$ representing time in seconds.

<table>
<thead>
<tr>
<th>$t$</th>
<th>$P(t)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6.71</td>
</tr>
<tr>
<td>3</td>
<td>6.26</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>3.41</td>
</tr>
</tbody>
</table>

Calculate the average rate of change from 3 to 9 seconds, in feet per second.

121 The graph of $f(t)$ models the height, in feet, that a bee is flying above the ground with respect to the time it traveled in $t$ seconds.

State all time intervals when the bee's rate of change is zero feet per second. Explain your reasoning.

122 An astronaut drops a rock off the edge of a cliff on the Moon. The distance, $d(t)$, in meters, the rock travels after $t$ seconds can be modeled by the function $d(t) = 0.8t^2$. What is the average speed, in meters per second, of the rock between 5 and 10 seconds after it was dropped?

1) 12
2) 20
3) 60
4) 80

123 A population of rabbits in a lab, $p(x)$, can be modeled by the function $p(x) = 20(1.014)^x$, where $x$ represents the number of days since the population was first counted. Explain what 20 and 1.014 represent in the context of the problem. Determine, to the nearest tenth, the average rate of change from day 50 to day 100.
124 In 2013, the United States Postal Service charged $0.46 to mail a letter weighing up to 1 oz. and $0.20 per ounce for each additional ounce. Which function would determine the cost, in dollars, $c(z)$, of mailing a letter weighing $z$ ounces where $z$ is an integer greater than 1?

1) $c(z) = 0.46z + 0.20$
2) $c(z) = 0.20z + 0.46$
3) $c(z) = 0.46(z - 1) + 0.20$
4) $c(z) = 0.20(z - 1) + 0.46$

125 Last weekend, Emma sold lemonade at a yard sale. The function $P(c) = .50c - 9.96$ represented the profit, $P(c)$, Emma earned selling $c$ cups of lemonade. Sales were strong, so she raised the price for this weekend by 25 cents per cup. Which function represents her profit for this weekend?

1) $P(c) = .25c - 9.96$
2) $P(c) = .50c - 9.71$
3) $P(c) = .50c - 10.21$
4) $P(c) = .75c - 9.96$

126 Caitlin has a movie rental card worth $175. After she rents the first movie, the card’s value is $172.25. After she rents the second movie, its value is $169.50. After she rents the third movie, the card is worth $166.75. Assuming the pattern continues, write an equation to define $A(n)$, the amount of money on the rental card after $n$ rentals. Caitlin rents a movie every Friday night. How many weeks in a row can she afford to rent a movie, using her rental card only? Explain how you arrived at your answer.

127 Alex is selling tickets to a school play. An adult ticket costs $6.50 and a student ticket costs $4.00. Alex sells $x$ adult tickets and 12 student tickets. Write a function, $f(x)$, to represent how much money Alex collected from selling tickets.

128 Jackson is starting an exercise program. The first day he will spend 30 minutes on a treadmill. He will increase his time on the treadmill by 2 minutes each day. Write an equation for $T(d)$, the time, in minutes, on the treadmill on day $d$. Find $T(6)$, the minutes he will spend on the treadmill on day 6.

129 Jim is a furniture salesman. His weekly pay is $300 plus 3.5% of his total sales for the week. Jim sells $x$ dollars' worth of furniture during the week. Write a function, $p(x)$, which can be used to determine his pay for the week. Use this function to determine Jim's pay to the nearest cent for a week when his sales total is $8250.$
130 Each day Toni records the height of a plant for her science lab. Her data are shown in the table below.

<table>
<thead>
<tr>
<th>Day (n)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (cm)</td>
<td>3.0</td>
<td>4.5</td>
<td>6.0</td>
<td>7.5</td>
<td>9.0</td>
</tr>
</tbody>
</table>

The plant continues to grow at a constant daily rate. Write an equation to represent \( h(n) \), the height of the plant on the \( n \)th day.

131 Tanya is making homemade greeting cards. The data table below represents the amount she spends in dollars, \( f(x) \), in terms of the number of cards she makes, \( x \).

<table>
<thead>
<tr>
<th>( x )</th>
<th>( f(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>7.50</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>9</td>
<td>11.25</td>
</tr>
<tr>
<td>10</td>
<td>12</td>
</tr>
</tbody>
</table>

Write a linear function, \( f(x) \), that represents the data. Explain what the slope and \( y \)-intercept of \( f(x) \) mean in the given context.
132 Which chart could represent the function \( f(x) = -2x + 6 \)?

<table>
<thead>
<tr>
<th>( x )</th>
<th>( f(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>6</td>
<td>18</td>
</tr>
</tbody>
</table>

1) The chart:

<table>
<thead>
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<th>( x )</th>
<th>( f(x) )</th>
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<tbody>
<tr>
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<td>2</td>
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2) The chart:

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<td>2</td>
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<td>4</td>
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<td>6</td>
<td>14</td>
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3) The chart:

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</tr>
<tr>
<td>2</td>
<td>2</td>
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<tr>
<td>4</td>
<td>-2</td>
</tr>
<tr>
<td>6</td>
<td>-6</td>
</tr>
</tbody>
</table>

4) The chart:

133 The cost of airing a commercial on television is modeled by the function \( C(n) = 110n + 900 \), where \( n \) is the number of times the commercial is aired. Based on this model, which statement is true?

1) The commercial costs $0 to produce and $110 per airing up to $900.
2) The commercial costs $110 to produce and $900 each time it is aired.
3) The commercial costs $900 to produce and $110 each time it is aired.
4) The commercial costs $1010 to produce and can air an unlimited number of times.

134 A company that manufactures radios first pays a start-up cost, and then spends a certain amount of money to manufacture each radio. If the cost of manufacturing \( r \) radios is given by the function \( c(r) = 5.25r + 125 \), then the value 5.25 best represents

1) the start-up cost
2) the profit earned from the sale of one radio
3) the amount spent to manufacture each radio
4) the average number of radios manufactured

135 A satellite television company charges a one-time installation fee and a monthly service charge. The total cost is modeled by the function \( y = 40 + 90x \). Which statement represents the meaning of each part of the function?

1) \( y \) is the total cost, \( x \) is the number of months of service, $90 is the installation fee, and $40 is the service charge per month.
2) \( y \) is the total cost, \( x \) is the number of months of service, $40 is the installation fee, and $90 is the service charge per month.
3) \( x \) is the total cost, \( y \) is the number of months of service, $40 is the installation fee, and $90 is the service charge per month.
4) \( x \) is the total cost, \( y \) is the number of months of service, $90 is the installation fee, and $40 is the service charge per month.

136 The owner of a small computer repair business has one employee, who is paid an hourly rate of $22. The owner estimates his weekly profit using the function \( P(x) = 8600 - 22x \). In this function, \( x \) represents the number of

1) computers repaired per week
2) hours worked per week
3) customers served per week
4) days worked per week
137 A car leaves Albany, NY, and travels west toward Buffalo, NY. The equation \( D = 280 - 59t \) can be used to represent the distance, \( D \), from Buffalo after \( t \) hours. In this equation, the 59 represents the
1) car's distance from Albany
2) speed of the car
3) distance between Buffalo and Albany
4) number of hours driving

138 A plumber has a set fee for a house call and charges by the hour for repairs. The total cost of her services can be modeled by \( c(t) = 125t + 95 \). Which statements about this function are true?
I. A house call fee costs $95.
II. The plumber charges $125 per hour.
III. The number of hours the job takes is represented by \( t \).
1) I and II, only
2) I and III, only
3) II and III, only
4) I, II, and III

139 The amount Mike gets paid weekly can be represented by the expression \( 2.50a + 290 \), where \( a \) is the number of cell phone accessories he sells that week. What is the constant term in this expression and what does it represent?
1) 2.50\( a \), the amount he is guaranteed to be paid each week
2) 2.50\( a \), the amount he earns when he sells \( a \) accessories
3) 290, the amount he is guaranteed to be paid each week
4) 290, the amount he earns when he sells \( a \) accessories

140 Each day, a local dog shelter spends an average of $2.40 on food per dog. The manager estimates the shelter's daily expenses, assuming there is at least one dog in the shelter, using the function \( E(x) = 30 + 2.40x \). Which statements regarding the function \( E(x) \) are correct?
I. \( x \) represents the number of dogs at the shelter per day.
II. \( x \) represents the number of volunteers at the shelter per day.
III. 30 represents the shelter's total expenses per day.
IV. 30 represents the shelter's nonfood expenses per day.
1) I and III
2) I and IV
3) II and III
4) II and IV

141 The cost of belonging to a gym can be modeled by \( C(m) = 50m + 79.50 \), where \( C(m) \) is the total cost for \( m \) months of membership. State the meaning of the slope and \( y \)-intercept of this function with respect to the costs associated with the gym membership.

142 During a recent snowstorm in Red Hook, NY, Jaime noted that there were 4 inches of snow on the ground at 3:00 p.m., and there were 6 inches of snow on the ground at 7:00 p.m. If she were to graph these data, what does the slope of the line connecting these two points represent in the context of this problem?
143 A student plotted the data from a sleep study as shown in the graph below.

The student used the equation of the line $y = -0.09x + 9.24$ to model the data. What does the rate of change represent in terms of these data?
1) The average number of hours of sleep per day increases 0.09 hour per year of age.
2) The average number of hours of sleep per day decreases 0.09 hour per year of age.
3) The average number of hours of sleep per day increases 9.24 hours per year of age.
4) The average number of hours of sleep per day decreases 9.24 hours per year of age.

144 During physical education class, Andrew recorded the exercise times in minutes and heart rates in beats per minute (bpm) of four of his classmates. Which table best represents a linear model of exercise time and heart rate?
A.CED.A.2, F.IF.B.4: GRAPHING LINEAR FUNCTIONS

145 The graph below was created by an employee at a gas station.

Which statement can be justified by using the graph?
1) If 10 gallons of gas was purchased, $35 was paid.
2) For every gallon of gas purchased, $3.75 was paid.
3) For every 2 gallons of gas purchased, $5.00 was paid.
4) If zero gallons of gas were purchased, zero miles were driven.

146 Which graph shows a line where each value of $y$ is three more than half of $x$?
147 Max purchased a box of green tea mints. The nutrition label on the box stated that a serving of three mints contains a total of 10 Calories. On the axes below, graph the function, \( C \), where \( C(x) \) represents the number of Calories in \( x \) mints.

Write an equation that represents \( C(x) \). A full box of mints contains 180 Calories. Use the equation to determine the total number of mints in the box.

148 Zeke and six of his friends are going to a baseball game. Their combined money totals $28.50. At the game, hot dogs cost $1.25 each, hamburgers cost $2.50 each, and sodas cost $0.50 each. Each person buys one soda. They spend all $28.50 on food and soda. Write an equation that can determine the number of hot dogs, \( x \), and hamburgers, \( y \), Zeke and his friends can buy. Graph your equation on the grid below.

Determine how many different combinations, including those combinations containing zero, of hot dogs and hamburgers Zeke and his friends can buy, spending all $28.50. Explain your answer.
149 Which function has the same \( y \)-intercept as the graph below?

\[ y = \frac{12 - 6x}{4} \]
\[ 27 + 3y = 6x \]
\[ 6y + x = 18 \]
\[ y + 3 = 6x \]

150 The value of the \( x \)-intercept for the graph of \( 4x - 5y = 40 \) is

1) 10
2) \( \frac{4}{5} \)
3) \( -\frac{4}{5} \)
4) -8

151 Samantha purchases a package of sugar cookies. The nutrition label states that each serving size of 3 cookies contains 160 Calories. Samantha creates the graph below showing the number of cookies eaten and the number of Calories consumed.

Explain why it is appropriate for Samantha to draw a line through the points on the graph.

A.REI.D.10: WRITING LINEAR FUNCTIONS

152 The graph of a linear equation contains the points \((3,11)\) and \((-2,1)\). Which point also lies on the graph?

1) \((2,1)\)
2) \((2,4)\)
3) \((2,6)\)
4) \((2,9)\)
153 How many of the equations listed below represent the line passing through the points (2,3) and (4,−7)?

- \(5x + y = 13\)
- \(y + 7 = −5(x − 4)\)
- \(y = −5x + 13\)
- \(y − 7 = 5(x − 4)\)

1) 1  
2) 2  
3) 3  
4) 4

154 Sue and Kathy were doing their algebra homework. They were asked to write the equation of the line that passes through the points (−3,4) and (6,1). Sue wrote \(y − 4 = −\frac{1}{3}(x + 3)\) and Kathy wrote \(y = −\frac{1}{3}x + 3\). Justify why both students are correct.

156 When \(3x + 2 \leq 5(x − 4)\) is solved for \(x\), the solution is

1) \(x ≤ 3\)
2) \(x ≥ 3\)
3) \(x ≤ −11\)
4) \(x ≥ 11\)

157 What is the solution to \(2h + 8 > 3h − 6\)

1) \(h < 14\)
2) \(h < \frac{14}{5}\)
3) \(h > 14\)
4) \(h > \frac{14}{5}\)

158 What is the solution to the inequality \(2 + \frac{4}{9}x ≥ 4 + x\)?

1) \(x ≤ \frac{18}{5}\)
2) \(x ≥ \frac{18}{5}\)
3) \(x ≤ \frac{54}{5}\)
4) \(x ≥ \frac{54}{5}\)

159 The solution to \(4p + 2 < 2(p + 5)\) is

1) \(p > −6\)
2) \(p < −6\)
3) \(p > 4\)
4) \(p < 4\)

160 Given that \(a > b\), solve for \(x\) in terms of \(a\) and \(b\):

\(b(x − 3) ≥ ax + 7b\)
161 Solve the inequality below:
\[1.8 - 0.4y \geq 2.2 - 2y\]

162 Solve algebraically for \(x\):
\[3600 + 1.02x < 2000 + 1.04x\]

167 Determine the smallest integer that makes \(-3x + 7 - 5x < 15\) true.

168 Solve for \(x\) algebraically:
\[7x - 3(4x - 8) \leq 6x + 12 - 9x\]
If \(x\) is a number in the interval \([4, 8]\), state all integers that satisfy the given inequality. Explain how you determined these values.

A.REI.B.3: INTERPRETING SOLUTIONS

163 Which value would be a solution for \(x\) in the inequality \(47 - 4x < 7\)?
1) -13
2) -10
3) 10
4) 11

A.CED.A.1: MODELING LINEAR INEQUALITIES

169 The acidity in a swimming pool is considered normal if the average of three pH readings, \(p\), is defined such that \(7.0 < p < 7.8\). If the first two readings are 7.2 and 7.6, which value for the third reading will result in an overall rating of normal?
1) 6.2
2) 7.3
3) 8.6
4) 8.8

170 Connor wants to attend the town carnival. The price of admission to the carnival is $4.50, and each ride costs an additional 79 cents. If he can spend at most $16.00 at the carnival, which inequality can be used to solve for \(r\), the number of rides Connor can go on, and what is the maximum number of rides he can go on?
1) \(0.79 + 4.50r \leq 16.00\); 3 rides
2) \(0.79 + 4.50r \leq 16.00\); 4 rides
3) \(4.50 + 0.79r \leq 16.00\); 14 rides
4) \(4.50 + 0.79r \leq 16.00\); 15 rides
171 Natasha is planning a school celebration and wants to have live music and food for everyone who attends. She has found a band that will charge her $750 and a caterer who will provide snacks and drinks for $2.25 per person. If her goal is to keep the average cost per person between $2.75 and $3.25, how many people, $p$, must attend?

1) $225 < p < 325$
2) $325 < p < 750$
3) $500 < p < 1000$
4) $750 < p < 1500$

172 The cost of a pack of chewing gum in a vending machine is $0.75. The cost of a bottle of juice in the same machine is $1.25. Julia has $22.00 to spend on chewing gum and bottles of juice for her team and she must buy seven packs of chewing gum. If $b$ represents the number of bottles of juice, which inequality represents the maximum number of bottles she can buy?

1) $0.75b + 1.25(7) \geq 22$
2) $0.75b + 1.25(7) \leq 22$
3) $0.75(7) + 1.25b \geq 22$
4) $0.75(7) + 1.25b \leq 22$

173 Joy wants to buy strawberries and raspberries to bring to a party. Strawberries cost $1.60 per pound and raspberries cost $1.75 per pound. If she only has $10 to spend on berries, which inequality represents the situation where she buys $x$ pounds of strawberries and $y$ pounds of raspberries?

1) $1.60x + 1.75y \leq 10$
2) $1.60x + 1.75y \geq 10$
3) $1.75x + 1.60y \leq 10$
4) $1.75x + 1.60y \geq 10$

174 The math department needs to buy new textbooks and laptops for the computer science classroom. The textbooks cost $116.00 each, and the laptops cost $439.00 each. If the math department has $6500 to spend and purchases 30 textbooks, how many laptops can they buy?

1) 6
2) 7
3) 11
4) 12

175 David has two jobs. He earns $8 per hour babysitting his neighbor’s children and he earns $11 per hour working at the coffee shop. Write an inequality to represent the number of hours, $x$, babysitting and the number of hours, $y$, working at the coffee shop that David will need to work to earn a minimum of $200. David worked 15 hours at the coffee shop. Use the inequality to find the number of full hours he must babysit to reach his goal of $200.$

176 Sarah wants to buy a snowboard that has a total cost of $580, including tax. She has already saved $135 for it. At the end of each week, she is paid $96 for babysitting and is going to save three-quarters of that for the snowboard. Write an inequality that can be used to determine the minimum number of weeks Sarah needs to babysit to have enough money to purchase the snowboard. Determine and state the minimum number of full weeks Sarah needs to babysit to have enough money to purchase this snowboard.
177 Which inequality is represented in the graph below?

\begin{align*}
1) & \quad y \geq -3x + 4 \\
2) & \quad y \leq -3x + 4 \\
3) & \quad y \geq -4x - 3 \\
4) & \quad y \leq -4x - 3
\end{align*}

178 Which inequality is represented by the graph below?

\begin{align*}
1) & \quad y \leq 2x - 3 \\
2) & \quad y \geq 2x - 3 \\
3) & \quad y \leq -3x + 2 \\
4) & \quad y \geq -3x + 2
\end{align*}

179 On the set of axes below, graph the inequality $2x + y > 1$. 

\begin{align*}
\end{align*}
180 Graph the inequality $y > 2x - 5$ on the set of axes below. State the coordinates of a point in its solution.

181 Graph the inequality $y + 4 < -2(x - 4)$ on the set of axes below.
182  Shawn incorrectly graphed the inequality 
\[-x - 2y \geq 8\] 
as shown below.

Explain Shawn's mistake. Graph the inequality correctly on the set of axes below.

183  Myranda received a movie gift card for $100 to her local theater. Matinee tickets cost $7.50 each and evening tickets cost $12.50 each. If \(x\) represents the number of matinee tickets she could purchase, and \(y\) represents the number of evening tickets she could purchase, write an inequality that represents all the possible ways Myranda could spend her gift card on movies at the theater. On the set of axes below, graph this inequality.

What is the maximum number of matinee tickets Myranda could purchase with her gift card? Explain your answer.

184  What is the minimum value of the function 
\[y = |x + 3| - 2?\]
1)  -2
2)  2
3)  3
4)  -3
185 On the set of axes below, graph the function $y = |x + 1|$.

State the range of the function. State the domain over which the function is increasing.

186 On the set of axes below, graph $f(x) = |x - 3| + 2$. 
187 On the axes below, graph \( f(x) = |3x| \).

If \( g(x) = f(x) - 2 \), how is the graph of \( f(x) \) translated to form the graph of \( g(x) \)? If \( h(x) = f(x - 4) \), how is the graph of \( f(x) \) translated to form the graph of \( h(x) \)?

188 Graph the function \( y = |x - 3| \) on the set of axes below.

Explain how the graph of \( y = |x - 3| \) has changed from the related graph \( y = |x| \).

189 Describe the effect that each transformation below has on the function \( f(x) = |x| \), where \( a > 0 \).
\[ g(x) = |x - a| \]
\[ h(x) = |x| - a \]

**QUADRATICS**

A.REI.B.4: SOLVING QUADRATICS

190 If \( 4x^2 - 100 = 0 \), the roots of the equation are
1) \(-25\) and \(25\)
2) \(-25\), only
3) \(-5\) and \(5\)
4) \(-5\), only
A student is asked to solve the equation

\[ 4(3x - 1)^2 - 17 = 83. \]

The student's solution to the problem starts as

\[ 4(3x - 1)^2 = 100 \]

\[ (3x - 1)^2 = 25 \]

A correct next step in the solution of the problem is

1) \( 3x - 1 = \pm 5 \)
2) \( 3x - 1 = \pm 25 \)
3) \( 9x^2 - 1 = 25 \)
4) \( 9x^2 - 6x + 1 = 5 \)

The solution of the equation \((x + 3)^2 = 7\) is

1) \( 3 \pm \sqrt{7} \)
2) \( 7 \pm \sqrt{3} \)
3) \( -3 \pm \sqrt{7} \)
4) \( -7 \pm \sqrt{3} \)

What is the solution of the equation \(2(x + 2)^2 - 4 = 28?\)

1) \( 6, \) only
2) \( 2, \) only
3) \( 2 \) and \( -6 \)
4) \( 6 \) and \( -2 \)

Which value of \( x \) is a solution to the equation \( 13 - 36x^2 = -12?\)

1) \( \frac{36}{25} \)
2) \( \frac{25}{36} \)
3) \( \frac{6}{5} \)
4) \( \frac{5}{6} \)

What are the solutions to the equation \(3(x - 4)^2 = 27?\)

1) \( 1 \) and \( 7 \)
2) \( -1 \) and \( -7 \)
3) \( 4 \pm \sqrt{24} \)
4) \( -4 \pm \sqrt{24} \)

The height, \( H, \) in feet, of an object dropped from the top of a building after \( t \) seconds is given by \( H(t) = -16t^2 + 144. \) How many feet did the object fall between one and two seconds after it was dropped? Determine, algebraically, how many seconds it will take for the object to reach the ground.

Solve the quadratic equation below for the exact values of \( x.\)

\[ 4x^2 - 5 = 75 \]
198 Which equation has the same solutions as 
\[2x^2 + x - 3 = 0\]
1) \[(2x - 1)(x + 3) = 0\]
2) \[(2x + 1)(x - 3) = 0\]
3) \[(2x - 3)(x + 1) = 0\]
4) \[(2x + 3)(x - 1) = 0\]

199 What are the solutions to the equation 
\[3x^2 + 10x = 8?\]
1) \(\frac{2}{3}\) and \(-4\)
2) \(-\frac{2}{3}\) and \(4\)
3) \(\frac{4}{3}\) and \(-2\)
4) \(-\frac{4}{3}\) and \(2\)

200 What is the solution set of the equation 
\[(x - 2)(x - a) = 0?\]
1) \(-2\) and \(a\)
2) \(-2\) and \(-a\)
3) \(2\) and \(a\)
4) \(2\) and \(-a\)

201 Solve \(8m^2 + 20m = 12\) for \(m\) by factoring.

202 Write an equation that defines \(m(x)\) as a trinomial 
where \(m(x) = (3x - 1)(3 - x) + 4x^2 + 19\). Solve for \(x\) when \(m(x) = 0\).

203 In the equation \(x^2 + 10x + 24 = (x + a)(x + b)\), \(b\) is an integer. Find algebraically all possible values of \(b\).

204 Solve the equation \(4x^2 - 12x = 7\) algebraically for \(x\).

205 Solve the equation for \(y\): \((y - 3)^2 = 4y - 12\)

206 Amy solved the equation \(2x^2 + 5x - 42 = 0\). She stated that the solutions to the equation were \(\frac{7}{2}\) and \(-6\). Do you agree with Amy's solutions? Explain why or why not.

207 Janice is asked to solve \(0 = 64x^2 + 16x - 3\). She begins the problem by writing the following steps:

Line 1 0 = 64\(x^2\) + 16\(x\) - 3  
Line 2 0 = \(B^2 + 2B - 3\)  
Line 3 0 = (\(B + 3\))(\(B - 1\))

Use Janice's procedure to solve the equation for \(x\). Explain the method Janice used to solve the quadratic equation.

208 Solve \(x^2 - 8x - 9 = 0\) algebraically. Explain the first step you used to solve the given equation.
209 Which equation has the same solution as 
\( x^2 - 6x - 12 = 0? \)
1) \( (x + 3)^2 = 21 \)
2) \( (x - 3)^2 = 21 \)
3) \( (x + 3)^2 = 3 \)
4) \( (x - 3)^2 = 3 \)

210 Which equation has the same solutions as 
\( x^2 + 6x - 7 = 0? \)
1) \( (x + 3)^2 = 2 \)
2) \( (x - 3)^2 = 2 \)
3) \( (x - 3)^2 = 16 \)
4) \( (x + 3)^2 = 16 \)

211 When solving the equation \( x^2 - 8x - 7 = 0 \) by completing the square, which equation is a step in the process?
1) \( (x - 4)^2 = 9 \)
2) \( (x - 4)^2 = 23 \)
3) \( (x - 8)^2 = 9 \)
4) \( (x - 8)^2 = 23 \)

212 The method of completing the square was used to solve the equation \( 2x^2 - 12x + 6 = 0 \). Which equation is a correct step when using this method?
1) \( (x - 3)^2 = 6 \)
2) \( (x - 3)^2 = -6 \)
3) \( (x - 3)^2 = 3 \)
4) \( (x - 3)^2 = -3 \)

213 Which equation has the same solution as 
\( x^2 + 8x - 33 = 0? \)
1) \( (x + 4)^2 = 49 \)
2) \( (x - 4)^2 = 49 \)
3) \( (x + 4)^2 = 17 \)
4) \( (x - 4)^2 = 17 \)

214 What are the roots of the equation \( x^2 + 4x - 16 = 0? \)
1) \( 2 \pm 2\sqrt{5} \)
2) \( -2 \pm 2\sqrt{5} \)
3) \( 2 \pm 4\sqrt{5} \)
4) \( -2 \pm 4\sqrt{5} \)

215 When directed to solve a quadratic equation by completing the square, Sam arrived at the equation \( \left( x - \frac{5}{2} \right)^2 = \frac{13}{4} \). Which equation could have been the original equation given to Sam?
1) \( x^2 + 5x + 7 = 0 \)
2) \( x^2 + 5x + 3 = 0 \)
3) \( x^2 - 5x + 7 = 0 \)
4) \( x^2 - 5x + 3 = 0 \)

216 What are the solutions to the equation \( x^2 - 8x = 24? \)
1) \( x = 4 \pm 2\sqrt{10} \)
2) \( x = -4 \pm 2\sqrt{10} \)
3) \( x = 4 \pm 2\sqrt{2} \)
4) \( x = -4 \pm 2\sqrt{2} \)
217 What are the solutions to the equation $x^2 - 8x = 10$?
1) $4 \pm \sqrt{10}$
2) $4 \pm \sqrt{26}$
3) $-4 \pm \sqrt{10}$
4) $-4 \pm \sqrt{26}$

218 The quadratic equation $x^2 - 6x = 12$ is rewritten in the form $(x + p)^2 = q$, where $q$ is a constant. What is the value of $p$?
1) $-12$
2) $-9$
3) $-3$
4) $9$

219 A student was given the equation $x^2 + 6x - 13 = 0$ to solve by completing the square. The first step that was written is shown below.

$x^2 + 6x = 13$

The next step in the student’s process was $x^2 + 6x + c = 13 + c$. State the value of $c$ that creates a perfect square trinomial. Explain how the value of $c$ is determined.

220 Solve the equation $x^2 - 6x = 15$ by completing the square.

221 Solve the following equation by completing the square: $x^2 + 4x = 2$

222 If the quadratic formula is used to find the roots of the equation $x^2 - 6x - 19 = 0$, the correct roots are
1) $3 \pm 2\sqrt{7}$
2) $-3 \pm 2\sqrt{7}$
3) $3 \pm 4\sqrt{14}$
4) $-3 \pm 4\sqrt{14}$

223 Fred's teacher gave the class the quadratic function $f(x) = 4x^2 + 16x + 9$.

a) State two different methods Fred could use to solve the equation $f(x) = 0$.

b) Using one of the methods stated in part a, solve $f(x) = 0$ for $x$, to the nearest tenth.

224 Solve for $x$ to the nearest tenth: $x^2 + x - 5 = 0$.

A.REI.B.4: USING THE DISCRIMINANT

225 How many real-number solutions does $4x^2 + 2x + 5 = 0$ have?
1) one
2) two
3) zero
4) infinitely many

226 How many real solutions does the equation $x^2 - 2x + 5 = 0$ have? Justify your answer.
227 Is the solution to the quadratic equation written below rational or irrational? Justify your answer.

\[ 0 = 2x^2 + 3x - 10 \]

A.CED.A.1: MODELING QUADRATICS

228 Sam and Jeremy have ages that are consecutive odd integers. The product of their ages is 783. Which equation could be used to find Jeremy’s age, \( j \), if he is the younger man?

1) \( j^2 + 2 = 783 \)
2) \( j^2 - 2 = 783 \)
3) \( j^2 + 2j = 783 \)
4) \( j^2 - 2j = 783 \)

A.CED.A.1: GEOMETRIC APPLICATIONS OF QUADRATICS

230 The length of the shortest side of a right triangle is 8 inches. The lengths of the other two sides are represented by consecutive odd integers. Which equation could be used to find the lengths of the other sides of the triangle?

1) \( 8^2 + (x + 1) = x^2 \)
2) \( x^2 + 8^2 = (x + 1)^2 \)
3) \( 8^2 + (x + 2) = x^2 \)
4) \( x^2 + 8^2 = (x + 2)^2 \)

231 Joe has a rectangular patio that measures 10 feet by 12 feet. He wants to increase the area by 50% and plans to increase each dimension by equal lengths, \( x \). Which equation could be used to determine \( x \)?

1) \( (10 + x)(12 + x) = 120 \)
2) \( (10 + x)(12 + x) = 180 \)
3) \( (15 + x)(18 + x) = 180 \)
4) \( (15)(18) = 120 + x^2 \)

232 A school is building a rectangular soccer field that has an area of 6000 square yards. The soccer field must be 40 yards longer than its width. Determine algebraically the dimensions of the soccer field, in yards.

233 A landscaper is creating a rectangular flower bed such that the width is half of the length. The area of the flower bed is 34 square feet. Write and solve an equation to determine the width of the flower bed, to the nearest tenth of a foot.
234 A contractor has 48 meters of fencing that he is going to use as the perimeter of a rectangular garden. The length of one side of the garden is represented by $x$, and the area of the garden is 108 square meters. Determine, algebraically, the dimensions of the garden in meters.

235 A rectangular garden measuring 12 meters by 16 meters is to have a walkway installed around it with a width of $x$ meters, as shown in the diagram below. Together, the walkway and the garden have an area of 396 square meters. Write an equation that can be used to find $x$, the width of the walkway. Describe how your equation models the situation. Determine and state the width of the walkway, in meters.

236 New Clarendon Park is undergoing renovations to its gardens. One garden that was originally a square is being adjusted so that one side is doubled in length, while the other side is decreased by three meters. The new rectangular garden will have an area that is 25% more than the original square garden. Write an equation that could be used to determine the length of a side of the original square garden. Explain how your equation models the situation. Determine the area, in square meters, of the new rectangular garden.

237 A rectangular picture measures 6 inches by 8 inches. Simon wants to build a wooden frame for the picture so that the framed picture takes up a maximum area of 100 square inches on his wall. The pieces of wood that he uses to build the frame all have the same width. Write an equation or inequality that could be used to determine the maximum width of the pieces of wood for the frame Simon could create. Explain how your equation or inequality models the situation. Solve the equation or inequality to determine the maximum width of the pieces of wood used for the frame to the nearest tenth of an inch.

238 Which equation is equivalent to $y - 34 = x(x - 12)$?
1) $y = (x - 17)(x + 2)$
2) $y = (x - 17)(x - 2)$
3) $y = (x - 6)^2 + 2$
4) $y = (x - 6)^2 - 2$
239 If Lylah completes the square for \( f(x) = x^2 - 12x + 7 \) in order to find the minimum, she must write \( f(x) \) in the general form \( f(x) = (x - a)^2 + b \). What is the value of \( a \) for \( f(x) \)?

1) 6 
2) −6 
3) 12 
4) −12

240 In the function \( f(x) = (x - 2)^2 + 4 \), the minimum value occurs when \( x \) is

1) −2 
2) 2 
3) −4 
4) 4

241 The function \( f(x) = 3x^2 + 12x + 11 \) can be written in vertex form as

1) \( f(x) = (3x + 6)^2 - 25 \) 
2) \( f(x) = 3(x + 6)^2 - 25 \) 
3) \( f(x) = 3(x + 2)^2 - 1 \) 
4) \( f(x) = 3(x + 2)^2 + 7 \)

242 Which equation and ordered pair represent the correct vertex form and vertex for \( f(x) = x^2 - 12x + 7 \)?

1) \( f(x) = (x - 6)^2 + 43, (6, 43) \) 
2) \( f(x) = (x - 6)^2 + 43, (-6, 43) \) 
3) \( f(x) = (x - 6)^2 - 29, (6, -29) \) 
4) \( f(x) = (x - 6)^2 - 29, (-6, -29) \)

243 a) Given the function \( f(x) = -x^2 + 8x + 9 \), state whether the vertex represents a maximum or minimum point for the function. Explain your answer. 

b) Rewrite \( f(x) \) in vertex form by completing the square.

244 The height of a rocket, at selected times, is shown in the table below.

<table>
<thead>
<tr>
<th>Time (sec)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (ft)</td>
<td>180</td>
<td>260</td>
<td>308</td>
<td>324</td>
<td>308</td>
<td>260</td>
<td>180</td>
<td>68</td>
</tr>
</tbody>
</table>

Based on these data, which statement is not a valid conclusion?

1) The rocket was launched from a height of 180 feet. 
2) The maximum height of the rocket occurred 3 seconds after launch. 
3) The rocket was in the air approximately 6 seconds before hitting the ground. 
4) The rocket was above 300 feet for approximately 2 seconds.
245 A ball is thrown into the air from the edge of a 48-foot-high cliff so that it eventually lands on the ground. The graph below shows the height, \( y \), of the ball from the ground after \( x \) seconds.

For which interval is the ball's height always decreasing?
1) \( 0 \leq x \leq 2.5 \)
2) \( 0 < x < 5.5 \)
3) \( 2.5 < x < 5.5 \)
4) \( x \geq 2 \)

246 The graph of a quadratic function is shown below.

An equation that represents the function could be
1) \( q(x) = \frac{1}{2} (x + 15)^2 - 25 \)
2) \( q(x) = -\frac{1}{2} (x + 15)^2 - 25 \)
3) \( q(x) = \frac{1}{2} (x - 15)^2 + 25 \)
4) \( q(x) = -\frac{1}{2} (x - 15)^2 + 25 \)

247 Morgan throws a ball up into the air. The height of the ball above the ground, in feet, is modeled by the function \( h(t) = -16t^2 + 24t \), where \( t \) represents the time, in seconds, since the ball was thrown. What is the appropriate domain for this situation?
1) \( 0 \leq t \leq 1.5 \)
2) \( 0 \leq t \leq 9 \)
3) \( 0 \leq h(t) \leq 1.5 \)
4) \( 0 \leq h(t) \leq 9 \)
248 The expression $-4.9t^2 + 50t + 2$ represents the height, in meters, of a toy rocket $t$ seconds after launch. The initial height of the rocket, in meters, is

1) 0  
2) 2  
3) 4.9  
4) 50

249 The height of a ball Doreen tossed into the air can be modeled by the function $h(x) = -4.9x^2 + 6x + 5$, where $x$ is the time elapsed in seconds, and $h(x)$ is the height in meters. The number 5 in the function represents

1) the initial height of the ball  
2) the time at which the ball reaches the ground  
3) the time at which the ball was at its highest point  
4) the maximum height the ball attained when thrown in the air

250 A football player attempts to kick a football over a goal post. The path of the football can be modeled by the function $h(x) = -\frac{1}{225}x^2 + \frac{2}{3}x$, where $x$ is the horizontal distance from the kick, and $h(x)$ is the height of the football above the ground, when both are measured in feet. On the set of axes below, graph the function $y = h(x)$ over the interval $0 \leq x \leq 150$.

Determine the vertex of $y = h(x)$. Interpret the meaning of this vertex in the context of the problem. The goal post is 10 feet high and 45 yards away from the kick. Will the ball be high enough to pass over the goal post? Justify your answer.
251 On the set of axes below, draw the graph of 
\[ y = x^2 - 4x - 1. \]

State the equation of the axis of symmetry.

252 Alex launched a ball into the air. The height of the ball can be represented by the equation 
\[ h = -8t^2 + 40t + 5, \]
where \( h \) is the height, in units, and \( t \) is the time, in seconds, after the ball was launched. Graph the equation from \( t = 0 \) to \( t = 5 \) seconds.

State the coordinates of the vertex and explain its meaning in the context of the problem.
253 Graph the function \( f(x) = -x^2 - 6x \) on the set of axes below.

State the coordinates of the vertex of the graph.

254 Paul plans to have a rectangular garden adjacent to his garage. He will use 36 feet of fence to enclose three sides of the garden. The area of the garden, in square feet, can be modeled by

\[ f(w) = w(36 - 2w), \]

where \( w \) is the width in feet. On the set of axes below, sketch the graph of \( f(w) \).

Explain the meaning of the vertex in the context of the problem.

255 A toy rocket is launched from the ground straight upward. The height of the rocket above the ground, in feet, is given by the equation

\[ h(t) = -16t^2 + 64t, \]

where \( t \) is the time in seconds. Determine the domain for this function in the given context. Explain your reasoning.
256 Let \( h(t) = -16t^2 + 64t + 80 \) represent the height of an object above the ground after \( t \) seconds. Determine the number of seconds it takes to achieve its maximum height. Justify your answer. State the time interval, in seconds, during which the height of the object decreases. Explain your reasoning.

257 An Air Force pilot is flying at a cruising altitude of 9000 feet and is forced to eject from her aircraft. The function \( h(t) = -16t^2 + 128t + 9000 \) models the height, in feet, of the pilot above the ground, where \( t \) is the time, in seconds, after she is ejected from the aircraft. Determine and state the vertex of \( h(t) \). Explain what the second coordinate of the vertex represents in the context of the problem. After the pilot was ejected, what is the maximum number of feet she was above the aircraft’s cruising altitude? Justify your answer.

259 The graph of the function \( f(x) = ax^2 + bx + c \) is given below.

Could the factors of \( f(x) \) be \( (x + 2) \) and \( (x - 3) \)? Based on the graph, explain why or why not.

258 If the zeros of a quadratic function, \( F \), are \(-3\) and \(5\), what is the equation of the axis of symmetry of \( F \)? Justify your answer.

260 When an apple is dropped from a tower 256 feet high, the function \( h(t) = -16t^2 + 256 \) models the height of the apple, in feet, after \( t \) seconds. Determine, algebraically, the number of seconds it takes the apple to hit the ground.
SYSTEMS
A.REI.5-6: SOLVING LINEAR SYSTEMS

261 Which system of equations has the same solution as the system below?
\[ 2x + 2y = 16 \]
\[ 3x - y = 4 \]
1) \[ 2x + 2y = 16 \]
\[ 6x - 2y = 4 \]
2) \[ 2x + 2y = 16 \]
\[ 6x - 2y = 8 \]
3) \[ x + y = 16 \]
\[ 3x - y = 4 \]
4) \[ 6x + 6y = 48 \]
\[ 6x + 2y = 8 \]

262 Which pair of equations could not be used to solve the following equations for \( x \) and \( y \)?
\[ 4x + 2y = 22 \]
\[ -2x + 2y = -8 \]
1) \[ 4x + 2y = 22 \]
\[ 2x - 2y = 8 \]
2) \[ 4x + 2y = 22 \]
\[ -4x + 4y = -16 \]
3) \[ 12x + 6y = 66 \]
\[ 6x - 6y = 24 \]
4) \[ 8x + 4y = 44 \]
\[ -8x + 8y = -8 \]

263 A system of equations is given below.
\[ x + 2y = 5 \]
\[ 2x + y = 4 \]
Which system of equations does not have the same solution?
1) \[ 3x + 6y = 15 \]
\[ 2x + y = 4 \]
2) \[ 4x + 8y = 20 \]
\[ 2x + y = 4 \]
3) \[ x + 2y = 5 \]
\[ 6x + 3y = 12 \]
4) \[ x + 2y = 5 \]
\[ 4x + 2y = 12 \]

264 Which system of equations does not have the same solution as the system below?
\[ 4x + 3y = 10 \]
\[ -6x - 5y = -16 \]
1) \[ -12x - 9y = -30 \]
\[ 12x + 10y = 32 \]
2) \[ 20x + 15y = 50 \]
\[ -18x - 15y = -48 \]
3) \[ 24x + 18y = 60 \]
\[ -24x - 20y = -64 \]
4) \[ 40x + 30y = 100 \]
\[ 36x + 30y = -96 \]
265 A system of equations is shown below.
Equation $A$: $5x + 9y = 12$
Equation $B$: $4x - 3y = 8$
Which method eliminates one of the variables?
1) Multiply equation $A$ by $-\frac{1}{3}$ and add the result to equation $B$.
2) Multiply equation $B$ by 3 and add the result to equation $A$.
3) Multiply equation $A$ by 2 and equation $B$ by $-6$ and add the results together.
4) Multiply equation $B$ by 5 and equation $A$ by 4 and add the results together.

266 Which system of equations will yield the same solution as the system below?
\begin{align*}
x - y &= 3 \\
2x - 3y &= -1
\end{align*}
1) $-2x - 2y = -6$
2) $2x - 3y = -1$
3) $-2x + 2y = 3$
4) $2x - 2y = 6$
5) $2x - 3y = -1$
6) $3x + 3y = 9$
7) $2x - 3y = -1$

267 Albert says that the two systems of equations shown below have the same solutions.

<table>
<thead>
<tr>
<th>First System</th>
<th>Second System</th>
</tr>
</thead>
<tbody>
<tr>
<td>$8x + 9y = 48$</td>
<td>$8x + 9y = 48$</td>
</tr>
<tr>
<td>$12x + 5y = 21$</td>
<td>$-8.5y = -51$</td>
</tr>
</tbody>
</table>

Determine and state whether you agree with Albert. Justify your answer.

268 The line represented by the equation $4y + 2x = 33.6$ shares a solution point with the line represented by the table below.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5</td>
<td>3.2</td>
</tr>
<tr>
<td>-2</td>
<td>3.8</td>
</tr>
<tr>
<td>2</td>
<td>4.6</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>6.4</td>
</tr>
</tbody>
</table>

The solution for this system is
1) $(-14.0, -1.4)$
2) $(-6.8, 5.0)$
3) $(1.9, 4.6)$
4) $(6.0, 5.4)$
269 Using the substitution method, Vito is solving the following system of equations algebraically:
\[
\begin{align*}
y + 3x &= -4 \\
2x - 3y &= -21
\end{align*}
\]
Which equivalent equation could Vito use?
1) \(2(-3x - 4) + 3x = -21\)
2) \(2(3x - 4) + 3x = -21\)
3) \(2x - 3(-3x - 4) = -21\)
4) \(2x - 3(3x - 4) = -21\)

270 What is the solution to the system of equations below?
\[
\begin{align*}
y &= 2x + 8 \\
3(-2x + y) &= 12
\end{align*}
\]
1) no solution
2) infinite solutions
3) \((-1, 6)\)
4) \(\left(\frac{1}{2}, 9\right)\)

271 Guy and Jim work at a furniture store. Guy is paid $185 per week plus 3% of his total sales in dollars, \(x\), which can be represented by \(g(x) = 185 + 0.03x\). Jim is paid $275 per week plus 2.5% of his total sales in dollars, \(x\), which can be represented by \(f(x) = 275 + 0.025x\). Determine the value of \(x\), in dollars, that will make their weekly pay the same.

272 In attempting to solve the system of equations
\[
\begin{align*}
y &= 3x - 2 \\
6x - 2y &= 4
\end{align*}
\]
John graphed the two equations on his graphing calculator. Because he saw only one line, John wrote that the answer to the system is the empty set. Is he correct? Explain your answer.

273 During the 2010 season, football player McGee’s earnings, \(m\), were 0.005 million dollars more than those of his teammate Fitzpatrick’s earnings, \(f\). The two players earned a total of 3.95 million dollars. Which system of equations could be used to determine the amount each player earned, in millions of dollars?
1) \(m + f = 3.95\)
2) \(m - 3.95 = f\)
3) \(f - 3.95 = m\)
4) \(m + f = 3.95\)

274 Mo’s farm stand sold a total of 165 pounds of apples and peaches. She sold apples for $1.75 per pound and peaches for $2.50 per pound. If she made $337.50, how many pounds of peaches did she sell?
1) 11
2) 18
3) 65
4) 100

275 Last week, a candle store received $355.60 for selling 20 candles. Small candles sell for $10.98 and large candles sell for $27.98. How many large candles did the store sell?
1) 6
2) 8
3) 10
4) 12
276 The Celluloid Cinema sold 150 tickets to a movie. Some of these were child tickets and the rest were adult tickets. A child ticket cost $7.75 and an adult ticket cost $10.25. If the cinema sold $1470 worth of tickets, which system of equations could be used to determine how many adult tickets, \( a \), and how many child tickets, \( c \), were sold?

1) \( a + c = 150 \)
   \[ 10.25a + 7.75c = 1470 \]

2) \( a + c = 1470 \)
   \[ 10.25a + 7.75c = 150 \]

3) \( a + c = 150 \)
   \[ 7.75a + 10.25c = 1470 \]

4) \( a + c = 1470 \)
   \[ 7.75a + 10.25c = 150 \]

277 Alicia purchased \( H \) half-gallons of ice cream for $3.50 each and \( P \) packages of ice cream cones for $2.50 each. She purchased 14 items and spent $43. Which system of equations could be used to determine how many of each item Alicia purchased?

1) \( 3.50H + 2.50P = 43 \)
   \[ H + P = 14 \]

2) \( 3.50P + 2.50H = 43 \)
   \[ P + H = 14 \]

3) \( 3.50H + 2.50P = 14 \)
   \[ H + P = 43 \]

4) \( 3.50P + 2.50H = 14 \)
   \[ P + H = 43 \]

278 Lizzy has 30 coins that total $4.80. All of her coins are dimes, \( D \), and quarters, \( Q \). Which system of equations models this situation?

1) \( D + Q = 4.80 \)
   \[ .10D + .25Q = 30 \]

2) \( D + Q = 30 \)
   \[ .10D + .25Q = 4.80 \]

3) \( D + Q = 30 \)
   \[ .25D + .10Q = 4.80 \]

4) \( D + Q = 4.80 \)
   \[ .25D + .10Q = 30 \]

279 The graph below models the cost of renting video games with a membership in Plan \( A \) and Plan \( B \).

Explain why Plan \( B \) is the better choice for Dylan if he only has $50 to spend on video games, including a membership fee. Bobby wants to spend $65 on video games, including a membership fee. Which plan should he choose? Explain your answer.
280 An animal shelter spends $2.35 per day to care for each cat and $5.50 per day to care for each dog. Pat noticed that the shelter spent $89.50 caring for cats and dogs on Wednesday. Write an equation to represent the possible numbers of cats and dogs that could have been at the shelter on Wednesday. Pat said that there might have been 8 cats and 14 dogs at the shelter on Wednesday. Are Pat’s numbers possible? Use your equation to justify your answer. Later, Pat found a record showing that there were a total of 22 cats and dogs at the shelter on Wednesday. How many cats were at the shelter on Wednesday?

281 Jacob and Zachary go to the movie theater and purchase refreshments for their friends. Jacob spends a total of $18.25 on two bags of popcorn and three drinks. Zachary spends a total of $27.50 for four bags of popcorn and two drinks. Write a system of equations that can be used to find the price of one bag of popcorn and the price of one drink. Using these equations, determine and state the price of a bag of popcorn and the price of a drink, to the nearest cent.

282 For a class picnic, two teachers went to the same store to purchase drinks. One teacher purchased 18 juice boxes and 32 bottles of water, and spent $19.92. The other teacher purchased 14 juice boxes and 26 bottles of water, and spent $15.76. Write a system of equations to represent the costs of a juice box, \( j \), and a bottle of water, \( w \). Kara said that the juice boxes might have cost 52 cents each and that the bottles of water might have cost 33 cents each. Use your system of equations to justify that Kara's prices are not possible. Solve your system of equations to determine the actual cost, in dollars, of each juice box and each bottle of water.

283 Two friends went to a restaurant and ordered one plain pizza and two sodas. Their bill totaled $15.95. Later that day, five friends went to the same restaurant. They ordered three plain pizzas and each person had one soda. Their bill totaled $45.90. Write and solve a system of equations to determine the price of one plain pizza. [Only an algebraic solution can receive full credit.]

284 At Bea's Pet Shop, the number of dogs, \( d \), is initially five less than twice the number of cats, \( c \). If she decides to add three more of each, the ratio of cats to dogs will be \( \frac{3}{4} \). Write an equation or system of equations that can be used to find the number of cats and dogs Bea has in her pet shop. Could Bea's Pet Shop initially have 15 cats and 20 dogs? Explain your reasoning. Determine algebraically the number of cats and the number of dogs Bea initially had in her pet shop.

285 There are two parking garages in Beacon Falls. Garage \( A \) charges $7.00 to park for the first 2 hours, and each additional hour costs $3.00. Garage \( B \) charges $3.25 per hour to park. When a person parks for at least 2 hours, write equations to model the cost of parking for a total of \( x \) hours in Garage \( A \) and Garage \( B \). Determine algebraically the number of hours when the cost of parking at both garages will be the same.
286 Dylan has a bank that sorts coins as they are dropped into it. A panel on the front displays the total number of coins inside as well as the total value of these coins. The panel shows 90 coins with a value of $17.55 inside of the bank. If Dylan only collects dimes and quarters, write a system of equations in two variables or an equation in one variable that could be used to model this situation. Using your equation or system of equations, algebraically determine the number of quarters Dylan has in his bank. Dylan's mom told him that she would replace each one of his dimes with a quarter. If he uses all of his coins, determine if Dylan would then have enough money to buy a game priced at $20.98 if he must also pay an 8% sales tax. Justify your answer.

287 At the present time, Mrs. Bee's age is six years more than four times her son's age. Three years ago, she was seven times as old as her son was then. If \( b \) represents Mrs. Bee's age now and \( s \) represents her son's age now, write a system of equations that could be used to model this scenario. Use this system of equations to determine, algebraically, the ages of both Mrs. Bee and her son now. Determine how many years from now Mrs. Bee will be three times as old as her son will be then.

A.REI.C.6: GRAPHING LINEAR SYSTEMS

288 Rowan has $50 in a savings jar and is putting in $5 every week. Jonah has $10 in his own jar and is putting in $15 every week. Each of them plots his progress on a graph with time on the horizontal axis and amount in the jar on the vertical axis. Which statement about their graphs is true?
1) Rowan’s graph has a steeper slope than Jonah’s.
2) Rowan’s graph always lies above Jonah’s.
3) Jonah’s graph has a steeper slope than Rowan’s.
4) Jonah’s graph always lies above Rowan’s.
289 Next weekend Marnie wants to attend either carnival $A$ or carnival $B$. Carnival $A$ charges $6$ for admission and an additional $1.50$ per ride. Carnival $B$ charges $2.50$ for admission and an additional $2$ per ride.

a) In function notation, write $A(x)$ to represent the total cost of attending carnival $A$ and going on $x$ rides. In function notation, write $B(x)$ to represent the total cost of attending carnival $B$ and going on $x$ rides.

b) Determine the number of rides Marnie can go on such that the total cost of attending each carnival is the same. [Use of the set of axes below is optional.]

c) Marnie wants to go on five rides. Determine which carnival would have the lower total cost. Justify your answer.

290 A local business was looking to hire a landscaper to work on their property. They narrowed their choices to two companies. Flourish Landscaping Company charges a flat rate of $120$ per hour. Green Thumb Landscapers charges $70$ per hour plus a $1600$ equipment fee. Write a system of equations representing how much each company charges. Determine and state the number of hours that must be worked for the cost of each company to be the same. [The use of the grid below is optional.] If it is estimated to take at least 35 hours to complete the job, which company will be less expensive? Justify your answer.
Franco and Caryl went to a bakery to buy desserts. Franco bought 3 packages of cupcakes and 2 packages of brownies for $19. Caryl bought 2 packages of cupcakes and 4 packages of brownies for $24. Let $x$ equal the price of one package of cupcakes and $y$ equal the price of one package of brownies. Write a system of equations that describes the given situation. On the set of axes below, graph the system of equations.

Central High School had five members on their swim team in 2010. Over the next several years, the team increased by an average of 10 members per year. The same school had 35 members in their chorus in 2010. The chorus saw an increase of 5 members per year. Write a system of equations to model this situation, where $x$ represents the number of years since 2010. Graph this system of equations on the set of axes below.

Determine the exact cost of one package of cupcakes and the exact cost of one package of brownies in dollars and cents. Justify your solution.

Explain in detail what each coordinate of the point of intersection of these equations means in the context of this problem.
293 A recreation center ordered a total of 15 tricycles and bicycles from a sporting goods store. The number of wheels for all the tricycles and bicycles totaled 38. Write a linear system of equations that models this scenario, where $t$ represents the number of tricycles and $b$ represents the number of bicycles ordered. On the set of axes below, graph this system of equations.

Based on your graph of this scenario, could the recreation center have ordered 10 tricycles? Explain your reasoning.

A.CED.A.3: MODELING SYSTEMS OF LINEAR INEQUALITIES

294 Jordan works for a landscape company during his summer vacation. He is paid $12 per hour for mowing lawns and $14 per hour for planting gardens. He can work a maximum of 40 hours per week, and would like to earn at least $250 this week. If $m$ represents the number of hours mowing lawns and $g$ represents the number of hours planting gardens, which system of inequalities could be used to represent the given conditions?

1) $m + g \leq 40$
2) $m + g \geq 40$
3) $m + g \leq 40$
4) $m + g \geq 40$

$12m + 14g \geq 250$

$12m + 14g \leq 250$

$12m + 14g \leq 250$

$12m + 14g \geq 250$
295 Gretchen has $50 that she can spend at the fair. Ride tickets cost $1.25 each and game tickets cost $2 each. She wants to go on a minimum of 10 rides and play at least 12 games. Which system of inequalities represents this situation when $r$ is the number of ride tickets purchased and $g$ is the number of game tickets purchased?

1) $1.25r + 2g < 50$
   
   $r \leq 10$

   $g > 12$

2) $1.25r + 2g \leq 50$
   
   $r \geq 10$

   $g \geq 12$

3) $1.25r + 2g \leq 50$

   $r \geq 10$

   $g > 12$

4) $1.25r + 2g < 50$
   
   $r \leq 10$

   $g \geq 12$

296 Edith babysits for $x$ hours a week after school at a job that pays $4 an hour. She has accepted a job that pays $8 an hour as a library assistant working $y$ hours a week. She will work both jobs. She is able to work no more than 15 hours a week, due to school commitments. Edith wants to earn at least $80 a week, working a combination of both jobs. Write a system of inequalities that can be used to represent the situation. Graph these inequalities on the set of axes below.

Determine and state one combination of hours that will allow Edith to earn at least $80 per week while working no more than 15 hours.
297 An on-line electronics store must sell at least $2500 worth of printers and computers per day. Each printer costs $50 and each computer costs $500. The store can ship a maximum of 15 items per day. On the set of axes below, graph a system of inequalities that models these constraints.

Determine a combination of printers and computers that would allow the electronics store to meet all of the constraints. Explain how you obtained your answer.

298 A drama club is selling tickets to the spring musical. The auditorium holds 200 people. Tickets cost $12 at the door and $8.50 if purchased in advance. The drama club has a goal of selling at least $1000 worth of tickets to Saturday's show. Write a system of inequalities that can be used to model this scenario. If 50 tickets are sold in advance, what is the minimum number of tickets that must be sold at the door so that the club meets its goal? Justify your answer.

299 The drama club is running a lemonade stand to raise money for its new production. A local grocery store donated cans of lemonade and bottles of water. Cans of lemonade sell for $2 each and bottles of water sell for $1.50 each. The club needs to raise at least $500 to cover the cost of renting costumes. The students can accept a maximum of 360 cans and bottles. Write a system of inequalities that can be used to represent this situation. The club sells 144 cans of lemonade. What is the least number of bottles of water that must be sold to cover the cost of renting costumes? Justify your answer.

300 A high school drama club is putting on their annual theater production. There is a maximum of 800 tickets for the show. The costs of the tickets are $6 before the day of the show and $9 on the day of the show. To meet the expenses of the show, the club must sell at least $5,000 worth of tickets.

a) Write a system of inequalities that represent this situation.
b) The club sells 440 tickets before the day of the show. Is it possible to sell enough additional tickets on the day of the show to at least meet the expenses of the show? Justify your answer.
A.REI.D.12: GRAPHING SYSTEMS OF LINEAR INEQUALITIES

301 What is one point that lies in the solution set of the system of inequalities graphed below?

1) (7,0)  
2) (3,0)  
3) (0,7)  
4) (−3,5)

302 Given:  
y + x > 2  
y ≤ 3x − 2
Which graph shows the solution of the given set of inequalities?
303 Which graph represents the solution of \( y \leq x + 3 \) and \( y \geq -2x - 2 \)?

1) 

2) 

3) 

4) 

304 Which ordered pair is not in the solution set of
\[ y > \frac{1}{2} x + 5 \] and \( y \leq 3x - 2 \)?

1) \((5,3)\)
2) \((4,3)\)
3) \((3,4)\)
4) \((4,4)\)

305 Which point is a solution to the system below?
\[
\begin{align*}
2y &< -12x + 4 \\
y &< -6x + 4
\end{align*}
\]

1) \( \left( \frac{1}{2}, \frac{1}{2} \right) \)
2) \((0,6)\)
3) \( \left( -\frac{1}{2}, 5 \right) \)
4) \((-3,2)\)

306 First consider the system of equations \( y = -\frac{1}{2} x + 1 \) and \( y = x - 5 \). Then consider the system of inequalities \( y > -\frac{1}{2} x + 1 \) and \( y < x - 5 \). When comparing the number of solutions in each of these systems, which statement is true?

1) Both systems have an infinite number of solutions.
2) The system of equations has more solutions.
3) The system of inequalities has more solutions.
4) Both systems have only one solution.
The Reel Good Cinema is conducting a mathematical study. In its theater, there are 200 seats. Adult tickets cost $12.50 and child tickets cost $6.25. The cinema's goal is to sell at least $1500 worth of tickets for the theater. Write a system of linear inequalities that can be used to find the possible combinations of adult tickets, \( x \), and child tickets, \( y \), that would satisfy the cinema's goal. Graph the solution to this system of inequalities on the set of axes below. Label the solution with an \( S \). Marta claims that selling 30 adult tickets and 80 child tickets will result in meeting the cinema's goal. Explain whether she is correct or incorrect, based on the graph drawn.
308 The graph of an inequality is shown below.

a) Write the inequality represented by the graph.
b) On the same set of axes, graph the inequality $x + 2y < 4$.
c) The two inequalities graphed on the set of axes form a system. Oscar thinks that the point (2,1) is in the solution set for this system of inequalities. Determine and state whether you agree with Oscar. Explain your reasoning.

309 The sum of two numbers, $x$ and $y$, is more than 8. When you double $x$ and add it to $y$, the sum is less than 14. Graph the inequalities that represent this scenario on the set of axes below.

Kai says that the point (6,2) is a solution to this system. Determine if he is correct and explain your reasoning.
310 Solve the following system of inequalities graphically on the grid below and label the solution set $S$.

\begin{align*}
3x + 4y &> 20 \\
x &< 3y - 18
\end{align*}

Is the point $(3, 7)$ in the solution set? Explain your answer.

311 Determine if the point $(0, 4)$ is a solution to the system of inequalities graphed below. Justify your answer.
312 On the set of axes below, graph the following system of inequalities:
\[ 2y + 3x \leq 14 \]
\[ 4x - y < 2 \]
Determine if the point (1,2) is in the solution set. Explain your answer.

313 Graph the following systems of inequalities on the set of axes below:
\[ 2y \geq 3x - 16 \]
\[ y + 2x > -5 \]
Based upon your graph, explain why (6,1) is a solution to this system and why (−6,7) is not a solution to this system.

A.REI.C.7, A.REI.D.11: QUADRATIC-LINEAR SYSTEMS

314 The graphs of \( y = x^2 - 3 \) and \( y = 3x - 4 \) intersect at approximately
1) (0.38,−2.85), only
2) (2.62,3.85), only
3) (0.38,−2.85) and (2.62,3.85)
4) (0.38,−2.85) and (3.85,2.62)
315 If \( f(x) = x^2 - 2x - 8 \) and \( g(x) = \frac{1}{4}x - 1 \), for which value of \( x \) is \( f(x) = g(x) \)?

1) \(-1.75 \) and \(-1.438\)
2) \(-1.75 \) and \(4\)
3) \(-1.438 \) and \(0\)
4) \(4 \) and \(0\)

316 A company is considering building a manufacturing plant. They determine the weekly production cost at site \( A \) to be \( A(x) = 3x^2 \) while the production cost at site \( B \) is \( B(x) = 8x + 3 \), where \( x \) represents the number of products, \textit{in hundreds}, and \( A(x) \) and \( B(x) \) are the production costs, \textit{in hundreds of dollars}. Graph the production cost functions on the set of axes below and label them site \( A \) and site \( B \).

Using this graph, determine and state \textit{all} values of \( x \) for which \( f(x) = g(x) \).

317 Let \( f(x) = -2x^2 \) and \( g(x) = 2x - 4 \). On the set of axes below, draw the graphs of \( y = f(x) \) and \( y = g(x) \).

318 John and Sarah are each saving money for a car. The total amount of money John will save is given by the function \( f(x) = 60 + 5x \). The total amount of money Sarah will save is given by the function \( g(x) = x^2 + 46 \). After how many weeks, \( x \), will they have the same amount of money saved? Explain how you arrived at your answer.

319 If \( f(x) = x^2 \) and \( g(x) = x \), determine the value(s) of \( x \) that satisfy the equation \( f(x) = g(x) \).
320 Given: \( g(x) = 2x^2 + 3x + 10 \)
\[ k(x) = 2x + 16 \]
Solve the equation \( g(x) = 2k(x) \) algebraically for \( x \), to the nearest tenth. Explain why you chose the method you used to solve this quadratic equation.

A.REL.D.11: OTHER SYSTEMS

321 The functions \( f(x) \) and \( g(x) \) are graphed below.

![Graph of functions](image)

Based on the graph, the solutions to the equation \( f(x) = g(x) \) are
1) the \( x \)-intercepts
2) the \( y \)-intercepts
3) the \( x \)-values of the points of intersection
4) the \( y \)-values of the points of intersection

322 Two functions, \( y = |x - 3| \) and \( 3x + 3y = 27 \), are graphed on the same set of axes. Which statement is true about the solution to the system of equations?
1) \((3,0)\) is the solution to the system because it satisfies the equation \( y = |x - 3| \).
2) \((9,0)\) is the solution to the system because it satisfies the equation \( 3x + 3y = 27 \).
3) \((6,3)\) is the solution to the system because it satisfies both equations.
4) \((3,0), (9,0), \) and \((6,3)\) are the solutions to the system of equations because they all satisfy at least one of the equations.

323 The graphs of the functions \( f(x) = |x - 3| + 1 \) and \( g(x) = 2x + 1 \) are drawn. Which statement about these functions is true?
1) The solution to \( f(x) = g(x) \) is 3.
2) The solution to \( f(x) = g(x) \) is 1.
3) The graphs intersect when \( y = 1 \).
4) The graphs intersect when \( x = 3 \).

324 Which pair of equations would have \((-1,2)\) as a solution?
1) \( y = x + 3 \) and \( y = 2x \)
2) \( y = x - 1 \) and \( y = 2x \)
3) \( y = x^2 - 3x - 2 \) and \( y = 4x + 6 \)
4) \( 2x + 3y = -4 \) and \( y = -\frac{1}{2}x - \frac{3}{2} \)
325 Given the functions \( h(x) = \frac{1}{2}x + 3 \) and \( j(x) = |x| \), which value of \( x \) makes \( h(x) = j(x) \)?

1) \(-2\)  
2) 2  
3) 3  
4) \(-6\)

326 Which value of \( x \) results in equal outputs for \( j(x) = 3x - 2 \) and \( b(x) = |x + 2| \)?

1) \(-2\)  
2) 2  
3) \(\frac{2}{3}\)  
4) 4

327 The graph below shows two functions, \( f(x) \) and \( g(x) \). State all the values of \( x \) for which \( f(x) = g(x) \).

328 On the set of axes below, graph \( g(x) = \frac{1}{2}x + 1 \) and \( f(x) = \begin{cases} 2x + 1, & x \leq -1 \\ 2 - x^2, & x > -1 \end{cases} \)

How many values of \( x \) satisfy the equation \( f(x) = g(x) \)? Explain your answer, using evidence from your graphs.
329 Graph \( f(x) = |x| \) and \( g(x) = -x^2 + 6 \) on the grid below. Does \( f(-2) = g(-2) \)? Use your graph to explain why or why not.

330 The growth of a certain organism can be modeled by \( C(t) = 10(1.029)^{24t} \), where \( C(t) \) is the total number of cells after \( t \) hours. Which function is approximately equivalent to \( C(t) \)?
1) \( C(t) = 240(0.083)^{24t} \)
2) \( C(t) = 10(0.083)^t \)
3) \( C(t) = 10(1.986)^t \)
4) \( C(t) = 240(1.986)^{t/24} \)

331 A computer application generates a sequence of musical notes using the function \( f(n) = 6(16)^n \), where \( n \) is the number of the note in the sequence and \( f(n) \) is the note frequency in hertz. Which function will generate the same note sequence as \( f(n) \)?
1) \( g(n) = 12(2)^{4n} \)
2) \( h(n) = 6(2)^{4n} \)
3) \( p(n) = 12(4)^{2n} \)
4) \( k(n) = 6(8)^{2n} \)

332 Mario's $15,000 car depreciates in value at a rate of 19% per year. The value, \( V \), after \( t \) years can be modeled by the function \( V = 15,000(0.81)^t \). Which function is equivalent to the original function?
1) \( V = 15,000(0.9)^{9t} \)
2) \( V = 15,000(0.9)^{2t} \)
3) \( V = 15,000(0.9)^{t/9} \)
4) \( V = 15,000(0.9)^{t/2} \)

333 Nora inherited a savings account that was started by her grandmother 25 years ago. This scenario is modeled by the function \( A(t) = 5000(1.013)^{t+25} \), where \( A(t) \) represents the value of the account, in dollars, \( t \) years after the inheritance. Which function below is equivalent to \( A(t) \)?
1) \( A(t) = 5000[(1.013)^t]^{25} \)
2) \( A(t) = 5000[(1.013)^t + (1.013)^{25}] \)
3) \( A(t) = (5000)^t(1.013)^{25} \)
4) \( A(t) = 5000(1.013)^t(1.013)^{25} \)
334 The number of bacteria grown in a lab can be modeled by \( P(t) = 300 \cdot 2^{4t} \), where \( t \) is the number of hours. Which expression is equivalent to \( P(t) \)?

1) \( 300 \cdot 8^t \)
2) \( 300 \cdot 16^t \)
3) \( 300^t \cdot 2^4 \)
4) \( 300^2 \cdot 2^{2t} \)

335 Miriam and Jessica are growing bacteria in a laboratory. Miriam uses the growth function \( f(t) = n^{2t} \) while Jessica uses the function \( g(t) = n^{4t} \), where \( n \) represents the initial number of bacteria and \( t \) is the time, in hours. If Miriam starts with 16 bacteria, how many bacteria should Jessica start with to achieve the same growth over time?

1) 32
2) 16
3) 8
4) 4

336 Materials \( A \) and \( B \) decay over time. The function for the amount of material \( A \) is \( A(t) = 1000(0.5)^{2t} \) and for the amount of material \( B \) is \( B(t) = 1000(0.25)^{t} \), where \( t \) represents time in days. On which day will the amounts of material be equal?

1) initial day, only
2) day 2, only
3) day 5, only
4) every day

337 Jacob and Jessica are studying the spread of dandelions. Jacob discovers that the growth over \( t \) weeks can be defined by the function \( f(t) = (8) \cdot 2^t \). Jessica finds that the growth function over \( t \) weeks is \( g(t) = 2^{t^3} \). Calculate the number of dandelions that Jacob and Jessica will each have after 5 weeks. Based on the growth from both functions, explain the relationship between \( f(t) \) and \( g(t) \).

338 The Ebola virus has an infection rate of 11% per day as compared to the SARS virus, which has a rate of 4% per day. If there were one case of Ebola and 30 cases of SARS initially reported to authorities and cases are reported each day, which statement is true?

1) At day 10 and day 53 there are more Ebola cases.
2) At day 10 and day 53 there are more SARS cases.
3) At day 10 there are more SARS cases, but at day 53 there are more Ebola cases.
4) At day 10 there are more Ebola cases, but at day 53 there are more SARS cases.

339 Dylan invested $600 in a savings account at a 1.6% annual interest rate. He made no deposits or withdrawals on the account for 2 years. The interest was compounded annually. Find, to the nearest cent, the balance in the account after 2 years.

340 A car was purchased for $25,000. Research shows that the car has an average yearly depreciation rate of 18.5%. Create a function that will determine the value, \( V(t) \), of the car \( t \) years after purchase. Determine, to the nearest cent, how much the car will depreciate from year 3 to year 4.
341. Marilyn collects old dolls. She purchases a doll for $450. Research shows this doll's value will increase by 2.5% each year. Write an equation that determines the value, \( V \), of the doll \( t \) years after purchase. Assuming the doll's rate of appreciation remains the same, will the doll's value be doubled in 20 years? Justify your reasoning.

342. A student invests $500 for 3 years in a savings account that earns 4% interest per year. No further deposits or withdrawals are made during this time. Which statement does not yield the correct balance in the account at the end of 3 years?
1) \( 500(1.04)^3 \)
2) \( 500(1−0.04)^3 \)
3) \( 500(1+0.04)(1+0.04)(1+0.04) \)
4) \( 500 + 500(0.04) + 520(0.04) + 540.8(0.04) \)

343. Krystal was given $3000 when she turned 2 years old. Her parents invested it at a 2% interest rate compounded annually. No deposits or withdrawals were made. Which expression can be used to determine how much money Krystal had in the account when she turned 18?
1) \( 3000(1 + 0.02)^{16} \)
2) \( 3000(1 – 0.02)^{16} \)
3) \( 3000(1 + 0.02)^{18} \)
4) \( 3000(1 – 0.02)^{18} \)

344. The country of Benin in West Africa has a population of 9.05 million people. The population is growing at a rate of 3.1% each year. Which function can be used to find the population 7 years from now?
1) \( f(t) = (9.05 \times 10^6)(1−0.31)^7 \)
2) \( f(t) = (9.05 \times 10^6)(1+0.31)^7 \)
3) \( f(t) = (9.05 \times 10^6)(1+0.031)^7 \)
4) \( f(t) = (9.05 \times 10^6)(1−0.031)^7 \)

345. Anne invested $1000 in an account with a 1.3% annual interest rate. She made no deposits or withdrawals on the account for 2 years. If interest was compounded annually, which equation represents the balance in the account after the 2 years?
1) \( A = 1000(1−0.013)^2 \)
2) \( A = 1000(1+0.013)^2 \)
3) \( A = 1000(1−1.3)^2 \)
4) \( A = 1000(1+1.3)^2 \)

346. Rhonda deposited $3000 in an account in the Merrick National Bank, earning 4.2% interest, compounded annually. She made no deposits or withdrawals. Write an equation that can be used to find \( B \), her account balance after \( t \) years.
Algebra I Regents Exam Questions by State Standard: Topic
www.jmap.org

347 Jill invests $400 in a savings bond. The value of the bond, \( V(x) \), in hundreds of dollars after \( x \) years is illustrated in the table below.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( V(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>5.4</td>
</tr>
<tr>
<td>2</td>
<td>7.29</td>
</tr>
<tr>
<td>3</td>
<td>9.84</td>
</tr>
</tbody>
</table>

Which equation and statement illustrate the approximate value of the bond in hundreds of dollars over time in years?
1) \( V(x) = 4(0.65)^x \) and it grows.  
2) \( V(x) = 4(0.65)^x \) and it decays.  
3) \( V(x) = 4(1.35)^x \) and it grows.  
4) \( V(x) = 4(1.35)^x \) and it decays.

348 Marc bought a new laptop for $1250. He kept track of the value of the laptop over the next three years, as shown in the table below.

<table>
<thead>
<tr>
<th>Years After Purchase</th>
<th>Value in Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1000</td>
</tr>
<tr>
<td>2</td>
<td>800</td>
</tr>
<tr>
<td>3</td>
<td>640</td>
</tr>
</tbody>
</table>

Which function can be used to determine the value of the laptop for \( x \) years after the purchase?
1) \( f(x) = 1000(1.2)^x \)  
2) \( f(x) = 1000(0.8)^x \)  
3) \( f(x) = 1250(1.2)^x \)  
4) \( f(x) = 1250(0.8)^x \)

349 The table below shows the temperature, \( T(m) \), of a cup of hot chocolate that is allowed to chill over several minutes, \( m \).

<table>
<thead>
<tr>
<th>Time, ( m ) (minutes)</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature, ( T(m) ) (ºF)</td>
<td>150</td>
<td>108</td>
<td>78</td>
<td>56</td>
<td>41</td>
</tr>
</tbody>
</table>

Which expression best fits the data for \( T(m) \)?
1) \( 150(0.85)^m \)  
2) \( 150(1.15)^m \)  
3) \( 150(0.85)^{m-1} \)  
4) \( 150(1.15)^{m-1} \)
350 Write an exponential equation for the graph shown below.

Explain how you determined the equation.

351 The 2014 winner of the Boston Marathon runs as many as 120 miles per week. During the last few weeks of his training for an event, his mileage can be modeled by \( M(w) = 120(0.90)^{w-1} \), where \( w \) represents the number of weeks since training began. Which statement is true about the model \( M(w) \)?
1) The number of miles he runs will increase by 90% each week.
2) The number of miles he runs will be 10% of the previous week.
3) \( M(w) \) represents the total mileage run in a given week.
4) \( w \) represents the number of weeks left until his marathon.

352 Some banks charge a fee on savings accounts that are left inactive for an extended period of time. The equation \( y = 5000(0.98)^x \) represents the value, \( y \), of one account that was left inactive for a period of \( x \) years. What is the \( y \)-intercept of this equation and what does it represent?
1) 0.98, the percent of money in the account initially
2) 0.98, the percent of money in the account after \( x \) years
3) 5000, the amount of money in the account initially
4) 5000, the amount of money in the account after \( x \) years

353 The function \( V(t) = 1350(1.017)^t \) represents the value \( V(t) \), in dollars, of a comic book \( t \) years after its purchase. The yearly rate of appreciation of the comic book is
1) 17%
2) 1.7%
3) 1.017%
4) 0.017%

354 The equation \( A = 1300(1.02)^7 \) is being used to calculate the amount of money in a savings account. What does 1.02 represent in this equation?
1) 0.02% decay
2) 0.02% growth
3) 2% decay
4) 2% growth
355 Milton has his money invested in a stock portfolio. The value, \( v(x) \), of his portfolio can be modeled with the function \( v(x) = 30,000(0.78)^x \), where \( x \) is the number of years since he made his investment. Which statement describes the rate of change of the value of his portfolio?
1) It decreases 78% per year.
2) It decreases 22% per year.
3) It increases 78% per year.
4) It increases 22% per year.

356 The breakdown of a sample of a chemical compound is represented by the function \( p(t) = 300(0.5)^t \), where \( p(t) \) represents the number of milligrams of the substance and \( t \) represents the time, in years. In the function \( p(t) \), explain what 0.5 and 300 represent.

357 The number of carbon atoms in a fossil is given by the function \( y = 5100(0.95)^x \), where \( x \) represents the number of years since being discovered. What is the percent of change each year? Explain how you arrived at your answer.

358 The value, \( v(t) \), of a car depreciates according to the function \( v(t) = P(0.85)^t \), where \( P \) is the purchase price of the car and \( t \) is the time, in years, since the car was purchased. State the percent that the value of the car decreases by each year. Justify your answer.

F.IF.C.7: GRAPHING EXPONENTIAL FUNCTIONS

359 Graph the function \( f(x) = 2^x - 7 \) on the set of axes below.

If \( g(x) = 1.5x - 3 \), determine if \( f(x) > g(x) \) when \( x = 4 \). Justify your answer.

POLYNOMIALS
A.REI.D.10: IDENTIFYING SOLUTIONS

360 The solution of an equation with two variables, \( x \) and \( y \), is
1) the set of all \( x \) values that make \( y = 0 \)
2) the set of all \( y \) values that make \( x = 0 \)
3) the set of all ordered pairs, \((x, y)\), that make the equation true
4) the set of all ordered pairs, \((x, y)\), where the graph of the equation crosses the \( y \)-axis
361 Which point is not on the graph represented by \( y = x^2 + 3x - 6 \)?
1) \((-6, 12)\)
2) \((-4, -2)\)
3) \((2, 4)\)
4) \((3, -6)\)

362 Which ordered pair below is not a solution to \( f(x) = x^2 - 3x + 4 \)?
1) \((0, 4)\)
2) \((1.5, 1.75)\)
3) \((5, 14)\)
4) \((-1, 6)\)

363 Which point is not in the solution set of the equation \( 3y + 2 = x^2 - 5x + 17 \)?
1) \((-2, 10)\)
2) \((-1, 7)\)
3) \((2, 3)\)
4) \((5, 5)\)

364 Which ordered pair would not be a solution to \( y = x^3 - x \)?
1) \((-4, -60)\)
2) \((-3, -24)\)
3) \((-2, -6)\)
4) \((-1, -2)\)

365 On the set of axes below, draw the graph of the equation \( y = \frac{3}{4}x + 3 \).

366 Which polynomial is twice the sum of \( 4x^2 - x + 1 \) and \(-6x^2 + x - 4\)?
1) \(-2x^2 - 3\)
2) \(-4x^2 - 3\)
3) \(-4x^2 - 6\)
4) \(-2x^2 + x - 5\)
367 If \( y = 3x^3 + x^2 - 5 \) and \( z = x^2 - 12 \), which polynomial is equivalent to \( 2(y + z) \)?

1) \( 6x^3 + 4x^2 - 34 \)
2) \( 6x^3 + 3x^2 - 17 \)
3) \( 6x^3 + 3x^2 - 22 \)
4) \( 6x^3 + 2x^2 - 17 \)

368 If \( A = 3x^2 + 5x - 6 \) and \( B = -2x^2 - 6x + 7 \), then \( A - B \) equals

1) \( -5x^2 - 11x + 13 \)
2) \( 5x^2 + 11x - 13 \)
3) \( -5x^2 - x + 1 \)
4) \( 5x^2 - x + 1 \)

369 The expression \( 3(x^2 - 1) - (x^2 - 7x + 10) \) is equivalent to

1) \( 2x^2 - 7x + 7 \)
2) \( 2x^2 + 7x - 13 \)
3) \( 2x^2 - 7x + 9 \)
4) \( 2x^2 + 7x - 11 \)

370 Which expression is equivalent to \( 2(3g - 4) - (8g + 3) \)?

1) \( -2g - 1 \)
2) \( -2g - 5 \)
3) \( -2g - 7 \)
4) \( -2g - 11 \)

371 The expression \( 3(x^2 + 2x - 3) - 4(4x^2 - 7x + 5) \) is equivalent to

1) \( -13x - 22x + 11 \)
2) \( -13x^2 + 34x - 29 \)
3) \( 19x^2 - 22x + 11 \)
4) \( 19x^2 + 34x - 29 \)

372 If \( C = 2a^2 - 5 \) and \( D = 3 - a \), then \( C - 2D \) equals

1) \( 2a^2 + a - 8 \)
2) \( 2a^2 - a - 8 \)
3) \( 2a^2 + 2a - 11 \)
4) \( 2a^2 - a - 11 \)

373 Subtract \( 5x^2 + 2x - 11 \) from \( 3x^2 + 8x - 7 \). Express the result as a trinomial.

374 Express in simplest form:

\( (3x^2 + 4x - 8) - (-2x^2 + 4x + 2) \)

375 Fred is given a rectangular piece of paper. If the length of Fred's piece of paper is represented by \( 2x - 6 \) and the width is represented by \( 3x - 5 \), then the paper has a total area represented by

1) \( 5x - 11 \)
2) \( 6x^2 - 28x + 30 \)
3) \( 10x - 22 \)
4) \( 6x^2 - 6x - 11 \)
376 Which trinomial is equivalent to 
3(x – 2)^2 – 2(x – 1)?
1) 3x^2 – 2x – 10
2) 3x^2 – 2x – 14
3) 3x^2 – 14x + 10
4) 3x^2 – 14x + 14

377 When (2x – 3)^2 is subtracted from 5x^2, the result is 
1) x^2 – 12x – 9
2) x^2 – 12x + 9
3) x^2 + 12x – 9
4) x^2 + 12x + 9

378 What is the product of 2x + 3 and 4x^2 – 5x + 6?
1) 8x^3 – 2x^2 + 3x + 18
2) 8x^3 – 2x^2 – 3x + 18
3) 8x^3 + 2x^2 – 3x + 18
4) 8x^3 + 2x^2 + 3x + 18

379 The length, width, and height of a rectangular box are represented by 2x, 3x + 1, and 5x – 6, respectively. When the volume is expressed as a polynomial in standard form, what is the coefficient of the 2nd term?
1) –13
2) 13
3) –26
4) 26

380 Express the product of 2x^2 + 7x – 10 and x + 5 in standard form.

381 If the difference (3x^2 – 2x + 5) – (x^2 + 3x – 2) is multiplied by \(\frac{1}{2}x^2\), what is the result, written in standard form?

382 Write the expression 5x + 4x^2 (2x + 7) – 6x^2 – 9x as a polynomial in standard form.

A.SSE.A.2: FACTORING POLYNOMIALS

383 Which expression is equivalent to \(x^4 – 12x^2 + 36\)?
1) \((x^2 – 6)(x^2 – 6)\)
2) \((x^2 + 6)(x^2 + 6)\)
3) \((6 – x^2)(6 + x^2)\)
4) \((x^2 + 6)(x^2 – 6)\)

384 Four expressions are shown below.

I \quad 2(2x^2 – 2x – 60)
II \quad 4(x^2 – x – 30)
III \quad 4(x + 6)(x – 5)
IV \quad 4x(x – 1) – 120

The expression 4x^2 – 4x – 120 is equivalent to
1) I and II, only
2) II and IV, only
3) I, II, and IV
4) II, III, and IV

385 When factored completely, \(x^3 – 13x^2 – 30x\) is
1) \(x(x + 3)(x – 10)\)
2) \(x(x – 3)(x – 10)\)
3) \(x(x + 2)(x – 15)\)
4) \(x(x – 2)(x + 15)\)
386 The trinomial \( x^2 - 14x + 49 \) can be expressed as

1) \( (x - 7)^2 \)
2) \( (x + 7)^2 \)
3) \( (x - 7)(x + 7) \)
4) \( (x - 7)(x + 2) \)

387 David correctly factored the expression \( m^2 - 12m - 64 \). Which expression did he write?

1) \( (m - 8)(m - 8) \)
2) \( (m - 8)(m + 8) \)
3) \( (m - 16)(m + 4) \)
4) \( (m + 16)(m - 4) \)

388 The area of a rectangle is represented by \( 3x^2 - 10x - 8 \). Which expression can also be used to represent the area of the same rectangle?

1) \( (3x + 2)(x - 4) \)
2) \( (3x + 2)(x + 4) \)
3) \( (3x + 4)(x - 2) \)
4) \( (3x - 4)(x + 2) \)

390 Which expression is equivalent to \( 16x^4 - 64 \)?

1) \( (4x^2 - 8)^2 \)
2) \( (8x^2 - 32)^2 \)
3) \( (4x^2 + 8)(4x^2 - 8) \)
4) \( (8x^2 + 32)(8x^2 - 32) \)

391 Which expression is equivalent to \( y^4 - 100 \)?

1) \( (y^2 - 10)^2 \)
2) \( (y^2 - 50)^2 \)
3) \( (y^2 + 10)(y^2 - 10) \)
4) \( (y^2 + 50)(y^2 - 50) \)

392 When factored completely, the expression \( p^4 - 81 \) is equivalent to

1) \( (p^2 + 9)(p^2 - 9) \)
2) \( (p^2 - 9)(p^2 + 9) \)
3) \( (p^2 + 9)(p + 3)(p - 3) \)
4) \( (p + 3)(p - 3)(p + 3)(p - 3) \)

393 If the area of a rectangle is expressed as \( x^4 - 9y^2 \), then the product of the length and the width of the rectangle could be expressed as

1) \( (x^2 - 3y)(x^2 + 3y) \)
2) \( (x^2 - 3y)(x^2 + 3y) \)
3) \( (x^2 - 3y)(x^2 - 3y) \)
4) \( (x^4 + y)(x - 9y) \)
394 Which expression is equivalent to $36x^2 - 100$?
1) $4(3x - 5)(3x - 5)$
2) $4(3x + 5)(3x - 5)$
3) $2(9x - 25)(9x - 25)$
4) $2(9x + 25)(9x - 25)$

395 Which expression is equivalent to $16x^2 - 36$?
1) $4(2x - 3)(2x - 3)$
2) $4(2x + 3)(2x - 3)$
3) $(4x - 6)(4x - 6)$
4) $(4x + 6)(4x + 6)$

396 The expression $49x^2 - 36$ is equivalent to
1) $(7x - 6)^2$
2) $(24.5x - 18)^2$
3) $(7x - 6)(7x + 6)$
4) $(24.5x - 18)(24.5x + 18)$

397 The expression $4x^2 - 25$ is equivalent to
1) $(4x - 5)(x + 5)$
2) $(4x + 5)(x - 5)$
3) $(2x + 5)(2x - 5)$
4) $(2x - 5)(2x - 5)$

398 Factor the expression $x^4 + 6x^2 - 7$ completely.

A.APR.B.3: ZEROS OF POLYNOMIALS

399 The graphs below represent functions defined by polynomials. For which function are the zeros of the polynomials 2 and $-3$?

1) $y$-intercept at 2, x-intercepts at $-3$ and $-1$
2) $y$-intercept at 2, x-intercepts at 3 and $-1$
3) $y$-intercept at 2, x-intercepts at 3 and 0
4) $y$-intercept at 2, x-intercepts at 2 and $-1$
400  Which function has zeros of -4 and 2?
1)  \( f(x) = x^2 + 7x - 8 \)
2)  \( g(x) = x^2 - 7x - 8 \)

401  The graph of \( y = \frac{1}{2}x^2 - x - 4 \) is shown below. The points \( A(-2,0), B(0,-4), \) and \( C(4,0) \) lie on this graph.

Which of these points can determine the zeros of the equation \( y = \frac{1}{2}x^2 - x - 4 \)?
1)  \( A, \) only
2)  \( B, \) only
3)  \( A \) and \( C, \) only
4)  \( A, B, \) and \( C \)

402  If \( f(x) = 2x^2 + x - 3 \), which equation can be used to determine the zeros of the function?
1)  \( 0 = (2x - 3)(x + 1) \)
2)  \( 0 = (2x + 3)(x - 1) \)
3)  \( 0 = 2x(x + 1) - 3 \)
4)  \( 0 = 2x(x - 1) - 3(x + 1) \)
403 For which function defined by a polynomial are the zeros of the polynomial $-4$ and $-6$?
1) $y = x^2 - 10x - 24$
2) $y = x^2 + 10x + 24$
3) $y = x^2 + 10x - 24$
4) $y = x^2 - 10x + 24$

404 Keith determines the zeros of the function $f(x)$ to be $-6$ and 5. What could be Keith's function?
1) $f(x) = (x + 5)(x + 6)$
2) $f(x) = (x + 5)(x - 6)$
3) $f(x) = (x - 5)(x + 6)$
4) $f(x) = (x - 5)(x - 6)$

405 The zeros of the function $f(x) = (x + 2)^2 - 25$ are
1) $-2$ and 5
2) $-3$ and 7
3) $-5$ and 2
4) $-7$ and 3

406 What are the zeros of the function $f(x) = x^2 - 13x - 30$?
1) $-10$ and 3
2) $10$ and $-3$
3) $-15$ and 2
4) $15$ and $-2$

407 The zeros of the function $f(x) = 3x^2 - 3x - 6$ are
1) $-1$ and $-2$
2) $1$ and $-2$
3) $1$ and 2
4) $-1$ and 2

408 The zeros of the function $f(x) = 2x^2 - 4x - 6$ are
1) $3$ and $-1$
2) $3$ and 1
3) $-3$ and 1
4) $-3$ and $-1$

409 The zeros of the function $f(x) = x^2 - 5x - 6$ are
1) $-1$ and 6
2) $1$ and $-6$
3) $2$ and $-3$
4) $-2$ and 3

410 Which polynomial function has zeros at $-3$, 0, and 4?
1) $f(x) = (x + 3)(x^2 + 4)$
2) $f(x) = (x^2 - 3)(x - 4)$
3) $f(x) = x(x + 3)(x - 4)$
4) $f(x) = x(x - 3)(x + 4)$

411 The zeros of the function $f(x) = 2x^3 + 12x - 10x^2$ are
1) $\{2, 3\}$
2) $\{-1, 6\}$
3) $\{0, 2, 3\}$
4) $\{0, -1, 6\}$

412 The zeros of the function $p(x) = x^2 - 2x - 24$ are
1) $-8$ and 3
2) $-6$ and 4
3) $-4$ and 6
4) $-3$ and 8
413 Ryker is given the graph of the function
\[ y = \frac{1}{2} x^2 - 4. \]
He wants to find the zeros of the function, but is unable to read them exactly from the graph.

Find the zeros in simplest radical form.

414 Find the zeros of \( f(x) = (x - 3)^2 - 49 \), algebraically.

415 The function \( r(x) \) is defined by the expression
\[ x^2 + 3x - 18. \]
Use factoring to determine the zeros of \( r(x) \). Explain what the zeros represent on the graph of \( r(x) \).

416 Determine all the zeros of \( m(x) = x^2 - 4x + 3 \), algebraically.

417 Explain how to determine the zeros of
\[ f(x) = (x + 3)(x - 1)(x - 8). \]
State the zeros of the function.

418 Determine algebraically the zeros of
\[ f(x) = 3x^3 + 21x^2 + 36x. \]

419 A polynomial function contains the factors \( x, x - 2, \) and \( x + 5 \). Which graph(s) below could represent the graph of this function?

1) I, only
2) II, only
3) I and III
4) I, II, and III
420 Which equation(s) represent the graph below?

I \[ y = (x + 2)(x^2 - 4x - 12) \]
II \[ y = (x - 3)(x^2 + x - 2) \]
III \[ y = (x - 1)(x^2 - 5x - 6) \]

1) I, only
2) II, only
3) I and II
4) II and III

421 The graph of \( f(x) \) is shown below.

Which function could represent the graph of \( f(x) \)?

1) \( f(x) = (x + 2)(x^2 + 3x - 4) \)
2) \( f(x) = (x - 2)(x^2 + 3x - 4) \)
3) \( f(x) = (x + 2)(x^2 + 3x + 4) \)
4) \( f(x) = (x - 2)(x^2 + 3x + 4) \)

422 Based on the graph below, which expression is a possible factorization of \( p(x) \)?

1) \( (x + 3)(x - 2)(x - 4) \)
2) \( (x - 3)(x + 2)(x + 4) \)
3) \( (x + 3)(x - 5)(x - 2)(x - 4) \)
4) \( (x - 3)(x + 5)(x + 2)(x + 4) \)
423 Wenona sketched the polynomial \( P(x) \) as shown on the axes below.

Which equation could represent \( P(x) \)?
1) \( P(x) = (x + 1)(x - 2)^2 \)
2) \( P(x) = (x - 1)(x + 2)^2 \)
3) \( P(x) = (x + 1)(x - 2) \)
4) \( P(x) = (x - 1)(x + 2) \)

424 A cubic function is graphed on the set of axes below.

Which function could represent this graph?
1) \( f(x) = (x - 3)(x - 1)(x + 1) \)
2) \( g(x) = (x + 3)(x + 1)(x - 1) \)
3) \( h(x) = (x - 3)(x - 1)(x + 3) \)
4) \( k(x) = (x + 3)(x + 1)(x - 3) \)

425 The graph of the equation \( y = ax^2 \) is shown below.

If \( a \) is multiplied by \( \frac{1}{2} \), the graph of the new equation is
1) wider and opens downward
2) wider and opens upward
3) narrower and opens downward
4) narrower and opens upward
426 If the original function \( f(x) = 2x^2 - 1 \) is shifted to the left 3 units to make the function \( g(x) \), which expression would represent \( g(x) \)?

- 1) \( 2(x - 3)^2 - 1 \)
- 2) \( 2(x + 3)^2 - 1 \)
- 3) \( 2x^2 + 2 \)
- 4) \( 2x^2 - 4 \)

427 How does the graph of \( f(x) = 3(x - 2)^2 + 1 \) compare to the graph of \( g(x) = x^2 \)?

- 1) The graph of \( f(x) \) is wider than the graph of \( g(x) \), and its vertex is moved to the left 2 units and up 1 unit.
- 2) The graph of \( f(x) \) is narrower than the graph of \( g(x) \), and its vertex is moved to the right 2 units and up 1 unit.
- 3) The graph of \( f(x) \) is narrower than the graph of \( g(x) \), and its vertex is moved to the left 2 units and up 1 unit.
- 4) The graph of \( f(x) \) is wider than the graph of \( g(x) \), and its vertex is moved to the right 2 units and up 1 unit.

428 When the function \( f(x) = x^2 \) is multiplied by the value \( a \), where \( a > 1 \), the graph of the new function, \( g(x) = ax^2 \),

- 1) opens upward and is wider
- 2) opens upward and is narrower
- 3) opens downward and is wider
- 4) opens downward and is narrower

429 In the functions \( f(x) = kx^2 \) and \( g(x) = |kx|, k \) is a positive integer. If \( k \) is replaced by \( \frac{1}{2} \), which statement about these new functions is true?

- 1) The graphs of both \( f(x) \) and \( g(x) \) become wider.
- 2) The graph of \( f(x) \) becomes narrower and the graph of \( g(x) \) shifts left.
- 3) The graphs of both \( f(x) \) and \( g(x) \) shift vertically.
- 4) The graph of \( f(x) \) shifts left and the graph of \( g(x) \) becomes wider.

430 Given the graph of the line represented by the equation \( f(x) = -2x + b \), if \( b \) is increased by 4 units, the graph of the new line would be shifted 4 units

- 1) right
- 2) up
- 3) left
- 4) down

431 Compared to the graph of \( f(x) = x^2 \), the graph of \( g(x) = (x - 2)^2 + 3 \) is the result of translating \( f(x) \)

- 1) 2 units up and 3 units right
- 2) 2 units down and 3 units up
- 3) 2 units right and 3 units up
- 4) 2 units left and 3 units right

432 Given the parent function \( f(x) = x^3 \), the function \( g(x) = (x - 1)^3 - 2 \) is the result of a shift of \( f(x) \)

- 1) 1 unit left and 2 units down
- 2) 1 unit left and 2 units up
- 3) 1 unit right and 2 units down
- 4) 1 unit right and 2 units up
433. The vertex of the parabola represented by \( f(x) = x^2 - 4x + 3 \) has coordinates \((2, -1)\). Find the coordinates of the vertex of the parabola defined by \( g(x) = f(x - 2) \). Explain how you arrived at your answer. [The use of the set of axes below is optional.]

434. In the diagram below, \( f(x) = x^3 + 2x^2 \) is graphed. Also graphed is \( g(x) \), the result of a translation of \( f(x) \).

Determine an equation of \( g(x) \). Explain your reasoning.
435 The graph of the function \( p(x) \) is represented below. On the same set of axes, sketch the function \( p(x + 2) \).

437 Which statement is \textit{not} always true?
1) The sum of two rational numbers is rational.
2) The product of two irrational numbers is rational.
3) The sum of a rational number and an irrational number is irrational.
4) The product of a nonzero rational number and an irrational number is irrational.

438 The product of \( \sqrt{576} \) and \( \sqrt{684} \) is
1) irrational because both factors are irrational
2) rational because both factors are rational
3) irrational because one factor is irrational
4) rational because one factor is rational

439 Given: \( L = \sqrt{2} \)
\[ M = 3\sqrt{3} \]
\[ N = \sqrt{16} \]
\[ P = \sqrt{9} \]
Which expression results in a rational number?
1) \( L + M \)
2) \( M + N \)
3) \( N + P \)
4) \( P + L \)
440 For which value of $P$ and $W$ is $P + W$ a rational number?

1) $P = \frac{1}{\sqrt{3}}$ and $W = \frac{1}{\sqrt{6}}$
2) $P = \frac{1}{\sqrt{4}}$ and $W = \frac{1}{\sqrt{9}}$
3) $P = \frac{1}{\sqrt{6}}$ and $W = \frac{1}{\sqrt{10}}$
4) $P = \frac{1}{\sqrt{25}}$ and $W = \frac{1}{\sqrt{2}}$

441 Which expression results in a rational number?

1) $\sqrt{121} - \sqrt{21}$
2) $\sqrt{25} \cdot \sqrt{50}$
3) $\sqrt{36} \div \sqrt{225}$
4) $3\sqrt{5} + 2\sqrt{5}$

442 Given the following expressions:

I. $\frac{5}{8} + \frac{3}{5}$
II. $\frac{1}{2} + \sqrt{2}$
III. $\left(\sqrt{5}\right) \cdot \left(\sqrt{5}\right)$
IV. $3 \cdot \left(\sqrt{49}\right)$

Which expression(s) result in an irrational number?

1) II, only
2) III, only
3) I, III, IV
4) II, III, IV

443 Ms. Fox asked her class "Is the sum of 4.2 and $\sqrt{2}$ rational or irrational?" Patrick answered that the sum would be irrational. State whether Patrick is correct or incorrect. Justify your reasoning.

444 Determine if the product of $3\sqrt{2}$ and $8\sqrt{18}$ is rational or irrational. Explain your answer.

445 Is the sum of $3\sqrt{2}$ and $4\sqrt{2}$ rational or irrational? Explain your answer.

446 Jakob is working on his math homework. He decides that the sum of the expression $\frac{1}{3} + \frac{6\sqrt{5}}{7}$ must be rational because it is a fraction. Is Jakob correct? Explain your reasoning.

447 State whether $7 - \sqrt{2}$ is rational or irrational. Explain your answer.

448 A teacher wrote the following set of numbers on the board:

$a = \sqrt{20}$, $b = 2.5$, $c = \sqrt{225}$

Explain why $a + b$ is irrational, but $b + c$ is rational.

449 Is the product of $\sqrt{16}$ and $\frac{4}{7}$ rational or irrational? Explain your reasoning.
F.IF.C.7: GRAPHING ROOT FUNCTIONS

450 Which graph represents $y = \sqrt{x - 2}$?

1) 

2) 

3) 

4) 

451 Draw the graph of $y = \sqrt{x} - 1$ on the set of axes below.

452 Graph the function $y = -\sqrt{x + 3}$ on the set of axes below.
453 Graph \( f(x) = \sqrt{x + 2} \) over the domain \(-2 \leq x \leq 7\).

454 On the set of axes below, graph the function represented by \( y = \frac{1}{3}x - 2 \) for the domain \(-6 \leq x \leq 10\).

455 Which table represents a function?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>f(x)</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>9</td>
</tr>
</tbody>
</table>

1) \((0,1),(2,3),(5,8),(7,2)\)

456 A function is defined as \{(0,1),(2,3),(5,8),(7,2)\}. Isaac is asked to create one more ordered pair for the function. Which ordered pair can he add to the set to keep it a function?

1) \((0,2)\)
2) \((5,3)\)
3) \((7,0)\)
4) \((1,3)\)
457 A mapping is shown in the diagram below.

This mapping is
1) a function, because Feb has two outputs, 28 and 29
2) a function, because two inputs, Jan and Mar, result in the output 31
3) not a function, because Feb has two outputs, 28 and 29
4) not a function, because two inputs, Jan and Mar, result in the output 31

458 A relation is graphed on the set of axes below.

Based on this graph, the relation is
1) a function because it passes the horizontal line test
2) a function because it passes the vertical line test
3) not a function because it fails the horizontal line test
4) not a function because it fails the vertical line test
459 Which relation does not represent a function?

1)  

\[
\begin{array}{c|c|c|c|c|c|c}
\hline
x & 1 & 2 & 3 & 4 & 5 & 6 \\
\hline
y & 3 & 2 & 4 & 5.1 & 6 & 7.4 & 8.8 \\
\hline
\end{array}
\]

2)  

\[y = 3\sqrt{x + 1} - 2\]

3)  

4)

460 Which representations are functions?

1) I and II
2) II and IV
3) III, only
4) IV, only

461 A function is shown in the table below.

<table>
<thead>
<tr>
<th>x</th>
<th>f(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-4</td>
<td>2</td>
</tr>
<tr>
<td>-1</td>
<td>-4</td>
</tr>
<tr>
<td>0</td>
<td>-2</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
</tr>
</tbody>
</table>

If included in the table, which ordered pair, (−4, 1) or (1, −4), would result in a relation that is no longer a function? Explain your answer.
462 Four relations are shown below.

I \{(1,2),(2,5),(3,8),(2,-5),(1,-2)\}

II

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>-4</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

III \[y = x^2\]

IV

State which relation(s) are functions. Explain why the other relation(s) are *not* functions.

463 The function \(f\) has a domain of \{1, 3, 5, 7\} and a range of \{2, 4, 6\}. Could \(f\) be represented by \{(1,2),(3,4),(5,6),(7,2)\}? Justify your answer.
464  Marcel claims that the graph below represents a function.

State whether Marcel is correct. Justify your answer.

465  Nora says that the graph of a circle is a function because she can trace the whole graph without picking up her pencil. Mia says that a circle graph is not a function because multiple values of $x$ map to the same $y$-value. Determine if either one is correct, and justify your answer completely.

466  The graph of $y = f(x)$ is shown below.

Which point could be used to find $f(2)$?

1) $A$
2) $B$
3) $C$
4) $D$
467 The graph of \( f(x) \) is shown below.

What is the value of \( f(-3) \)?

1) 6  
2) 2  
3) -2  
4) -4

468 The function \( g(x) \) is defined as \( g(x) = -2x^2 + 3x \).

The value of \( g(-3) \) is

1) -27  
2) -9  
3) 27  
4) 45

470 If \( f(x) = \frac{1}{2}x^2 - \left(\frac{1}{4}x + 3\right) \), what is the value of \( f(8) \)?

1) 11  
2) 17  
3) 27  
4) 33

471 If \( k(x) = 2x^2 - 3\sqrt{x} \), then \( k(9) \) is

1) 315  
2) 307  
3) 159  
4) 153

472 If \( f(x) = \frac{\sqrt{2x+3}}{6x-5} \), then \( f\left(\frac{1}{2}\right) = \)

1) 1  
2) -2  
3) -1  
4) \( \frac{13}{3} \)

473 Lynn, Jude, and Anne were given the function \( f(x) = -2x^2 + 32 \), and they were asked to find \( f(3) \).

Lynn's answer was 14, Jude's answer was 4, and Anne's answer was \pm 4. Who is correct?

1) Lynn, only  
2) Jude, only  
3) Anne, only  
4) Both Lynn and Jude
474 The value in dollars, \( v(x) \), of a certain car after \( x \) years is represented by the equation \( v(x) = 25,000(0.86)^x \). To the nearest dollar, how much more is the car worth after 2 years than after 3 years?
1) 2589
2) 6510
3) 15,901
4) 18,490

475 The equation to determine the weekly earnings of an employee at The Hamburger Shack is given by \( w(x) \), where \( x \) is the number of hours worked.
\[
w(x) = \begin{cases} 
10x, & 0 \leq x \leq 40 \\
15(x - 40) + 400, & x > 40 
\end{cases}
\]
Determine the difference in salary, in dollars, for an employee who works 52 hours versus one who works 38 hours. Determine the number of hours an employee must work in order to earn $445. Explain how you arrived at this answer.

476 For a recently released movie, the function \( y = 119.67(0.61)^x \) models the revenue earned, \( y \), in millions of dollars each week, \( x \), for several weeks after its release. Based on the equation, how much more money, in millions of dollars, was earned in revenue for week 3 than for week 5?
1) 37.27
2) 27.16
3) 17.06
4) 10.11

F.IF.A.2, F.IF.B.5: DOMAIN AND RANGE

477 The function \( f(x) \) is graphed below.

![Graph](image)
The domain of this function is
1) all positive real numbers
2) all positive integers
3) \( x \geq 0 \)
4) \( x \geq -1 \)

478 The graph of the function \( f(x) = \sqrt{x + 4} \) is shown below.

![Graph](image)
The domain of the function is
1) \( \{x \mid x > 0\} \)
2) \( \{x \mid x \geq 0\} \)
3) \( \{x \mid x > -4\} \)
4) \( \{x \mid x \geq -4\} \)
479 If \( f(x) = \frac{1}{3}x + 9 \), which statement is always true?

1) \( f(x) < 0 \)
2) \( f(x) > 0 \)
3) If \( x < 0 \), then \( f(x) < 0 \).
4) If \( x > 0 \), then \( f(x) > 0 \).

480 Let \( f \) be a function such that \( f(x) = 2x - 4 \) is defined on the domain \( 2 \leq x \leq 6 \). The range of this function is

1) \( 0 \leq y \leq 8 \)
2) \( 0 \leq y < \infty \)
3) \( 2 \leq y \leq 6 \)
4) \( -\infty < y < \infty \)

481 The range of the function defined as \( y = 5^x \) is

1) \( y < 0 \)
2) \( y > 0 \)
3) \( y \leq 0 \)
4) \( y \geq 0 \)

482 The range of the function \( f(x) = x^2 + 2x - 8 \) is all real numbers

1) less than or equal to \(-9\)
2) greater than or equal to \(-9\)
3) less than or equal to \(-1\)
4) greater than or equal to \(-1\)

483 What is the domain of the relation shown below?
\[ \{(4,2),(1,1),(0,0),(1,-1),(4,-2)\} \]

1) \( \{0,1,4\} \)
2) \( \{-2,-1,0,1,2\} \)
3) \( \{-2,-1,0,1,2,4\} \)
4) \( \{-2,-1,0,0,1,1,1,2,4,4\} \)

484 If the domain of the function \( f(x) = 2x^2 - 8 \) is \( \{-2,3,5\} \), then the range is

1) \( \{−2,3,5\} \)
2) \( \{−16,4,92\} \)
3) \( \{0,10,42\} \)
4) \( \{0,4,92\} \)

485 If \( f(x) = x^2 + 2 \), which interval describes the range of this function?

1) \( (−\infty, \infty) \)
2) \( [0, \infty) \)
3) \( [2, \infty) \)
4) \( (−\infty,2] \)

486 If the function \( f(x) = x^2 \) has the domain \( \{0,1,4,9\} \), what is its range?

1) \( \{0,1,2,3\} \)
2) \( \{0,1,16,81\} \)
3) \( \{0,—1,−1,—2,—2,—3,3\} \)
4) \( \{0,—1,—1,—16,—16,—81,81\} \)

487 The function \( f(x) = 2x^2 + 6x − 12 \) has a domain consisting of the integers from \(-2\) to \(1\), inclusive. Which set represents the corresponding range values for \( f(x) \)?

1) \( \{-32,—20,—12,—4\} \)
2) \( \{-16,—12,—4\} \)
3) \( \{-32,—4\} \)
4) \( \{-16,—4\} \)
488 Officials in a town use a function, \( C \), to analyze traffic patterns. \( C(n) \) represents the rate of traffic through an intersection where \( n \) is the number of observed vehicles in a specified time interval. What would be the most appropriate domain for the function?

1) \( \{\ldots -2, -1, 0, 1, 2, 3, \ldots \} \)
2) \( \{-2, -1, 0, 1, 2, 3\} \)
3) \( \{0, \frac{1}{2}, 1, 1 \frac{1}{2}, 2, 2 \frac{1}{2}\} \)
4) \( \{0, 1, 2, 3, \ldots \} \)

489 The function \( h(t) = -16t^2 + 144 \) represents the height, \( h(t) \), in feet, of an object from the ground at \( t \) seconds after it is dropped. A realistic domain for this function is

1) \( -3 \leq t \leq 3 \)
2) \( 0 \leq t \leq 3 \)
3) \( 0 \leq h(t) \leq 144 \)
4) all real numbers

490 Which domain would be the most appropriate set to use for a function that predicts the number of household online-devices in terms of the number of people in the household?

1) integers
2) whole numbers
3) irrational numbers
4) rational numbers

491 A construction company uses the function \( f(p) \), where \( p \) is the number of people working on a project, to model the amount of money it spends to complete a project. A reasonable domain for this function would be

1) positive integers
2) positive real numbers
3) both positive and negative integers
4) both positive and negative real numbers

492 A store sells self-serve frozen yogurt sundaes. The function \( C(w) \) represents the cost, in dollars, of a sundae weighing \( w \) ounces. An appropriate domain for the function would be

1) integers
2) rational numbers
3) nonnegative integers
4) nonnegative rational numbers

493 An online company lets you download songs for $0.99 each after you have paid a $5 membership fee. Which domain would be most appropriate to calculate the cost to download songs?

1) rational numbers greater than zero
2) whole numbers greater than or equal to one
3) integers less than or equal to zero
4) whole numbers less than or equal to one

494 The daily cost of production in a factory is calculated using \( c(x) = 200 + 16x \), where \( x \) is the number of complete products manufactured. Which set of numbers best defines the domain of \( c(x) \)?

1) integers
2) positive real numbers
3) positive rational numbers
4) whole numbers
At an ice cream shop, the profit, \( P(c) \), is modeled by the function \( P(c) = 0.87c \), where \( c \) represents the number of ice cream cones sold. An appropriate domain for this function is

1) an integer \( \leq 0 \)
2) an integer \( \geq 0 \)
3) a rational number \( \leq 0 \)
4) a rational number \( \geq 0 \)

A company produces \( x \) units of a product per month, where \( C(x) \) represents the total cost and \( R(x) \) represents the total revenue for the month. The functions are modeled by \( C(x) = 300x + 250 \) and \( R(x) = -0.5x^2 + 800x - 100 \). The profit is the difference between revenue and cost where \( P(x) = R(x) - C(x) \). What is the total profit, \( P(x) \), for the month?

1) \( P(x) = -0.5x^2 + 500x - 150 \)
2) \( P(x) = -0.5x^2 + 500x - 350 \)
3) \( P(x) = -0.5x^2 - 500x + 350 \)
4) \( P(x) = -0.5x^2 + 500x + 350 \)

Given that \( f(x) = 2x + 1 \), find \( g(x) \) if \( g(x) = 2[f(x)]^2 - 1 \).
499 The table below shows the average yearly balance in a savings account where interest is compounded annually. No money is deposited or withdrawn after the initial amount is deposited.

<table>
<thead>
<tr>
<th>Year</th>
<th>Balance, in Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>380.00</td>
</tr>
<tr>
<td>10</td>
<td>562.49</td>
</tr>
<tr>
<td>20</td>
<td>832.63</td>
</tr>
<tr>
<td>30</td>
<td>1232.49</td>
</tr>
<tr>
<td>40</td>
<td>1824.39</td>
</tr>
<tr>
<td>50</td>
<td>2700.54</td>
</tr>
</tbody>
</table>

Which type of function best models the given data?
1) linear function with a negative rate of change
2) linear function with a positive rate of change
3) exponential decay function
4) exponential growth function

500 The tables below show the values of four different functions for given values of x.

<table>
<thead>
<tr>
<th>x</th>
<th>f(x)</th>
<th>x</th>
<th>g(x)</th>
<th>x</th>
<th>h(x)</th>
<th>x</th>
<th>k(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>9</td>
<td>1</td>
<td>-2</td>
</tr>
<tr>
<td>2</td>
<td>19</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>12</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>26</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>17</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>4</td>
<td>33</td>
<td>4</td>
<td>13</td>
<td>4</td>
<td>24</td>
<td>4</td>
<td>28</td>
</tr>
</tbody>
</table>

Which table represents a linear function?
1) \( f(x) \) 3) \( h(x) \)
2) \( g(x) \) 4) \( k(x) \)

501 Rachel and Marc were given the information shown below about the bacteria growing in a Petri dish in their biology class.

<table>
<thead>
<tr>
<th>Number of Hours, x</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Bacteria, B(x)</td>
<td>220</td>
<td>280</td>
<td>350</td>
<td>440</td>
<td>550</td>
<td>690</td>
<td>860</td>
<td>1070</td>
<td>1340</td>
<td>1680</td>
</tr>
</tbody>
</table>

Rachel wants to model this information with a linear function. Marc wants to use an exponential function. Which model is the better choice? Explain why you chose this model.
502 The function, \( t(x) \), is shown in the table below.

<table>
<thead>
<tr>
<th>x</th>
<th>t(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>10</td>
</tr>
<tr>
<td>-1</td>
<td>7.5</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

Determine whether \( t(x) \) is linear or exponential. Explain your answer.

503 Caleb claims that the ordered pairs shown in the table below are from a nonlinear function.

<table>
<thead>
<tr>
<th>x</th>
<th>f(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
</tr>
</tbody>
</table>

State if Caleb is correct. Explain your reasoning.

504 The number of people who attended a school's last six basketball games increased as the team neared the state sectional games. The table below shows the data.

<table>
<thead>
<tr>
<th>Game</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance</td>
<td>348</td>
<td>435</td>
<td>522</td>
<td>609</td>
<td>696</td>
<td>783</td>
</tr>
</tbody>
</table>

State the type of function that best fits the given data. Justify your choice of a function type.

505 Consider the pattern of squares shown below:

Which type of model, linear or exponential, should be used to determine how many squares are in the \( n \)th pattern? Explain your answer.
506 A population that initially has 20 birds approximately doubles every 10 years. Which graph represents this population growth?

1) 

2) 

3) 

4) 

507 Which situation could be modeled by using a linear function?
1) a bank account balance that grows at a rate of 5% per year, compounded annually
2) a population of bacteria that doubles every 4.5 hours
3) the cost of cell phone service that charges a base amount plus 20 cents per minute
4) the concentration of medicine in a person’s body that decays by a factor of one-third every hour

508 Which scenario represents exponential growth?
1) A water tank is filled at a rate of 2 gallons/minute.
2) A vine grows 6 inches every week.
3) A species of fly doubles its population every month during the summer.
4) A car increases its distance from a garage as it travels at a constant speed of 25 miles per hour.

509 One characteristic of all linear functions is that they change by
1) equal factors over equal intervals
2) unequal factors over equal intervals
3) equal differences over equal intervals
4) unequal differences over equal intervals

510 Which situation is not a linear function?
1) A gym charges a membership fee of $10.00 down and $10.00 per month.
2) A cab company charges $2.50 initially and $3.00 per mile.
3) A restaurant employee earns $12.50 per hour.
4) A $12,000 car depreciates 15% per year.
511 Grisham is considering the three situations below.
I. For the first 28 days, a sunflower grows at a rate of 3.5 cm per day.
II. The value of a car depreciates at a rate of 15% per year after it is purchased.
III. The amount of bacteria in a culture triples every two days during an experiment.
Which of the statements describes a situation with an equal difference over an equal interval?
1) I, only
2) II, only
3) I and III
4) II and III

512 Sara was asked to solve this word problem: "The product of two consecutive integers is 156. What are the integers?" What type of equation should she create to solve this problem?
1) linear
2) quadratic
3) exponential
4) absolute value

513 The highest possible grade for a book report is 100. The teacher deducts 10 points for each day the report is late. Which kind of function describes this situation?
1) linear
2) quadratic
3) exponential growth
4) exponential decay

514 Ian is saving up to buy a new baseball glove. Every month he puts $10 into a jar. Which type of function best models the total amount of money in the jar after a given number of months?
1) linear
2) exponential
3) quadratic
4) square root

515 Which of the three situations given below is best modeled by an exponential function?
I. A bacteria culture doubles in size every day.
II. A plant grows by 1 inch every 4 days.
III. The population of a town declines by 5% every 3 years.
1) I, only
2) II, only
3) I and II
4) I and III

516 The table below represents the function $F$.

<table>
<thead>
<tr>
<th>$x$</th>
<th>3</th>
<th>4</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>$F(x)$</td>
<td>9</td>
<td>17</td>
<td>65</td>
<td>129</td>
<td>257</td>
</tr>
</tbody>
</table>

The equation that represents this function is
1) $F(x) = 3^x$
2) $F(x) = 3x$
3) $F(x) = 2^x + 1$
4) $F(x) = 2x + 3$
517 A laboratory technician studied the population growth of a colony of bacteria. He recorded the number of bacteria every other day, as shown in the partial table below.

<table>
<thead>
<tr>
<th>t (time, in days)</th>
<th>0</th>
<th>2</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>f(t) (bacteria)</td>
<td>25</td>
<td>15,625</td>
<td>9,765,625</td>
</tr>
</tbody>
</table>

Which function would accurately model the technician's data?

1) \( f(t) = 25^i \)
2) \( f(t) = 25^{t+1} \)
3) \( f(t) = 25t \)
4) \( f(t) = 25(t + 1) \)

518 Which function is shown in the table below?

<table>
<thead>
<tr>
<th>x</th>
<th>f(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>( \frac{1}{9} )</td>
</tr>
<tr>
<td>-1</td>
<td>( \frac{1}{3} )</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>27</td>
</tr>
</tbody>
</table>

1) \( f(x) = 3x \)
2) \( f(x) = x + 3 \)
3) \( f(x) = -x^3 \)
4) \( f(x) = 3^x \)
Vinny collects population data, \( P(h) \), about a specific strain of bacteria over time in hours, \( h \), as shown in the graph below.

Which equation represents the graph of \( P(h) \)?

1) \( P(h) = 4(2)^h \)
2) \( P(h) = \frac{46}{5} h + \frac{6}{5} \)
3) \( P(h) = 3h^2 + 0.2h + 4.2 \)
4) \( P(h) = \frac{2}{3} h^3 - h^2 + 3h + 4 \)

If a population of 100 cells triples every hour, which function represents \( p(t) \), the population after \( t \) hours?

1) \( p(t) = 3(100)^t \)
2) \( p(t) = 100(3)^t \)
3) \( p(t) = 3t + 100 \)
4) \( p(t) = 100t + 3 \)

If \( f(x) = 3^x \) and \( g(x) = 2x + 5 \), at which value of \( x \) is \( f(x) < g(x) \)?

1) \(-1\)
2) \(2\)
3) \(-3\)
4) \(4\)

As \( x \) increases beyond 25, which function will have the largest value?

1) \( f(x) = 1.5^x \)
2) \( g(x) = 1.5x + 3 \)
3) \( h(x) = 1.5x^2 \)
4) \( k(x) = 1.5x^3 + 1.5x^2 \)

Alicia has invented a new app for smart phones that two companies are interested in purchasing for a 2-year contract. Company \( A \) is offering her $10,000 for the first month and will increase the amount each month by $5000. Company \( B \) is offering $500 for the first month and will double their payment each month from the previous month. Monthly payments are made at the end of each month. For which monthly payment will company \( B \)’s payment first exceed company \( A \)’s payment?

1) \(6\)
2) \(7\)
3) \(8\)
4) \(9\)

What is the largest integer, \( x \), for which the value of \( f(x) = 5x^4 + 30x^2 + 9 \) will be greater than the value of \( g(x) = 3^x \)?

1) \(7\)
2) \(8\)
3) \(9\)
4) \(10\)
The table below shows the weights of Liam's pumpkin, \( l(w) \), and Patricia's pumpkin, \( p(w) \), over a four-week period where \( w \) represents the number of weeks. Liam's pumpkin grows at a constant rate. Patricia's pumpkin grows at a weekly rate of approximately 52%.

<table>
<thead>
<tr>
<th>Weeks ( w )</th>
<th>Weight in Pounds ( l(w) )</th>
<th>Weight in Pounds ( p(w) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>2.4</td>
<td>2.5</td>
</tr>
<tr>
<td>7</td>
<td>5.5</td>
<td>3.8</td>
</tr>
<tr>
<td>8</td>
<td>8.6</td>
<td>5.8</td>
</tr>
<tr>
<td>9</td>
<td>11.7</td>
<td>8.8</td>
</tr>
</tbody>
</table>

Assume the pumpkins continue to grow at these rates through week 13. When comparing the weights of both Liam's and Patricia's pumpkins in week 10 and week 13, which statement is true?

1) Liam's pumpkin will weigh more in week 10 and week 13.
2) Patricia's pumpkin will weigh more in week 10 and week 13.
3) Liam's pumpkin will weigh more in week 10, and Patricia's pumpkin will weigh more in week 13.
4) Patricia's pumpkin will weigh more in week 10, and Liam's pumpkin will weigh more in week 13.
526 Graph $f(x) = x^2$ and $g(x) = 2^x$ for $x \geq 0$ on the set of axes below.

State which function, $f(x)$ or $g(x)$, has a greater value when $x = 20$. Justify your reasoning.

527 Michael has $10 in his savings account. Option 1 will add $100 to his account each week. Option 2 will double the amount in his account at the end of each week. Write a function in terms of $x$ to model each option of saving. Michael wants to have at least $700 in his account at the end of 7 weeks to buy a mountain bike. Determine which option(s) will enable him to reach his goal. Justify your answer.

528 The graph of $y = f(x)$ is shown below.

What is the graph of $y = f(x + 1) - 2$?

1)  
2)  
3)  
4)
529 Richard is asked to transform the graph of $b(x)$ below.

The graph of $b(x)$ is transformed using the equation $h(x) = b(x - 2) - 3$. Describe how the graph of $b(x)$ changed to form the graph of $h(x)$.

530 Which quadratic function has the largest maximum?

1) $h(x) = (3 - x)(2 + x)$

2) $k(x) = -5x^2 - 12x + 4$

3) $g(x) = -(x^2 - x + 6$

F.IF.C.9: COMPARING FUNCTIONS

531 Given the following quadratic functions:

$$g(x) = -x^2 - x + 6$$

<table>
<thead>
<tr>
<th>x</th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>n(x)</td>
<td>-7</td>
<td>0</td>
<td>5</td>
<td>8</td>
<td>9</td>
<td>8</td>
<td>5</td>
<td>0</td>
<td>-7</td>
</tr>
</tbody>
</table>

Which statement about these functions is true?

1) Over the interval $-1 \leq x \leq 1$, the average rate of change for $n(x)$ is less than that for $g(x)$.

2) The $y$-intercept of $g(x)$ is greater than the $y$-intercept for $n(x)$.

3) The function $g(x)$ has a greater maximum value than $n(x)$.

4) The sum of the roots of $n(x) = 0$ is greater than the sum of the roots of $g(x) = 0$. 

123
532 Which statement is true about the quadratic functions \( g(x) \), shown in the table below, and \( f(x) = (x - 3)^2 + 2 \)?

<table>
<thead>
<tr>
<th>( x )</th>
<th>( g(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>-1</td>
</tr>
<tr>
<td>2</td>
<td>-4</td>
</tr>
<tr>
<td>3</td>
<td>-5</td>
</tr>
<tr>
<td>4</td>
<td>-4</td>
</tr>
<tr>
<td>5</td>
<td>-1</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

1) They have the same vertex. 3) They have the same axis of symmetry.
2) They have the same zeros. 4) They intersect at two points.

533 The graph representing a function is shown below.

Which function has a minimum that is less than the one shown in the graph?
1) \( y = x^2 - 6x + 7 \)
2) \( y = |x + 3| - 6 \)
3) \( y = x^2 - 2x - 10 \)
4) \( y = |x - 8| + 2 \)

534 Which function has the greatest \( y \)-intercept?
1) \( f(x) = 3x \)
2) \( 2x + 3y = 12 \)
3) the line that has a slope of 2 and passes through \((1, -4)\)
535 Which function has a constant rate of change equal to \(-3\)?

1) \{(1,5),(2,2),(3,\text{-}5),(4,4)\}

2) \[
\begin{array}{|c|c|}
\hline
x & y \\
\hline
0 & 2 \\
1 & 5 \\
2 & 8 \\
3 & 11 \\
\hline
\end{array}
\]

3) \[2y = -6x + 10\]

4) \[
\begin{array}{|c|c|}
\hline
x & y \\
\hline
\end{array}
\]

536 Nancy works for a company that offers two types of savings plans. Plan A is represented on the graph below.

Plan B is represented by the function 
\[f(x) = 0.01 + 0.05x^2\], where \(x\) is the number of weeks. Nancy wants to have the highest savings possible after a year. Nancy picks Plan B. Her decision is

1) correct, because Plan B is an exponential function and will increase at a faster rate

2) correct, because Plan B is a quadratic function and will increase at a faster rate

3) incorrect, because Plan A will have a higher value after 1 year

4) incorrect, because Plan B is a quadratic function and will increase at a slower rate
537 Which quadratic function has the largest maximum over the set of real numbers?

1) \( f(x) = -x^2 + 2x + 4 \)

<table>
<thead>
<tr>
<th>x</th>
<th>k(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>-1</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>-1</td>
</tr>
</tbody>
</table>

2) \( g(x) = -(x - 5)^2 + 5 \)

<table>
<thead>
<tr>
<th>x</th>
<th>h(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>-9</td>
</tr>
<tr>
<td>-1</td>
<td>-3</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

538 Which of the quadratic functions below has the _smallest_ minimum value?

1) \( h(x) = x^2 + 2x - 6 \)

2) \( k(x) = (x + 5)(x + 2) \)
539 The function \( h(x) \), which is graphed below, and the function \( g(x) = 2|x + 4| - 3 \) are given.

Which statements about these functions are true?
I. \( g(x) \) has a lower minimum value than \( h(x) \).
II. For all values of \( x \), \( h(x) < g(x) \).
III. For any value of \( x \), \( g(x) \neq h(x) \).
1) I and II, only
2) I and III, only
3) II and III, only
4) I, II, and III

540 Which graph does not represent a function that is always increasing over the entire interval \(-2 < x < 2\)?
Three functions are shown below.

\[ g(x) = 3^x + 2 \]

<table>
<thead>
<tr>
<th>x</th>
<th>h(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5</td>
<td>30</td>
</tr>
<tr>
<td>-4</td>
<td>14</td>
</tr>
<tr>
<td>-3</td>
<td>6</td>
</tr>
<tr>
<td>-2</td>
<td>2</td>
</tr>
<tr>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-1</td>
</tr>
<tr>
<td>1</td>
<td>-1.5</td>
</tr>
<tr>
<td>2</td>
<td>-1.75</td>
</tr>
</tbody>
</table>

Which statement is true?

1) The \( y \)-intercept for \( h(x) \) is greater than the \( y \)-intercept for \( f(x) \).

2) The \( y \)-intercept for \( f(x) \) is greater than the \( y \)-intercept for \( g(x) \).

3) The \( y \)-intercept for \( h(x) \) is greater than the \( y \)-intercept for both \( g(x) \) and \( f(x) \).

4) The \( y \)-intercept for \( g(x) \) is greater than the \( y \)-intercept for both \( f(x) \) and \( h(x) \).
Given the functions $g(x)$, $f(x)$, and $h(x)$ shown below:

$$g(x) = x^2 - 2x$$

The correct list of functions ordered from greatest to least by average rate of change over the interval $0 \leq x \leq 3$ is

1) $f(x)$, $g(x)$, $h(x)$
2) $h(x)$, $g(x)$, $f(x)$
3) $g(x)$, $f(x)$, $h(x)$
4) $h(x)$, $f(x)$, $g(x)$
The functions \( f(x) \), \( q(x) \), and \( p(x) \) are shown below.

\[ q(x) = (x - 1)^2 - 6 \]

<table>
<thead>
<tr>
<th>( x )</th>
<th>( p(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

When the input is 4, which functions have the same output value?

1) \( f(x) \) and \( q(x) \), only
2) \( f(x) \) and \( p(x) \), only
3) \( q(x) \) and \( p(x) \), only
4) \( f(x) \), \( q(x) \), and \( p(x) \)
131

544 Let $f$ be the function represented by the graph below.

Let $g$ be a function such that $g(x) = - \frac{1}{2} x^2 + 4x + 3$.

Determine which function has the larger maximum value. Justify your answer.

F.IF.B.4: RELATING GRAPHS TO EVENTS

545 The graph below represents a jogger's speed during her 20-minute jog around her neighborhood.

Which statement best describes what the jogger was doing during the 9 – 12 minute interval of her jog?
1) She was standing still.
2) She was increasing her speed.
3) She was decreasing her speed.
4) She was jogging at a constant rate.
To keep track of his profits, the owner of a carnival booth decided to model his ticket sales on a graph. He found that his profits only declined when he sold between 10 and 40 tickets. Which graph could represent his profits?

During a snowstorm, a meteorologist tracks the amount of accumulating snow. For the first three hours of the storm, the snow fell at a constant rate of one inch per hour. The storm then stopped for two hours and then started again at a constant rate of one-half inch per hour for the next four hours.

a) On the grid below, draw and label a graph that models the accumulation of snow over time using the data the meteorologist collected.

b) If the snowstorm started at 6 p.m., how much snow had accumulated by midnight?
548 A driver leaves home for a business trip and drives at a constant speed of 60 miles per hour for 2 hours. Her car gets a flat tire, and she spends 30 minutes changing the tire. She resumes driving and drives at 30 miles per hour for the remaining one hour until she reaches her destination. On the set of axes below, draw a graph that models the driver’s distance from home.

549 The graph below models Craig's trip to visit his friend in another state. In the course of his travels, he encountered both highway and city driving.

Based on the graph, during which interval did Craig most likely drive in the city? Explain your reasoning. Explain what might have happened in the interval between B and C. Determine Craig's average speed, to the nearest tenth of a mile per hour, for his entire trip.
550 One spring day, Elroy noted the time of day and the temperature, in degrees Fahrenheit. His findings are stated below.

At 6 a.m., the temperature was 50°F. For the next 4 hours, the temperature rose 3° per hour. The next 6 hours, it rose 2° per hour. The temperature then stayed steady until 6 p.m. For the next 2 hours, the temperature dropped 1° per hour. The temperature then dropped steadily until the temperature was 56°F at midnight.

On the set of axes below, graph Elroy's data.

State the entire time interval for which the temperature was increasing. Determine the average rate of change, in degrees per hour, from 6:00 p.m. to midnight.

F.IF.C.7: GRAPHING PIECEWISE-DEFINED FUNCTIONS

551 A function is graphed on the set of axes below.

Which function is related to the graph?

1) \( f(x) = \begin{cases} x^2, & x < 1 \\ x - 2, & x > 1 \end{cases} \)

2) \( f(x) = \begin{cases} x^2, & x < 1 \\ \frac{1}{2}x + \frac{1}{2}, & x > 1 \end{cases} \)

3) \( f(x) = \begin{cases} x^2, & x < 1 \\ 2x - 7, & x > 1 \end{cases} \)

4) \( f(x) = \begin{cases} x^2, & x < 1 \\ \frac{3}{2}x - \frac{9}{2}, & x > 1 \end{cases} \)
552 Which graph represents \( f(x) = \begin{cases} \lfloor x \rfloor & x < 1 \\ \sqrt{x} & x \geq 1 \end{cases} \)?

553 When the function \( g(x) = \begin{cases} 5x, & x \leq 3 \\ x^2 + 4, & x > 3 \end{cases} \) is graphed correctly, how should the points be drawn on the graph for an \( x \)-value of 3?

1) open circles at (3,15) and (3,13)
2) closed circles at (3,15) and (3,13)
3) an open circle at (3,15) and a closed circle at (3,13)
4) a closed circle at (3,15) and an open circle at (3,13)
At an office supply store, if a customer purchases fewer than 10 pencils, the cost of each pencil is $1.75. If a customer purchases 10 or more pencils, the cost of each pencil is $1.25. Let \( c \) be a function for which \( c(x) \) is the cost of purchasing \( x \) pencils, where \( x \) is a whole number.

\[
c(x) = \begin{cases} 
1.75x, & \text{if } 0 \leq x \leq 9 \\
1.25x, & \text{if } x \geq 10 
\end{cases}
\]

Create a graph of \( c \) on the axes below.

A customer brings 8 pencils to the cashier. The cashier suggests that the total cost to purchase 10 pencils would be less expensive. State whether the cashier is correct or incorrect. Justify your answer.
556 On the set of axes below, graph the piecewise function:

\[ f(x) = \begin{cases} 
\frac{1}{2} x, & x < 2 \\
 x, & x \geq 2 
\end{cases} \]

F.I.F.C.7: GRAPHING STEP FUNCTIONS

557 Morgan can start wrestling at age 5 in Division 1. He remains in that division until his next odd birthday when he is required to move up to the next division level. Which graph correctly represents this information?
The table below lists the total cost for parking for a period of time on a street in Albany, N.Y. The total cost is for any length of time up to and including the hours parked. For example, parking for up to and including 1 hour would cost $1.25; parking for 3.5 hours would cost $5.75.

<table>
<thead>
<tr>
<th>Hours Parked</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.25</td>
</tr>
<tr>
<td>2</td>
<td>2.50</td>
</tr>
<tr>
<td>3</td>
<td>4.00</td>
</tr>
<tr>
<td>4</td>
<td>5.75</td>
</tr>
<tr>
<td>5</td>
<td>7.75</td>
</tr>
<tr>
<td>6</td>
<td>10.00</td>
</tr>
</tbody>
</table>

Graph the step function that represents the cost for the number of hours parked.

Explain how the cost per hour to park changes over the six-hour period.

If \( f(1) = 3 \) and \( f(n) = -2f(n-1) + 1 \), then \( f(5) = \)

1) -5  
2) 11  
3) 21  
4) 43

If a sequence is defined recursively by \( f(0) = 2 \) and \( f(n + 1) = -2f(n) + 3 \) for \( n \geq 0 \), then \( f(2) \) is equal to

1) 1  
2) -11  
3) 5  
4) 17
561 In a sequence, the first term is 4 and the common difference is 3. The fifth term of this sequence is
1) −11
2) −8
3) 16
4) 19

562 Given the function \( f(n) \) defined by the following:

\[
f(1) = 2 \\
f(n) = -5f(n - 1) + 2
\]

Which set could represent the range of the function?
1) \{2, 4, 6, 8, \ldots\}
2) \{2, -8, 42, -208, \ldots\}
3) \{-8, -42, -208, 1042, \ldots\}
4) \{-10, 50, -250, 1250, \ldots\}

563 A sequence of blocks is shown in the diagram below.

![Diagram of blocks]

This sequence can be defined by the recursive function \( a_1 = 1 \) and \( a_n = a_{n-1} + n \). Assuming the pattern continues, how many blocks will there be when \( n = 7 \)?
1) 13
2) 21
3) 28
4) 36

564 On the main floor of the Kodak Hall at the Eastman Theater, the number of seats per row increases at a constant rate. Steven counts 31 seats in row 3 and 37 seats in row 6. How many seats are there in row 20?
1) 65
2) 67
3) 69
4) 71

565 If \( a_n = n (a_{n-1}) \) and \( a_1 = 1 \), what is the value of \( a_5 \)?
1) 5
2) 20
3) 120
4) 720

566 Determine and state whether the sequence 1, 3, 9, 27, \ldots displays exponential behavior. Explain how you arrived at your decision.

567 Write the first five terms of the recursive sequence defined below.
\[
a_1 = 0 \\
a_n = 2 (a_{n-1})^2 - 1, \text{ for } n > 1
\]

a_1 = \_\_\_\_
564 On the main floor of the Kodak Hall at the Eastman Theater, the number of seats per row increases at a constant rate. Steven counts 31 seats in row 3 and 37 seats in row 6. How many seats are there in row 20?
1) 65
2) 67
3) 69
4) 71

565 If \( a_n = n (a_{n-1}) \) and \( a_1 = 1 \), what is the value of \( a_5 \)?
1) 5
2) 20
3) 120
4) 720

566 Determine and state whether the sequence 1, 3, 9, 27, \ldots displays exponential behavior. Explain how you arrived at your decision.

567 Write the first five terms of the recursive sequence defined below.
\[
a_1 = 0 \\
a_n = 2 (a_{n-1})^2 - 1, \text{ for } n > 1
\]

a_1 = \_\_\_\_
A pattern of blocks is shown below.

If the pattern of blocks continues, which formula(s) could be used to determine the number of blocks in the \( n \)th term?

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>II</td>
<td>III</td>
</tr>
<tr>
<td>( a_n = n + 4 )</td>
<td>( a_1 = 2 )</td>
<td>( a_n = 4n - 2 )</td>
</tr>
<tr>
<td>( a_n = a_{n-1} + 4 )</td>
<td>( a_n = a_{n-1} + 4 )</td>
<td></td>
</tr>
</tbody>
</table>

1) I and II  
2) I and III  
3) II and III  
4) III, only

The diagrams below represent the first three terms of a sequence.

Assuming the pattern continues, which formula determines \( a_n \), the number of shaded squares in the \( n \)th term?

1) \( a_n = 4n + 12 \)  
2) \( a_n = 4n + 8 \)  
3) \( a_n = 4n + 4 \)  
4) \( a_n = 4n + 2 \)

If the pattern below continues, which equation(s) is a recursive formula that represents the number of squares in this sequence?

1) \( y = 2x + 1 \)  
2) \( y = 2x + 3 \)  
3) \( a_1 = 3 \)  
4) \( a_1 = 1 \)  

\( a_n = a_{n-1} + 2 \)  
\( a_n = a_{n-1} + 2 \)
571 A sunflower is 3 inches tall at week 0 and grows 2 inches each week. Which function(s) shown below can be used to determine the height, \( f(n) \), of the sunflower in \( n \) weeks?

I. \( f(n) = 2n + 3 \)
II. \( f(n) = 2n + 3(n - 1) \)
III. \( f(n) = f(n - 1) + 2 \) where \( f(0) = 3 \)

1) I and II
2) II, only
3) III, only
4) I and III

572 The third term in an arithmetic sequence is 10 and the fifth term is 26. If the first term is \( a_1 \), which is an equation for the \( n \)th term of this sequence?

1) \( a_n = 8n + 10 \)
2) \( a_n = 8n - 14 \)
3) \( a_n = 16n + 10 \)
4) \( a_n = 16n - 38 \)

573 Which recursively defined function has a first term equal to 10 and a common difference of 4?

1) \( f(1) = 10 \)
   \( f(x) = f(x - 1) + 4 \)
2) \( f(1) = 4 \)
   \( f(x) = f(x - 1) + 10 \)
3) \( f(1) = 10 \)
   \( f(x) = 4f(x - 1) \)
4) \( f(1) = 4 \)
   \( f(x) = 10f(x - 1) \)

574 Which recursively defined function represents the sequence 3, 7, 15, 31, \ldots?

1) \( f(1) = 3, \ f(n + 1) = 2^{f(n)} + 3 \)
2) \( f(1) = 3, \ f(n + 1) = 2^{f(n)} - 1 \)
3) \( f(1) = 3, \ f(n + 1) = 2f(n) + 1 \)
4) \( f(1) = 3, \ f(n + 1) = 3f(n) - 2 \)

575 Which function defines the sequence -6, -10, -14, -18, \ldots, where \( f(6) = -26 \)?

1) \( f(x) = -4x - 2 \)
2) \( f(x) = 4x - 2 \)
3) \( f(x) = -x + 32 \)
4) \( f(x) = x - 26 \)

576 In 2014, the cost to mail a letter was 49¢ for up to one ounce. Every additional ounce cost 21¢. Which recursive function could be used to determine the cost of a 3-ounce letter, in cents?

1) \( a_1 = 49; \ a_n = a_{n-1} + 21 \)
2) \( a_1 = 0; \ a_n = 49a_{n-1} + 21 \)
3) \( a_1 = 21; \ a_n = a_{n-1} + 49 \)
4) \( a_1 = 0; \ a_n = 21a_{n-1} + 49 \)

577 For the sequence -27, -12, 3, 18, \ldots, the expression that defines the \( n \)th term where \( a_1 = -27 \) is

1) \( 15 - 27n \)
2) \( 15 - 27(n - 1) \)
3) \( -27 + 15n \)
4) \( -27 + 15(n - 1) \)
Which function could be used to represent the sequence 8, 20, 50, 125, 312.5, ..., given that \( a_1 = 8 \)?

1) \( a_n = a_{n-1} + a_1 \)
2) \( a_n = 2.5 \left( a_{n-1} \right) \)
3) \( a_n = a_1 + 1.5 \left( a_{n-1} \right) \)
4) \( a_n = \left( a_1 \right) \left( a_{n-1} \right) \)
Algebra I Regents Exam Questions by State Standard: Topic
Answer Section

1 ANS: 1  REF: 061401ai  NAT: A.REI.A.1  TOP: Identifying Properties
2 ANS: 4  REF: 081701ai  NAT: A.REI.A.1  TOP: Identifying Properties
3 ANS: 4  REF: 011801ai  NAT: A.REI.A.1  TOP: Identifying Properties
4 ANS: 4  REF: 011908ai  NAT: A.REI.A.1  TOP: Identifying Properties
5 ANS: 3

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Q1</th>
<th>Median</th>
<th>Q3</th>
<th>IQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester 1</td>
<td>86.8</td>
<td>80.5</td>
<td>88</td>
<td>92.5</td>
<td>12</td>
</tr>
<tr>
<td>Semester 2</td>
<td>87</td>
<td>80</td>
<td>88</td>
<td>92</td>
<td>12</td>
</tr>
</tbody>
</table>

6 ANS: 1  REF: 061419ai  NAT: S.ID.A.2  TOP: Central Tendency and Dispersion
A: \( \bar{x} = 6; \sigma_x = 3.16 \)  B: \( \bar{x} = 6.875; \sigma_x = 3.06 \)

7 ANS: 4  REF: 081519ai  NAT: S.ID.A.2  TOP: Central Tendency and Dispersion
8 ANS: 4  REF: 011514ai  NAT: S.ID.A.2  TOP: Central Tendency and Dispersion
9 ANS: 3

<table>
<thead>
<tr>
<th></th>
<th>Company 1</th>
<th>Company 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>median salary</td>
<td>33,500</td>
</tr>
<tr>
<td>2</td>
<td>mean salary</td>
<td>33,750</td>
</tr>
<tr>
<td>3</td>
<td>salary range</td>
<td>8,000</td>
</tr>
<tr>
<td>4</td>
<td>mean age</td>
<td>28.25</td>
</tr>
</tbody>
</table>

10 ANS: 4th because IQR and \( \sigma_x \) are greater for 4th Period. Regents Exam originally asked about the “largest” spread.

11 ANS:  Los Angeles because range, IQR and \( \sigma_x \) are less.

<table>
<thead>
<tr>
<th></th>
<th>( \sigma_x )</th>
<th>Min</th>
<th>Q1</th>
<th>Q3</th>
<th>Max</th>
<th>Range</th>
<th>IQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miami</td>
<td>7.2</td>
<td>60</td>
<td>75</td>
<td>83</td>
<td>87</td>
<td>27</td>
<td>8</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>3.6</td>
<td>61</td>
<td>63</td>
<td>67</td>
<td>74</td>
<td>13</td>
<td>4</td>
</tr>
</tbody>
</table>

12 ANS: 3  REF: 011931ai  NAT: S.ID.A.2  TOP: Central Tendency and Dispersion
Median remains at 1.4.

13 ANS:  REF: 061520ai  NAT: S.ID.A.3  TOP: Central Tendency and Dispersion
13 ANS: 4
(1) The box plot indicates the data is not evenly spread. (2) The median is 62.5. (3) The data is skewed because the mean does not equal the median. (4) An outlier is greater than \( Q_3 + 1.5 \cdot IRQ = 66 + 1.5(66 - 60.5) = 74.25 \).

14 ANS: 1
(1) The mode is a bit high (2) \( Q_1 = 41, Q_3 = 68 \), 1.5 times the IQR of 27 is 40.5, \( Q_1 - 1.5IQR = 41 - 40.5 = 0.5, \)
\( Q_3 + 1.5IQR = 68 + 40.5 = 108.5 \), so the data have two outliers.

15 ANS: 4
\[
\frac{30}{30 + 12 + 8} = 0.6
\]

16 ANS: 2
\[
\frac{14}{16 + 20 + 14} = 28\%
\]

17 ANS: 1
\[
\frac{58 + 41}{42 + 58 + 20 + 84 + 41 + 5} = \frac{99}{250} = 0.396
\]

18 ANS: 2
\[
\frac{60 - 45}{60} = \frac{15}{60} = \frac{1}{4}
\]
19 ANS: \[ \frac{33 + 12}{180} = 25\% \]

REF: 011526ai NAT: S.ID.B.5 TOP: Frequency Tables
KEY: two-way

20 ANS: \[ \frac{m}{351} = \frac{70}{70 + 35} \]

\[ 105m = 24570 \]

\[ m = 234 \]

REF: 011630ai NAT: S.ID.B.5 TOP: Frequency Tables
KEY: two-way

21 ANS:

<table>
<thead>
<tr>
<th>Like Pop</th>
<th>Watch Sports</th>
<th>Don't Watch Sports</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>26</td>
<td>18</td>
<td>54</td>
</tr>
<tr>
<td>Don't Like Pop</td>
<td>34</td>
<td>12</td>
<td>46</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>

REF: 061729ai NAT: S.ID.B.5 TOP: Frequency Tables
KEY: two-way

22 ANS:

<table>
<thead>
<tr>
<th>Interval</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.0 - 6.1</td>
<td>5</td>
</tr>
<tr>
<td>6.2 - 6.3</td>
<td>10</td>
</tr>
<tr>
<td>6.4 - 6.5</td>
<td>11</td>
</tr>
<tr>
<td>6.6 - 6.7</td>
<td>0</td>
</tr>
<tr>
<td>6.8 - 6.9</td>
<td>2</td>
</tr>
<tr>
<td>7.0 - 7.1</td>
<td>3</td>
</tr>
</tbody>
</table>

REF: 081734ai NAT: S.ID.A.1 TOP: Frequency Histograms
KEY: frequency histograms

23 ANS: 4 REF: 081603ai NAT: S.ID.A.1 TOP: Box Plots
KEY: interpret

24 ANS: 2 REF: 061805ai NAT: S.ID.A.1 TOP: Box Plots
KEY: interpret
25. ANS:

\[
\begin{array}{llll}
\text{MIN: 1} & \text{Q1: 2} & \text{MEDIAN: 3} & \text{Q3: 4} & \text{MAX: 5}
\end{array}
\]

REF: 061432ai NAT: S.ID.A.1 TOP: Box Plots KEY: represent

26. ANS: 3

median = 3, IQR = 4 - 2 = 2, \(x = 2.75\). An outlier is outside the interval \([Q_1 - 1.5(IQR), Q_3 + 1.5(IQR)]\).

\([-1, 7]\]

REF: 061620ai NAT: S.ID.A.1 TOP: Dot Plots

27. ANS: 2

REF: 011901ai NAT: S.ID.B.6 TOP: Scatter Plots

KEY: line of best fit

28. ANS: 2

REF: 011713ai NAT: S.ID.C.9 TOP: Analysis of Data

29. ANS: 2

REF: 081708ai NAT: S.ID.C.9 TOP: Analysis of Data

30. ANS: 3

REF: 081821ai NAT: S.ID.C.9 TOP: Analysis of Data

31. ANS: 2

REF: 061516ai NAT: S.ID.C.9 TOP: Analysis of Data

32. ANS: 4

REF: 081421ai NAT: S.ID.B.6 TOP: Regression

KEY: linear

33. ANS:

\[y = 0.05x - 0.92\]

REF: fall1307ai NAT: S.ID.B.6 TOP: Regression KEY: linear

34. ANS:

\[y = 17.159x - 2.476, \quad y = 17.159(0.65) - 2.476 \approx 8.7\]

REF: 081633ai NAT: S.ID.B.6 TOP: Regression KEY: linear

35. ANS:

\[y = -8.5x + 99.2\] The y-intercept represents the length of the rope without knots. The slope represents the decrease in the length of the rope for each knot.

REF: 011834ai NAT: S.ID.B.6 TOP: Regression KEY: linear

36. ANS:

\[y = 0.16x + 8.27, \quad r = 0.97, \quad \text{which suggests a strong association.}\]

REF: 081536ai NAT: S.ID.B.6 TOP: Regression KEY: linear with correlation coefficient

37. ANS:

\[f(t) = -58t + 6182, \quad r = -0.94\] This indicates a strong linear relationship because \(r\) is close to -1.

REF: 011635ai NAT: S.ID.B.6 TOP: Regression KEY: linear with correlation coefficient

38. ANS:

\[y = 0.96x + 23.95, 0.92, \quad \text{high, positive correlation between scores 85 or better on the math and English exams.}\]

REF: 061836ai NAT: S.ID.B.6 TOP: Regression KEY: linear with correlation coefficient
39 ANS:
\[ y = 1.9x + 29.8 \quad r = 0.3 \] This indicates a weak relationship between a dog’s height and mass.

REF: 011934ai NAT: S.ID.B.6 TOP: Regression KEY: linear with correlation coefficient

40 ANS:
\[ y = 80(1.5)^x \quad 80(1.5)^{26} \approx 3,030,140. \] No, because the prediction at \( x = 52 \) is already too large.

REF: 061536ai NAT: S.ID.B.6 TOP: Regression KEY: exponential

41 ANS:
\[ y = 836.47(2.05)^x \] The data appear to grow at an exponential rate. \( y = 836.47(2.05)^2 \approx 3515 \).

REF: fall1313ai NAT: S.ID.B.6 TOP: Regression KEY: choose model

42 ANS: 2
\[ r = 0.92 \]

REF: 081606ai NAT: S.ID.C.8 TOP: Correlation Coefficient

43 ANS: 2 REF: 061604ai NAT: S.ID.C.8 TOP: Correlation Coefficient

44 ANS: 4 REF: 011703ai NAT: S.ID.C.8 TOP: Correlation Coefficient

45 ANS: 1 REF: 061714ai NAT: S.ID.C.8 TOP: Correlation Coefficient

46 ANS: 1 REF: 081722ai NAT: S.ID.C.8 TOP: Correlation Coefficient

47 ANS: 3 REF: 061411ai NAT: S.ID.C.8 TOP: Correlation Coefficient

48 ANS:
\[ r \approx 0.94. \] The correlation coefficient suggests that as calories increase, so does sodium.

REF: 011535ai NAT: S.ID.C.8 TOP: Correlation Coefficient

49 ANS:
\[ r \approx 0.92. \] The correlation coefficient suggests a strong positive correlation between a student’s mathematics and physics scores.

REF: 011831ai NAT: S.ID.C.8 TOP: Correlation Coefficient

50 ANS: 3
A correlation coefficient close to –1 or 1 indicates a good fit. For a residual plot, there should be no observable pattern and a similar distribution of residuals above and below the \( x \)-axis.

REF: fall1303ai NAT: S.ID.B.6 TOP: Residuals

51 ANS: 3
For a residual plot, there should be no observable pattern and a similar distribution of residuals above and below the \( x \)-axis.

REF: 011624ai NAT: S.ID.B.6 TOP: Residuals
Based on the residual plot, the equation is a good fit for the data because the residual values are scattered without a pattern and are fairly evenly distributed above and below the x-axis.

Ref: fall1314ai, Nat: S.ID.B.6, Top: Residuals

The line is a poor fit because the residuals form a pattern.

Ref: 081431ai, Nat: S.ID.B.6, Top: Residuals

Graph A is a good fit because it does not have a clear pattern, whereas Graph B does.

Ref: 061531ai, Nat: S.ID.B.6, Top: Residuals

No, \( -2 \) is the coefficient of the term with the highest power.

Ref: 081628ai, Nat: A.SSE.A.1, Top: Modeling Expressions
\[
\frac{7}{3} \left( x + \frac{9}{28} \right) = 20
\]

\[
\frac{7}{3} x + \frac{3}{4} = \frac{80}{4}
\]

\[
\frac{7}{3} x = \frac{77}{4}
\]

\[
x = \frac{33}{4} = 8.25
\]

REF: 061405ai NAT: A.REI.B.3 TOP: Solving Linear Equations
KEY: fractional expressions

63 ANS: 1
\[
\frac{x - 2}{3} = \frac{4}{6}
\]

6x - 12 = 12

6x = 24

x = 4

REF: 081420ai NAT: A.REI.B.3 TOP: Solving Linear Equations
KEY: fractional expressions

64 ANS: 1
\[
4(x - 7) = 0.3(x + 2) + 2.11
\]

4x - 28 = 0.3x + 0.6 + 2.11

3.7x - 28 = 2.71

3.7x = 30.71

x = 8.3

REF: 061719ai NAT: A.REI.B.3 TOP: Solving Linear Equations
KEY: decimals
65 ANS: 2
\[
6 \left( \frac{5}{6} \left( \frac{3}{8} - x \right) \right) = 16
\]

\[
8 \left( \frac{5}{3} \frac{3}{8} - x \right) = 96
\]

\[
15 - 40x = 768
\]

\[
-40x = 753
\]

\[
x = -18.825
\]

REF: 081713ai   NAT: A.REI.B.3   TOP: Solving Linear Equations
KEY: fractional expressions

66 ANS: 4
\[
\frac{2}{3} \left( \frac{1}{4} x - 2 \right) = \frac{1}{5} \left( \frac{4}{3} x - 1 \right)
\]

\[
10(3x - 24) = 3(16x - 12)
\]

\[
30x - 240 = 48x - 36
\]

\[
-204 = 18x
\]

\[
x = -11.3
\]

REF: 011822ai   NAT: A.REI.B.3   TOP: Solving Linear Equations
KEY: fractional expressions

67 ANS: 2
\[
-2 + 8x = 3x + 8
\]

\[
5x = 10
\]

\[
x = 2
\]

REF: 081804ai   NAT: A.REI.B.3   TOP: Solving Linear Equations
KEY: integral expressions

68 ANS: 2
\[
\frac{3}{5} \left( x + \frac{4}{3} \right) = 1.04
\]

\[
3 \left( x + \frac{4}{3} \right) = 5.2
\]

\[
3x + 4 = 5.2
\]

\[
3x = 1.2
\]

\[
x = 0.4
\]

REF: 011905ai   NAT: A.REI.B.3   TOP: Solving Linear Equations
KEY: decimals
69 ANS:
\[18 - 2(x + 5) = 12x\]
\[18 - 2x - 10 = 12x\]
\[8 = 14x\]
\[x = \frac{8}{14} = \frac{4}{7}\]

REF: 061830ai  NAT: A.REI.B.3  TOP: Solving Linear Equations
KEY: fractional expressions

70 ANS: 3  REF: 081614ai  NAT: A.CED.A.1  TOP: Modeling Linear Equations

71 ANS: 2  REF: 061416ai  NAT: A.CED.A.1  TOP: Modeling Linear Equations

72 ANS: 3  REF: 081616ai  NAT: A.CED.A.1  TOP: Modeling Linear Equations

73 ANS:
\[12x + 9(2x) + 5(3x) = 15 \cdot 6 \left(\frac{1}{3}\right) = 2 \text{ pounds}\]
\[45x = 15\]
\[x = \frac{1}{3}\]

REF: spr1305ai  NAT: A.CED.A.1  TOP: Modeling Linear Equations

74 ANS:
\[15x + 36 = 10x + 48\]
\[5x = 12\]
\[x = 2.4\]

REF: 011531ai  NAT: A.CED.A.1  TOP: Modeling Linear Equations

75 ANS:
\[1000 - 60x = 600 - 20x. \quad 1000 - 60(10) = 400. \quad \text{Ian is incorrect because} \quad I = 1000 - 6(16) = 40 \neq 0\]
\[40x = 400\]
\[x = 10\]

REF: 011737ai  NAT: A.CED.A.1  TOP: Modeling Linear Equations

76 ANS: 4  REF: 061422ai  NAT: A.CED.A.2  TOP: Modeling Linear Equations

77 ANS: 4  REF: 081508ai  NAT: A.CED.A.2  TOP: Modeling Linear Equations

78 ANS:
\[C = 1.29 + .99(s - 1) \quad \text{No, because} \quad C = 1.29 + .99(52 - 1) = 51.78\]

REF: 011730ai  NAT: A.CED.A.2  TOP: Modeling Linear Equations

79 ANS: 3  REF: 061723ai  NAT: A.CED.A.4  TOP: Transforming Formulas
80 ANS: \(1\)
\[
V = \frac{1}{3} \pi r^2 h
\]
\[
3V = \pi r^2 h
\]
\[
\frac{3V}{\pi h} = r^2
\]
\[
\sqrt{\frac{3V}{\pi h}} = r
\]

REF: 061423ai  NAT: A.CED.A.4  TOP: Transforming Formulas

81 ANS: \(1\)  
REF: 011516ai  NAT: A.CED.A.4  TOP: Transforming Formulas

82 ANS: \(2\)
\[
d = \frac{1}{2} at^2
\]
\[
2d = at^2
\]
\[
\frac{2d}{a} = t^2
\]
\[
\sqrt{\frac{2d}{a}} = t
\]

REF: 061519ai  NAT: A.CED.A.4  TOP: Transforming Formulas

83 ANS: \(2\)
\[
P = I^2 R
\]
\[
I^2 = \frac{P}{R}
\]
\[
I = \sqrt{\frac{P}{R}}
\]

REF: 011920ai  NAT: A.CED.A.4  TOP: Transforming Formulas

84 ANS: \(3\)  
REF: 011606ai  NAT: A.CED.A.4  TOP: Transforming Formulas

85 ANS: \(3\)  
REF: 011704ai  NAT: A.CED.A.4  TOP: Transforming Formulas

86 ANS: \(4\)  
REF: 061823ai  NAT: A.CED.A.4  TOP: Transforming Formulas

87 ANS:
\[
A = \frac{1}{2} h(b_1 + b_2) \quad b_1 = \frac{2(60)}{6} - 12 = 20 - 12 = 8
\]
\[
\frac{2A}{h} = b_1 + b_2
\]
\[
\frac{2A}{h} - b_2 = b_1
\]

REF: 081434ai  NAT: A.CED.A.4  TOP: Transforming Formulas
88 ANS:
\[
\frac{V}{\pi h} = \frac{\pi r^2 h}{\pi h} \quad d = 2 \sqrt{\frac{66}{3.3\pi}} \approx 5
\]
\[
\frac{V}{\pi h} = r^2
\]
\[
\sqrt{\frac{V}{\pi h}} = r
\]
REF: 081535ai NAT: A.CED.A.4 TOP: Transforming Formulas

89 ANS:
\[
\frac{S}{180} = n - 2
\]
\[
\frac{S}{180} + 2 = n
\]
REF: 061631ai NAT: A.CED.A.4 TOP: Transforming Formulas

90 ANS:
\[
4ax + 12 - 3ax = 25 + 3a
\]
\[
ax = 13 + 3a
\]
\[
x = \frac{13 + 3a}{a}
\]
REF: 081632ai NAT: A.CED.A.4 TOP: Transforming Formulas

91 ANS:
\[
V = \frac{1}{3} \pi r^2 h
\]
\[
3V = \pi r^2 h
\]
\[
\frac{3V}{\pi h} = r^2
\]
\[
\sqrt{\frac{3V}{\pi h}} = r
\]
REF: 081727ai NAT: A.CED.A.4 TOP: Transforming Formulas
92 ANS:

\[ F_g = \frac{GM_1M_2}{r^2} \]

\[ r^2 = \frac{GM_1M_2}{F_g} \]

\[ r = \sqrt{\frac{GM_1M_2}{F_g}} \]

REF: 011830ai NAT: A.CED.A.4 TOP: Transforming Formulas

93 ANS:

\[ 9K = 5F + 2298.35 \]

\[ F = \frac{9K - 2298.35}{5} \]

REF: 081829ai NAT: A.CED.A.4 TOP: Transforming Formulas

94 ANS: 1

\[ 12.5 \text{ sec} \times \frac{1 \text{ min}}{60 \text{ sec}} = 0.2083 \text{ min} \]

REF: 061608ai NAT: N.Q.A.1 TOP: Conversions KEY: dimensional analysis

95 ANS: 1

\[ C(68) = \frac{5}{9} (68 - 32) = 20 \]

REF: 011710ai NAT: N.Q.A.1 TOP: Conversions KEY: formula

96 ANS: 1

I. \( 10 \text{ mi} \left( \frac{1.609 \text{ km}}{1 \text{ mi}} \right) = 16.09 \text{ km} \);
II. \( 44880 \text{ ft} \left( \frac{1 \text{ mi}}{5280 \text{ ft}} \right) \left( \frac{1.609 \text{ km}}{1 \text{ mi}} \right) \approx 13.6765 \text{ km} \);
III. \( 15560 \text{ yd} \left( \frac{3 \text{ ft}}{1 \text{ yd}} \right) \left( \frac{1 \text{ mi}}{5280 \text{ ft}} \right) \left( \frac{1.609 \text{ km}}{1 \text{ mi}} \right) \approx 14.225 \text{ km} \)

REF: 061815ai NAT: N.Q.A.1 TOP: Conversions KEY: dimensional analysis

97 ANS: 2 REF: 011502ai NAT: N.Q.A.1 TOP: Conversions KEY: dimensional analysis

98 ANS: 4 REF: 061720ai NAT: N.Q.A.1 TOP: Conversions KEY: dimensional analysis

99 ANS: 4 REF: 011924ai NAT: N.Q.A.1 TOP: Conversions KEY: dimensional analysis

100 ANS: 3 REF: 081812ai NAT: N.Q.A.1 TOP: Conversions KEY: dimensional analysis
101 ANS: 
\[
12 \text{ km} \left( \frac{0.62 \text{ m}}{1 \text{ km}} \right) = 7.44 \text{ m} \quad \frac{26.2 \text{ m}}{7.44 \text{ mph}} \approx 3.5 \text{ hours}
\]

REF: 011726ai NAT: N.Q.A.1 TOP: Conversions KEY: dimensional analysis

102 ANS: 3

REF: 081609ai NAT: N.Q.A.2 TOP: Using Rate

103 ANS: 
\[
\frac{2}{40} = \frac{5.75}{x} \quad \frac{5280}{115} \approx 46
\]

\[
x = 115
\]

REF: 081730ai NAT: N.Q.A.2 TOP: Using Rate

104 ANS: 
The rate of speed is expressed in \( \frac{\text{feet}}{\text{minute}} \) because speed= \( \frac{\text{distance}}{\text{time}} \).

REF: 011827ai NAT: A.CED.A.2 TOP: Speed

105 ANS: 
\[
\frac{762 - 192}{92 - 32} = \frac{570}{60} = 9.5 \quad y = 9.5x \quad T = 192 + 9.5(120 - 32) = 1028
\]

REF: 061635ai NAT: A.CED.A.2 TOP: Speed

106 ANS: 
\[
610 - 55(4) = 390 \quad \frac{390}{65} = 6 \quad 4 + 6 = 10 \quad 610 - 55(2) = 500 \quad \frac{500}{65} \approx 7.7 \quad 10 - (2 + 7.7) \approx 0.3
\]

REF: 081733ai NAT: A.CED.A.2 TOP: Speed

107 ANS: 1 
\[
\frac{110 - 40}{2 - 1} > \frac{350 - 230}{8 - 6}
\]

\[
70 > 60
\]

REF: 061418ai NAT: F.IF.B.6 TOP: Rate of Change

108 ANS: 1

REF: 081515ai NAT: F.IF.B.6 TOP: Rate of Change

109 ANS: 2 
The slope of a line connecting (5,19) and (10,20) is lowest.

REF: 081705ai NAT: F.IF.B.6 TOP: Rate of Change

110 ANS: 1

REF: 011721ai NAT: F.IF.B.6 TOP: Rate of Change

111 ANS: 2 
From 1996-2012, the average rate of change was positive for three age groups.

REF: 011824ai NAT: F.IF.B.6 TOP: Rate of Change
112 ANS: 1
The graph is steepest between hour 0 and hour 1.

REF: 081601ai NAT: F.IF.B.6 TOP: Rate of Change

113 ANS: 4
(1) \( \frac{6 - 1}{1971 - 1898} = \frac{5}{73} \approx 0.07 \) (2) \( \frac{14 - 6}{1985 - 1971} = \frac{8}{14} \approx 0.57 \) (3) \( \frac{24 - 14}{2006 - 1985} = \frac{10}{21} \approx 0.48 \) (4) \( \frac{35 - 24}{2012 - 2006} = \frac{11}{6} \approx 1.83 \)

REF: 011613ai NAT: F.IF.B.6 TOP: Rate of Change

114 ANS: 1
REF: 061603ai NAT: F.IF.B.6 TOP: Rate of Change

115 ANS: 4
\( \frac{4.7 - 2.3}{20 - 80} = \frac{2.4}{-60} = -0.04 \).

REF: 081414ai NAT: F.IF.B.6 TOP: Rate of Change

116 ANS: 3
\( \frac{36.6 - 15}{4 - 0} = \frac{21.6}{4} = 5.4 \)

REF: 061511ai NAT: F.IF.B.6 TOP: Rate of Change

117 ANS:
During 1960-1965 the graph has the steepest slope.

REF: 011628ai NAT: F.IF.B.6 TOP: Rate of Change

118 ANS:
The set of integers includes negative numbers, so is not an appropriate domain for time; for (0,6), the hourly rate is increasing, or for (0,14), the total numbers of shoes is increasing; \( \frac{120 - 0}{6 - 14} = -15 \), 15 fewer shoes were sold each hour between the sixth and fourteenth hours.

REF: 011836ai NAT: F.IF.B.6 TOP: Rate of Change

119 ANS:
\( \frac{480 - 140}{7 - 2} = 68 \text{ mph} \)

REF: 011731ai NAT: F.IF.B.6 TOP: Rate of Change

120 ANS:
\( \frac{3.41 - 6.26}{9 - 3} = -0.475 \)

REF: 081827ai NAT: F.IF.B.6 TOP: Rate of Change

121 ANS:
\( 2 < t < 6 \) and \( 14 < t < 15 \) because horizontal lines have zero slope.

REF: 011928ai NAT: F.IF.B.6 TOP: Rate of Change
122 ANS: 1
\[
\frac{0.8(10^2) - 0.8(5^2)}{10 - 5} = \frac{80 - 20}{5} = 12
\]
REF: 011521ai NAT: F.IF.B.6 TOP: Rate of Change

123 ANS:
There are 20 rabbits at \( x = 0 \) and they are growing 1.4% per day. \[
\frac{p(100) - p(50)}{100 - 50} \approx 0.8
\]
REF: 061833ai NAT: F.IF.B.6 TOP: Rate of Change

124 ANS: 4 REF: 011523ai NAT: F.BF.A.1 TOP: Modeling Linear Functions

125 ANS: 4
\[
P(c) = (.50 + .25)c - 9.96 = .75c - 9.96
\]
REF: 011807ai NAT: F.BF.A.1 TOP: Modeling Linear Functions

126 ANS:
\[
A(n) = 175 - 2.75n \quad 0 = 175 - 2.75n \quad \text{After 63 weeks, Caitlin will not have enough money to rent another movie.}
\]
\[
2.75n = 175
\]
\[
n = 63.6
\]
REF: 061435ai NAT: F.BF.A.1 TOP: Modeling Linear Functions

127 ANS:
\[
f(x) = 6.50x + 4(12)
\]
REF: 061526ai NAT: F.BF.A.1 TOP: Modeling Linear Functions

128 ANS:
\[
T(d) = 2d + 28 \quad T(6) = 2(6) + 28 = 40
\]
REF: 081532ai NAT: F.BF.A.1 TOP: Modeling Linear Functions

129 ANS:
\[
p(x) = 0.035x + 300 \quad p(8250) = 0.035(8250) + 300 = 588.75
\]
REF: 011833ai NAT: F.BF.A.1 TOP: Modeling Linear Functions

130 ANS:
\[
h(n) = 1.5(n - 1) + 3
\]
REF: 081525ai NAT: F.LE.A.2 TOP: Modeling Linear Functions

131 ANS:
\[
f(x) = 0.75x + 4.50. \quad \text{Each card costs 75¢ and start-up costs were $4.50.}
\]
REF: 011735ai NAT: F.LE.A.2 TOP: Modeling Linear Functions

132 ANS: 4 REF: 081604ai NAT: F.LE.A.2 TOP: Modeling Linear Functions

133 ANS: 3 REF: 061501ai NAT: F.LE.B.5 TOP: Modeling Linear Functions

134 ANS: 3 REF: 061407ai NAT: F.LE.B.5 TOP: Modeling Linear Functions

135 ANS: 2 REF: 081402ai NAT: F.LE.B.5 TOP: Modeling Linear Functions
The slope represents the amount paid each month and the $y$-intercept represents the initial cost of membership.

There is 2 inches of snow every 4 hours.

$C(x) = \frac{10}{3} x$

$180 = \frac{10}{3} x$

$540 = 10x$

$54 = x$

There are 11 combinations, as each dot represents a possible combination.
149 ANS: 4
\[ y + 3 = 6(0) \]
\[ y = -3 \]

REF: 011509ai  NAT: F.IF.B.4  TOP: Graphing Linear Functions

150 ANS: 1
\[ 4x - 5(0) = 40 \]
\[ 4x = 40 \]
\[ x = 10 \]

REF: 081408ai  NAT: F.IF.B.4  TOP: Graphing Linear Functions

151 ANS: The data is continuous, i.e. a fraction of a cookie may be eaten.

REF: 081729ai  NAT: F.IF.B.4  TOP: Graphing Linear Functions

152 ANS: 4
\[ m = \frac{11 - 1}{3 - (-2)} = \frac{10}{5} = 2 \quad \rightarrow \quad y = mx + b \quad y = 2x + 5 \]
\[ 11 = 2(3) + b \quad 9 = 2(2) + 5 \]
\[ 5 = b \]

REF: 011511ai  NAT: A.REI.D.10  TOP: Writing Linear Equations
KEY: other forms

153 ANS: 3
\[ m = \frac{3 - (-7)}{2 - 4} = -5 \quad 3 = (-5)(2) + b \quad y = -5x + 13 \]
represents the line passing through the points (2,3) and (4,-7). The
fourth equation may be rewritten as \( y = 5x - 13 \), so is a different line.

REF: 081720ai  NAT: A.REI.D.10  TOP: Writing Linear Equations
KEY: other forms

154 ANS:
\[ m = \frac{4 - 1}{-3 - 6} = \frac{3}{-9} = -\frac{1}{3} \quad y - y_1 = m(x - x_1) \]
\[ 4 = -\frac{1}{3}(-3) + b \quad y - 4 = -\frac{1}{3}(x + 3) \]
\[ 4 = 1 + b \]
\[ 3 = b \]
\[ y = -\frac{1}{3}x + 3 \]

REF: 061629ai  NAT: A.REI.D.10  TOP: Writing Linear Equations
KEY: other forms
155 ANS: 1
\[
7 - \frac{2}{3} x < x - 8
\]
\[
15 < \frac{5}{3} x
\]
\[
9 < x
\]
REF: 011507ai NAT: A.REI.B.3 TOP: Solving Linear Inequalities

156 ANS: 4
\[
3x + 2 \leq 5x - 20
\]
\[
22 \leq 2x
\]
\[
11 \leq x
\]
REF: 061609ai NAT: A.REI.B.3 TOP: Solving Linear Inequalities

157 ANS: 1
\[
2h + 8 > 3h - 6
\]
\[
14 > h
\]
\[
h < 14
\]
REF: 081607ai NAT: A.REI.B.3 TOP: Solving Linear Inequalities

158 ANS: 1
\[
2 + \frac{4}{9} x \geq 4 + x
\]
\[
-2 \geq \frac{5}{9} x
\]
\[
x \leq \frac{18}{5}
\]
REF: 081711ai NAT: A.REI.B.3 TOP: Solving Linear Inequalities

159 ANS: 4
\[
4p + 2 < 2p + 10
\]
\[
2p < 8
\]
\[
p < 4
\]
REF: 061801ai NAT: A.REI.B.3 TOP: Solving Linear Inequalities
160 ANS:
\[ b(x - 3) \geq ax + 7b \]
\[ bx - 3b \geq ax + 7b \]
\[ bx - ax \geq 10b \]
\[ x(b - a) \geq 10b \]
\[ x \leq \frac{10b}{b-a} \]

REF: 011631ai  NAT: A.REI.B.3  TOP: Solving Linear Inequalities

161 ANS:
\[ 1.8 - 0.4y \geq 2.2 - 2y \]
\[ 1.6y \geq 0.4 \]
\[ y \geq 0.25 \]

REF: 011727ai  NAT: A.REI.B.3  TOP: Solving Linear Inequalities

162 ANS:
\[ 3600 + 1.02x < 2000 + 1.04x \]
\[ 1600 < 0.02x \]
\[ 80000 < x \]

REF: 011925ai  NAT: A.REI.B.3  TOP: Solving Linear Inequalities

163 ANS: 4
\[ 47 - 4x < 7 \]
\[ -4x < -40 \]
\[ x > 10 \]

REF: 061713ai  NAT: A.REI.B.3  TOP: Interpreting Solutions

164 ANS: 2
\[ -2(x - 5) < 10 \]
\[ x - 5 > -5 \]
\[ x > 0 \]

REF: 011817ai  NAT: A.REI.B.3  TOP: Interpreting Solutions

165 ANS:
\[ 2(-1) + a(-1) - 7 > -12 \quad a = 2 \]
\[ -a - 9 > -12 \]
\[ -a > -3 \]
\[ a < 3 \]

REF: 061427ai  NAT: A.REI.B.3  TOP: Interpreting Solutions
166 ANS:
6. $3x + 9 \leq 5x - 3$
   
   $12 \leq 2x$
   
   $6 \leq x$

   REF: 081430ai   NAT: A.REI.B.3   TOP: Interpreting Solutions

167 ANS:
$-3x + 7 - 5x < 15$ 0 is the smallest integer.

   $-8x < 8$
   
   $x > -1$

   REF: 061530ai   NAT: A.REI.B.3   TOP: Interpreting Solutions

168 ANS:
$7x - 3(4x - 8) \leq 6x + 12 - 9x$ 6, 7, 8 are the numbers greater than or equal to 6 in the interval.

   $7x - 12x + 24 \leq -3x + 12$
   
   $-5x + 24 \leq -3x + 12$
   
   $12 \leq 2x$
   
   $6 \leq x$

   REF: 081534ai   NAT: A.REI.B.3   TOP: Interpreting Solutions

169 ANS: 2

   $7 < \frac{7.2 + 7.6 + p_L}{3}$ and $\frac{7.2 + 7.6 + p_H}{3} < 7.8$
   
   $6.2 < p_L$  
   
   $p_H < 8.6$

   REF: 061607ai   NAT: A.CED.A.1   TOP: Modeling Linear Inequalities

170 ANS: 3

   REF: 011513ai   NAT: A.CED.A.1   TOP: Modeling Linear Inequalities

171 ANS: 4

   $\frac{750 + 2.25p}{p} > 2.75$  
   
   $\frac{750 + 2.25p}{p} < 3.25$
   
   $750 + 2.25p > 2.75p$  
   
   $750 + 2.25p < 3.25p$
   
   $750 > 50p$  
   
   $750 < p$
   
   $1500 > p$

   REF: 061524ai   NAT: A.CED.A.1   TOP: Modeling Linear Inequalities

172 ANS: 4

   REF: 081505ai   NAT: A.CED.A.1   TOP: Modeling Linear Inequalities

173 ANS: 1

   REF: 061806ai   NAT: A.CED.A.1   TOP: Modeling Linear Inequalities
174 ANS: 1
\[116(30) + 439L \leq 6500\]
\[439L \leq 3020\]
\[L \leq 6.879\]

REF: 011904ai NAT: A.CED.A.1 TOP: Modeling Linear Inequalities

175 ANS:
\[8x + 11y \geq 200\]
\[8x + 11(15) \geq 200\]
\[8x + 165 \geq 200\]
\[8x \geq 35\]
\[x \geq 4.375\]
5 hours

REF: fall1309ai NAT: A.CED.A.1 TOP: Modeling Linear Inequalities

176 ANS:
\[135 + 72x \geq 580\]
\[72x \geq 445\]
\[x \geq 6.2\]

REF: 081833ai NAT: A.CED.A.1 TOP: Modeling Linear Inequalities

177 ANS: 1 REF: 061505ai NAT: A.REI.D.12 TOP: Graphing Linear Inequalities
178 ANS: 2 REF: 011605ai NAT: A.REI.D.12 TOP: Graphing Linear Inequalities
179 ANS:

REF: 081526ai NAT: A.REI.D.12 TOP: Graphing Linear Inequalities
180 ANS:

REF: 011729ai NAT: A.REI.D.12 TOP: Graphing Linear Inequalities
181 ANS:

\[ y < -2x + 4 \]

REF: 061730ai  NAT: A.REI.D.12  TOP: Graphing Linear Inequalities

182 ANS:

\[ 7.5x + 12.5y \leq 100 \]

13, because \( 7.5(13) \leq 100 \) and \( 7.5(14) > 100 \).

REF: 081634ai  NAT: A.REI.D.12  TOP: Graphing Linear Inequalities

183 ANS:

Range: \( y \geq 0 \). The function is increasing for \( x > -1 \).

REF: fall1310ai  NAT: F.IF.C.7  TOP: Graphing Absolute Value Functions
186 ANS:

![Graph](image1)

REF: 011825ai  NAT: F.IF.C.7  TOP: Graphing Absolute Value Functions

187 ANS:

![Graph](image2)

2 down. 4 right.

REF: 081433ai  NAT: F.BF.B.3  TOP: Graphing Absolute Value Functions

188 ANS:

![Graph](image3)

The graph has shifted three units to the right.

REF: 061525ai  NAT: F.BF.B.3  TOP: Graphing Absolute Value Functions

189 ANS:

g(x) is \( f(x) \) shifted right by \( a \), \( h(x) \) is \( f(x) \) shifted down by \( a \).

REF: 061732ai  NAT: F.BF.B.3  TOP: Graphing Absolute Value Functions

190 ANS: 3  REF: 081403ai  NAT: A.REI.B.4  TOP: Solving Quadratics

KEY: taking square roots
Algebra I Regents Exam Questions by State Standard: Topic
Answer Section

191  ANS: 1  REF: 061521ai  NAT: A.REI.B.4  TOP: Solving Quadratics
    KEY: taking square roots

192  ANS: 3  REF: 081523ai  NAT: A.REI.B.4  TOP: Solving Quadratics
    KEY: taking square roots

193  ANS: 3
    $2(x + 2)^2 = 32$
    $(x + 2)^2 = 16$
    $x + 2 = \pm 4$
    $x = -6, 2$

194  ANS: 4
    $36x^2 = 25$
    $x^2 = \frac{25}{36}$
    $x = \pm \frac{5}{6}$

195  ANS: 1
    $3(x - 4)^2 = 27$
    $(x - 4)^2 = 9$
    $x - 4 = \pm 3$
    $x = 1, 7$

196  ANS:
    $H(1) - H(2) = -16(1)^2 + 144 - (-16(2)^2 + 144) = 128 - 80 = 48$
    $-16r^2 = -144$
    $r^2 = 9$
    $r = 3$
197 ANS:

\[4x^2 = 80\]
\[x^2 = 20\]
\[x = \pm \sqrt{20}\]

REF: 011932ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: taking square roots

198 ANS: 4

REF: 011503ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: factoring

199 ANS: 1

\[3x^2 + 10x - 8 = 0\]
\[(3x - 2)(x + 4) = 0\]
\[x = \frac{2}{3}, -4\]

REF: 081619ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: factoring

200 ANS: 3

REF: 011702ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: factoring

201 ANS:

\[8m^2 + 20m - 12 = 0\]
\[4(2m^2 + 5m - 3) = 0\]
\[(2m - 1)(m + 3) = 0\]
\[m = \frac{1}{2}, -3\]

REF: fall1305ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: factoring

202 ANS:

\[m(x) = (3x - 1)(3 - x) + 4x^2 + 19\]
\[x^2 + 10x + 16 = 0\]
\[m(x) = 9x - 3x^2 - 3 + x + 4x^2 + 19\]
\[(x + 8)(x + 2) = 0\]
\[m(x) = x^2 + 10x + 16\]
\[x = -8, -2\]

REF: 061433ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: factoring

203 ANS:

\[x^2 + 10x + 24 = (x + 4)(x + 6) = (x + 6)(x + 4). 6 and 4\]

REF: 081425ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: factoring
204 ANS:

\[ 4x^2 - 12x - 7 = 0 \]
\[(4x^2 - 14x) + (2x - 7) = 0 \]
\[2x(2x - 7) + (2x - 7) = 0 \]
\[(2x + 1)(2x - 7) = 0 \]
\[ x = \frac{-1}{2} \cdot \frac{7}{2} \]

REF: 011529ai  NAT: A.REI.B.4  TOP: Solving Quadratics
KEY: factoring

205 ANS:

\[ y^2 - 6y + 9 = 4y - 12 \]
\[ y^2 - 10y + 21 = 0 \]
\[(y - 7)(y - 3) = 0 \]
\[ y = 7, 3 \]

REF: 011627ai  NAT: A.REI.B.4  TOP: Solving Quadratics
KEY: factoring

206 ANS:

\[ 2x^2 + 5x - 42 = 0 \]  Agree, as shown by solving the equation by factoring.
\[(x + 6)(2x - 7) = 0 \]
\[ x = -6, \frac{7}{2} \]

REF: 061628ai  NAT: A.REI.B.4  TOP: Solving Quadratics
KEY: factoring

207 ANS:

\[ 0 = (B + 3)(B - 1) \]  Janice substituted \( B \) for \( 8x \), resulting in a simpler quadratic. Once factored, Janice substituted \( 0 = (8x + 3)(8x - 1) \)
\[ x = \frac{3}{8}, \frac{1}{8} \]
\[ 8x \] for \( B \).

REF: 081636ai  NAT: A.REI.B.4  TOP: Solving Quadratics
KEY: factoring
208 ANS:
\[x^2 - 8x - 9 = 0\] I factored the quadratic.
\[(x - 9)(x + 1) = 0\]
\[x = 9, -1\]

REF: 011927ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: factoring

209 ANS: 2
\[x^2 - 6x = 12\]
\[x^2 - 6x + 9 = 12 + 9\]
\[(x - 3)^2 = 21\]

REF: 061408ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: completing the square

210 ANS: 4
\[x^2 + 6x = 7\]
\[x^2 + 6x + 9 = 7 + 9\]
\[(x + 3)^2 = 16\]

REF: 011517ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: completing the square

211 ANS: 2
\[x^2 - 8x = 7\]
\[x^2 - 8x + 16 = 7 + 16\]
\[(x - 4)^2 = 23\]

REF: 011614ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: completing the square

212 ANS: 1
\[2(x^2 - 6x + 3) = 0\]
\[x^2 - 6x = -3\]
\[x^2 - 6x + 9 = -3 + 9\]
\[(x - 3)^2 = 6\]

REF: 011722ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: completing the square
213 ANS: 1
\[ x^2 + 8x = 33 \]
\[ x^2 + 8x + 16 = 33 + 16 \]
\[ (x + 4)^2 = 49 \]
REF: 011915ai  NAT: A.REI.B.4  TOP: Solving Quadratics
KEY: completing the square

214 ANS: 2
\[ x^2 + 4x = 16 \]
\[ x^2 + 4x + 4 = 16 + 4 \]
\[ (x + 2)^2 = 20 \]
\[ x + 2 = \pm \sqrt{4 \cdot 5} \]
\[ x = -2 \pm 2\sqrt{5} \]
REF: 061410ai  NAT: A.REI.B.4  TOP: Solving Quadratics
KEY: completing the square

215 ANS: 4
\[ x^2 - 5x = -3 \]
\[ x^2 - 5x + \frac{25}{4} = -\frac{12}{4} + \frac{25}{4} \]
\[ \left(x - \frac{5}{2}\right)^2 = \frac{13}{4} \]
REF: 061518ai  NAT: A.REI.B.4  TOP: Solving Quadratics
KEY: completing the square

216 ANS: 1
\[ x^2 - 8x + 16 = 24 + 16 \]
\[ (x - 4)^2 = 40 \]
\[ x - 4 = \pm \sqrt{40} \]
\[ x = 4 \pm 2\sqrt{10} \]
REF: 061523ai  NAT: A.REI.B.4  TOP: Solving Quadratics
KEY: completing the square
217 ANS: 2
\[x^2 - 8x + 16 = 10 + 16\]
\[(x - 4)^2 = 26\]
\[x - 4 = \pm \sqrt{26}\]
\[x = 4 \pm \sqrt{26}\]

REF: 061722ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: completing the square

218 ANS: 3
\[x^2 - 6x = 12\]
\[x^2 - 6x + 9 = 12 + 9\]
\[(x - 3)^2 = 21\]

REF: 061812ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: completing the square

219 ANS:
\[\text{Since } (x + p)^2 = x^2 + 2px + p^2, \text{ } p \text{ is half the coefficient of } x, \text{ and the constant term is equal to } p^2. \left( \frac{6}{2} \right)^2 = 9\]

REF: 081432ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: completing the square

220 ANS:
\[x^2 - 6x + 9 = 15 + 9\]
\[(x - 3)^2 = 24\]
\[x - 3 = \pm \sqrt{24}\]
\[x = 3 \pm 2\sqrt{6}\]

REF: 081732ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: completing the square

221 ANS:
\[x^2 + 4x + 4 = 2 + 4\]
\[(x + 2)^2 = 6\]
\[x + 2 = \pm \sqrt{6}\]
\[x = -2 \pm \sqrt{6}\]

REF: 081830ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: completing the square
222 ANS: 1
\[ x^2 - 6x = 19 \]
\[ x^2 - 6x + 9 = 19 + 9 \]
\[ (x - 3)^2 = 28 \]
\[ x - 3 = \pm \sqrt{4 \cdot 7} \]
\[ x = 3 \pm 2\sqrt{7} \]

REF: fall1302ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: quadratic formula

223 ANS:
Two of the following: quadratic formula, complete the square, factor by grouping or graphically.
\[ x = \frac{-16 \pm \sqrt{16^2 - 4(4)(9)}}{2(4)} = \frac{-16 \pm \sqrt{112}}{8} \approx -0.7, -3.3 \]

REF: 011634ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: quadratic formula

224 ANS:
\[ \frac{-1 \pm \sqrt{1^2 - 4(1)(-5)}}{2(1)} = \frac{-1 \pm \sqrt{21}}{2} \approx -2.8, 1.8 \]

REF: 061827ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: quadratic formula

225 ANS: 3
\[ b^2 - 4ac = 2^2 - 4(4)(5) = -76 \]

REF: 061822ai NAT: A.REI.B.4 TOP: Using the Discriminant

226 ANS:
\[ b^2 - 4ac = (-2)^2 - 4(1)(5) = 4 - 20 = -16 \text{ None} \]

REF: 081529ai NAT: A.REI.B.4 TOP: Using the Discriminant

227 ANS:
Irrational, as 89 is not a perfect square. \[ 3^2 - 4(2)(-10) = 89 \]

REF: 081828ai NAT: A.REI.B.4 TOP: Using the Discriminant

228 ANS: 3
REF: 081409ai NAT: A.CED.A.1 TOP: Modeling Quadratics

229 ANS: 4
REF: 081723ai NAT: A.CED.A.1 TOP: Modeling Quadratics

230 ANS: 4
REF: spr1304ai NAT: A.CED.A.1 TOP: Geometric Applications of Quadratics

231 ANS: 2
REF: 011611ai NAT: A.CED.A.1 TOP: Geometric Applications of Quadratics
232 ANS:
\[ w(w + 40) = 6000 \]
\[ w^2 + 40w - 6000 = 0 \]
\[ (w + 100)(w - 60) = 0 \]
\[ w = 60, l = 100 \]

REF: 081436ai NAT: A.CED.A.1 TOP: Geometric Applications of Quadratics

233 ANS:
\[ (2w)(w) = 34 \]
\[ w^2 = 17 \]
\[ w \approx 4.1 \]

REF: 061532ai NAT: A.CED.A.1 TOP: Geometric Applications of Quadratics

234 ANS:
\[ 108 = x(24 - x) \quad 18 \times 6 \]
\[ 108 = 24x - x^2 \]
\[ x^2 - 24x + 108 = 0 \]
\[ (x - 18)(x - 6) = 0 \]
\[ x = 18, 6 \]

REF: 011636ai NAT: A.CED.A.1 TOP: Geometric Applications of Quadratics

235 ANS:
\[ (2x + 16)(2x + 12) = 396. \text{ The length, } 2x + 16, \text{ and the width, } 2x + 12, \text{ are multiplied and set equal to the area.} \]
\[ (2x + 16)(2x + 12) = 396 \]
\[ 4x^2 + 24x + 32x + 192 = 396 \]
\[ 4x^2 + 56x - 204 = 0 \]
\[ x^2 + 14x - 51 = 0 \]
\[ (x + 17)(x - 3) = 0 \]
\[ x = 3 = \text{ width} \]

REF: 061434ai NAT: A.CED.A.1 TOP: Geometric Applications of Quadratics
236 ANS: 
\[(x - 3)(2x) = 1.25x^2\] Because the original garden is a square, \(x^2\) represents the original area, \(x - 3\) represents the side decreased by 3 meters, \(2x\) represents the doubled side, and \(1.25x^2\) represents the new garden with an area 25% larger. 
\[(x - 3)(2x) = 1.25x^2\] \(1.25(8)^2 = 80\) 
\[2x^2 - 6x = 1.25x^2\] 
\[.75x^2 - 6x = 0\] 
\[x^2 - 8x = 0\] 
\[x(x - 8) = 0\] 
\[x = 8\] 

REF: 011537ai NAT: A.CED.A.1 TOP: Geometric Applications of Quadratics

237 ANS: 
\[(2x + 8)(2x + 6) = 100\] The frame has two parts added to each side, so \(2x\) must be added to the length and width. 

\[4x^2 + 28x + 48 = 100\] 
\[x^2 + 7x - 13 = 0\] 

Multiply length and width to find area and set equal to 100. 
\[x = \frac{-7 \pm \sqrt{7^2 - 4(1)(-13)}}{2(1)} = \frac{-7 \pm \sqrt{101}}{2} \approx 1.5\] 

REF: 081537ai NAT: A.CED.A.1 TOP: Geometric Applications of Quadratics

238 ANS: 4 
\[y - 34 = x^2 - 12x\] 
\[y = x^2 - 12x + 34\] 
\[y = x^2 - 12x + 36 - 2\] 
\[y = (x - 6)^2 - 2\] 

REF: 011607ai NAT: F.IF.C.8 TOP: Vertex Form of a Quadratic

239 ANS: 1 
\[x^2 - 12x + 7\] 
\[x^2 - 12x + 36 - 29\] 
\[(x - 6)^2 - 29\] 

REF: 081520ai NAT: F.IF.C.8 TOP: Vertex Form of a Quadratic

240 ANS: 2 REF: 011601ai NAT: F.IF.C.8 TOP: Vertex Form of a Quadratic
ANS: 3
\[ 3(x^2 + 4x + 4) - 12 + 11 = 3(x + 2)^2 - 1 \]

REF: 081621ai  NAT: F.IF.C.8  TOP: Vertex Form of a Quadratic

ANS: 3
\[ j(x) = x^2 - 12x + 36 + 7 - 36 = (x - 6)^2 - 29 \]

REF: 061616ai  NAT: F.IF.C.8  TOP: Vertex Form of a Quadratic

ANS:
The vertex represents a maximum since \( a < 0 \).
\[ f(x) = -x^2 + 8x + 9 = -(x^2 - 8x - 9) = -(x^2 - 8x + 16) + 9 + 16 = -(x - 4)^2 + 25 \]

REF: 011536ai  NAT: F.IF.C.8  TOP: Vertex Form of a Quadratic

ANS: 3
The rocket was in the air more than 7 seconds before hitting the ground.

REF: 081613ai  NAT: F.IF.B.4  TOP: Graphing Quadratic Functions

KEY: context

ANS: 3
KEY: context

ANS: 4

Vertex \((15,25)\), point \((10,12.5)\)
\[ 12.5 = a(10 - 15)^2 + 25 \]
\[ -12.5 = 25a \]
\[ \frac{-1}{2} = a \]

REF: 061716ai  NAT: F.IF.B.4  TOP: Graphing Quadratic Functions

KEY: no context

ANS: 1
\[ 0 = -16t^2 + 24t \]
\[ 0 = -8t(2t - 3) \]
\[ t = 0, \frac{3}{2} \]

REF: 061724ai  NAT: F.IF.B.4  TOP: Graphing Quadratic Functions

KEY: context
ANS: 2
\[-4.9(0)^2 + 50(0) + 2\]

REF: 011811ai  NAT: F.I.F.B.4  TOP: Graphing Quadratic Functions
KEY: context

ANS: 1
\[h(0) = -4.9(0)^2 + 6(0) + 5 = 5\]

REF: 011913ai  NAT: F.I.F.B.4  TOP: Graphing Quadratic Functions
KEY: context

ANS:
\[
x = \frac{-\frac{2}{3}}{2 \left( \frac{-1}{225} \right)} = \frac{2}{3} \cdot \frac{225}{2} = 75 \quad y = \frac{1}{225} (75)^2 + \frac{2}{3} (75) = -25 + 50 = 25
\]

(75,25) represents the horizontal distance (75) where the football is at its greatest height (25). No, because the ball is less than 10 feet high \[y = \frac{1}{225} (135)^2 + \frac{2}{3} (135) = -81 + 90 = 9\]

REF: 061537ai  NAT: F.I.F.B.4  TOP: Graphing Quadratic Functions
KEY: context

ANS:
\[
x = \frac{-b}{2a} = \frac{-(-4)}{2(1)} = \frac{4}{2} = 2
\]

REF: 061627ai  NAT: F.I.F.B.4  TOP: Graphing Quadratic Functions
KEY: no context
252 ANS:

The ball reaches a maximum height of 55 units at 2.5 seconds.

REF: 011736ai NAT: F.IF.B.4 TOP: Graphing Quadratic Functions
KEY: context

253 ANS:

REF: 061726ai NAT: F.IF.B.4 TOP: Graphing Quadratic Functions
KEY: no context

254 ANS:

If the garden’s width is 9 ft, its area is 162 ft².

REF: 081836ai NAT: F.IF.B.4 TOP: Graphing Quadratic Functions
KEY: context

255 ANS:

\[-16t^2 + 64t = 0 \quad 0 \leq t \leq 4\]

The rocket launches at \( t = 0 \) and lands at \( t = 4 \)

\[-16(t - 4) = 0\]

\[t = 0, 4\]

REF: 081531ai NAT: F.IF.B.4 TOP: Graphing Quadratic Functions
KEY: context
The height decreases after reaching its maximum at \( t = 2 \) until it lands at \( t = 5 \).

\[
t = \frac{-b}{2a} = \frac{-64}{2(-16)} = \frac{-64}{-32} = 2 \text{ seconds.}
\]

The pilot’s height above the ground after ejection is 9,256.

The \( y \) coordinate represents the pilot’s height above the ground after ejection. 9256 \( - 9000 = 256 \).

Yes, because from the graph the zeroes of \( f(x) \) are \(-2\) and 3.
264 ANS: 4  
36x + 30y = 96  

REF: 081724ai  NAT: A.REI.C.5  TOP: Solving Linear Systems

265 ANS: 2  

REF: 011815ai  NAT: A.REI.C.5  TOP: Solving Linear Systems

266 ANS: 3  
2(x − y = 3)  
2x − 2y = 6  

REF: 081822ai  NAT: A.REI.C.5  TOP: Solving Linear Systems

267 ANS:  
24x + 27y = 144  
−8.5y = −51  Agree, as both systems have the same solution.  
24x + 10y = 42  
y = 6  
17y = 102  8x + 9(6) = 48  
y = 6  8x = −6  
8x + 9(6) = 48  
x = −\frac{3}{4}  
8x = −6  
x = −\frac{3}{4}  

REF: 061533ai  NAT: A.REI.C.5  TOP: Solving Linear Systems

268 ANS: 4

\[ m = \frac{5 - 4.6}{4 - 2} = \frac{4}{2} = 2 \]  
4(0.2x + 4.2) + 2x = 33.6  
y = 0.2(6) + 4.2 = 5.4  
5 = 0.2(4) + b  
0.8x + 16.8 + 2x = 33.6  
4.2 = b  
2.8x = 16.8  
y = 0.2x + 4.2  
x = 6  

REF: 061618ai  NAT: A.REI.C.6  TOP: Solving Linear Systems

KEY: substitution

269 ANS: 3  
y = −3x−4  
2x − 3(−3x − 4) = −21  

REF: 011922ai  NAT: A.REI.C.6  TOP: Solving Linear Systems

KEY: substitution
270 ANS: 1
3(−2x + 2x + 8) = 12
24 ≠ 12

REF: 061708ai NAT: A.REI.C.6 TOP: Solving Linear Systems
KEY: substitution

271 ANS:
185 + 0.03x = 275 + 0.025x
0.005x = 90
x = 18000

REF: 081427ai NAT: A.REI.C.6 TOP: Solving Linear Systems
KEY: substitution

272 ANS:
No. There are infinite solutions.

REF: 011725ai NAT: A.REI.C.6 TOP: Solving Linear Systems
KEY: substitution

273 ANS: 4
REF: 081419ai NAT: A.CED.A.3 TOP: Modeling Linear Systems

274 ANS: 3
a + p = 165 1.75(165 − p) + 2.5p = 337.5
1.75a + 2.5p = 337.5 288.75 − 1.75p + 2.5p = 337.5
0.75p = 48.75
p = 65

REF: 061506ai NAT: A.CED.A.3 TOP: Modeling Linear Systems

275 ANS: 2
L + S = 20 27.98L + 10.98(20 − L) = 355.60
27.98L + 10.98S = 355.60 27.98L + 219.60 − 10.98L = 355.60
17L = 136
L = 8

REF: 081510ai NAT: A.CED.A.3 TOP: Modeling Linear Systems

276 ANS: 1
REF: 061605ai NAT: A.CED.A.3 TOP: Modeling Linear Systems

277 ANS: 1
REF: 011803ai NAT: A.CED.A.3 TOP: Modeling Linear Systems

278 ANS: 2
REF: 081809ai NAT: A.CED.A.3 TOP: Modeling Linear Systems
Plan $A$: $C = 2G + 25$, Plan $B$: $C = 2.5G + 15$. $50 = 2.5G + 15$ $50 = 2G + 25$ With Plan $B$, Dylan can rent 14 games, but with Plan $A$, Dylan can rent only 12. $65 = 2(20) + 25 = 2.5(20) + 15$ Bobby can choose either plan, as he could rent 20 games for $65 with both plans.

$2.35c + 5.50d = 89.50$ Pat’s numbers are not possible: $2.35(8) + 5.50(14) \neq 89.50$ $18.80 + 77.00 \neq 89.50$ $2.35c + 5.50(22 - c) = 89.50$ $95.80 \neq 89.50$ $2.35c + 121 - 5.50c = 89.50$ $-3.15c = -31.50$ $c = 10$

$2p + 3d = 18.25$ $4p + 6d = 36.50$ $4p + 2(2.25) = 27.50$ $4p + 2d = 27.50$ $4p = 23$ $4d = 9$ $p = 5.75$ $d = 2.25$

$18j + 32w = 19.92$ $14(.52) + 26(.33) = 15.86 \neq 15.76$ $7(18j + 32w = 19.92)$ $18j + 32(.24) = 19.92$ $14j + 26w = 15.76$ $9(14j + 26w = 15.76)$ $18j + 7.68 = 19.92$ $126j + 224w = 139.44$ $18j = 12.24$ $126j + 234w = 141.84$ $j = .68$ $10w = 2.4$ $w = .24$

$16$
284 ANS:
\[ d = 2c - 5; \quad 20 \neq 2(15) - 5 \quad \text{20 dogs is not five less than twice 15 cats;} \]
\[ \frac{c + 3}{d + 3} = \frac{3}{4} \quad 20 \neq 25 \quad 4c + 12 = 6c - 6 \]
\[ 18 = 2c \]
\[ c = 9 \]

REF: 011837ai NAT: A.CED.A.3 TOP: Modeling Linear Systems

285 ANS:
\[ A(x) = 7 + 3(x - 2) \quad 7 + 3(x - 2) = 6.50 + 3.25(x - 2) \]
\[ B(x) = 3.25x \quad 7 + 3x - 6 = 3.25x \]
\[ 1 = 0.25x \]
\[ 4 = x \]

REF: 061834ai NAT: A.CED.A.3 TOP: Modeling Linear Systems

286 ANS:
\[ 10d + 25q = 1755, \quad 10(90 - q) + 25q = 1755, \quad \text{no, because} \quad 20.98 \cdot 1.08 > 90 \cdot 0.25 \]
\[ d + q = 90 \quad 900 - 10q + 25q = 1755 \]
\[ 15q = 855 \]
\[ q = 57 \]

REF: 061837ai NAT: A.CED.A.3 TOP: Modeling Linear Systems

287 ANS:
\[ b = 4s + 6 \quad 4s + 6 - 3 = 7s - 21 \quad b = 4(8) + 6 = 38 \quad 38 + x = 3(8 + x) \]
\[ b - 3 = 7(s - 3) \quad 3s = 24 \quad x + 38 = 24 + 3x \]
\[ s = 8 \quad 2x = 14 \]
\[ x = 7 \]

REF: 081837ai NAT: A.CED.A.3 TOP: Modeling Linear Systems

288 ANS: 3
\[ 15 > 5 \]

REF: 081502ai NAT: A.REI.C.6 TOP: Graphing Linear Systems

289 ANS:
\[ a) \quad A(x) = 1.50x + 6 \quad b) \quad 1.50x + 6 = 2x + 2.50 \quad c) \quad A(x) = 1.50(5) + 6 = 13.50 \quad \text{Carnival B has a lower cost.} \]
\[ B(x) = 2x + 2.50 \]
\[ .50x = 3.50 \]
\[ B(x) = 2(5) + 2.50 = 12.50 \]
\[ x = 7 \]

REF: spr1308ai NAT: A.REI.C.6 TOP: Graphing Linear Systems
**ANS:**

\[ y = 120x \text{ and } y = 70x + 1600 \]

\[ 120x = 70x + 1600 \]

\[ 50x = 1600 \]

\[ x = 32 \]

\[ y = 120(35) = 4200 \quad \text{Green Thumb is less expensive.} \]

\[ y = 70(35) + 1600 = 4050 \]

**REF:** fall1315ai  
**NAT:** A.REI.C.6  
**TOP:** Graphing Linear Systems

**ANS:**

\[ 3x + 2y = 19 \]

\[ 6x + 4y = 38 \]

\[ 2(3.50) + 4y = 24 \]

\[ 2x + 4y = 24 \]

\[ 7 + 4y = 24 \]

\[ 4x = 14 \]

\[ 4y = 17 \]

\[ x = 3.50 \]

\[ y = 4.25 \]

**REF:** 061637ai  
**NAT:** A.REI.C.6  
**TOP:** Graphing Linear Systems
In 2016, the swim team and chorus will each have 65 members.

\begin{align*}
y &= 10x + 5 \\
y &= 5x + 35
\end{align*}

No, because according to the graph, 8 tricycles were ordered.

\begin{align*}
t + b &= 15 \\
3t + 2b &= 38
\end{align*}

One hour at school and eleven hours at the library.

\begin{align*}
x + y &\leq 15 \\
4x + 8y &\geq 80
\end{align*}
A combination of 2 printers and 10 computers meets all the constraints because (2, 10) is in the solution set of the graph.

REF: 061535ai NAT: A.CED.A.3 TOP: Modeling Systems of Linear Inequalities

ANS:

\[ x + y \leq 200 \]
\[ 12x + 8.50y \geq 1000 \]
\[ 12x + 8.50y \geq 1000 \]
\[ 12x \geq 575 \]
\[ x \geq \frac{575}{12} \]
\[ 48 \]

REF: 081635ai NAT: A.CED.A.3 TOP: Modeling Systems of Linear Inequalities

ANS:

\[ 2L + 1.5W \geq 500 \]
\[ 2(144) + 1.5W = 500 \]
\[ 142 \text{ bottles of water must be sold to cover the cost of renting costumes.} \]
\[ L + W \leq 360 \]
\[ 1.5W = 212 \]
\[ W = 141.3 \]

REF: 011835ai NAT: A.CED.A.3 TOP: Modeling Systems of Linear Inequalities

ANS:

\[ a) \ p + d \leq 800 \]
\[ b) 6(440) + 9d \geq 5000 \]
\[ 6p + 9d \geq 5000 \]
\[ 2640 + 9d \geq 5000 \]
\[ 9d \geq 2360 \]
\[ d \geq 262.2 \]

Since 440 + 263 \leq 800, it is possible.
(4,3) is on the boundary of \( y > \frac{1}{2}x + 5 \), so (4,3) is not a solution of the system.

\[
2(2) < -12(-3) + 4 \quad 4 < -6(-3) + 4 \\
4 < 40 \\ 4 < 22
\]

Marta is incorrect because \( 12.5(30) + 6.25(80) < 1500 \)

\[
12.5x + 6.25y \geq 1500 \\
375 + 500 < 1500 \\
875 < 1500
\]

Oscar is wrong. \((2) + 2(1) < 4\) is not true.
309 ANS:

(6, 2) is not a solution as it falls on the edge of each inequality.

REF: 061634ai NAT: A.REI.D.12 TOP: Graphing Systems of Linear Inequalities KEY: graph

310 ANS:

No, (3, 7) is on the boundary line, and not included in the solution set, because this is a strict inequality.

REF: 081735ai NAT: A.REI.D.12 TOP: Graphing Systems of Linear Inequalities KEY: graph

311 ANS:

No, because the point (0, 4) does not satisfy the inequality \( y < \frac{1}{2} x + 4 \). \( 4 < \frac{1}{2} (0) + 4 \) is not a true statement.

REF: 011828ai NAT: A.REI.D.12 TOP: Graphing Systems of Linear Inequalities KEY: solution set

312 ANS:

REF: 061835ai NAT: A.REI.D.12 TOP: Graphing Systems of Linear Inequalities KEY: graph
(6,1) is on a solid line. (-6,7) is on a dashed line.

REF: 081835ai  NAT: A.REI.D.12  TOP: Graphing Systems of Linear Inequalities
KEY: graph

314 ANS: 3

REF: 011810ai  NAT: A.REI.C.7  TOP: Quadratic-Linear Systems
KEY: algebraically

315 ANS: 2

\[ x^2 - 2x - 8 = \frac{1}{4}x - 1 \]

\[ 4x^2 - 8x - 32 = x - 4 \]

\[ 4x^2 - 9x - 28 = 0 \]

\[ (4x + 7)(x - 4) = 0 \]

\[ x = -\frac{7}{4}, \, 4 \]

REF: 081517ai  NAT: A.REI.D.11  TOP: Quadratic-Linear Systems
The graphs of the production costs intersect at $x = 3$. The company should use Site $A$, because the cost of Site $A$ is lower at $x = 2$.

John and Sarah will have the same amount of money saved at 7 weeks. I set the expressions representing their savings equal to each other and solved for the positive value of $x$ by factoring.
319 ANS:
\[ x^2 = x \]
\[ x^2 - x = 0 \]
\[ x(x - 1) = 0 \]
\[ x = 0, 1 \]

REF: 061731ai NAT: A.REI.D.11 TOP: Quadratic-Linear Systems

320 ANS:
\[ 2x^2 + 3x + 10 = 4x + 32 \]
\[ x = \frac{1 \pm \sqrt{(-1)^2 - 4(2)(-22)}}{2(2)} \approx -3.1, 3.6. \] Quadratic formula, because the answer must be to the nearest tenth.

REF: 061735ai NAT: A.REI.D.11 TOP: Quadratic-Linear Systems

321 ANS: 3
REF: 081819ai NAT: A.REI.D.11 TOP: Other Systems

322 ANS: 3
REF: 011518ai NAT: A.REI.D.11 TOP: Other Systems

323 ANS: 2

324 ANS: 3
\[ y = (-1)^2 - 3(-1) - 2 = 2, \quad y = 4(-1) + 6 = 2 \]

REF: 011918ai NAT: A.REI.D.11 TOP: Other Systems

325 ANS: 1
\[ \frac{1}{2}x + 3 = |x| \quad \frac{1}{2}x - 3 = x \]
\[ \frac{1}{2}x + 3 = x \quad -x - 6 = 2x \]
\[ \frac{1}{2}x + 3 = x \quad -6 = 3x \]
\[ x + 6 = 2x \quad -2 = x \]
\[ 6 = x \]

REF: 011617ai NAT: A.REI.D.11 TOP: Other Systems
326 ANS: 2
\[ |x + 2| = 3x - 2 \]
\[ x + 2 = 3x - 2 \]
\[ 4 = 2x \]
\[ x = 2 \]

REF: 081702ai  NAT: A.REI.D.11  TOP: Other Systems

327 ANS: -3, 1

REF: 081630ai  NAT: A.REI.D.11  TOP: Other Systems

328 ANS:

1, because the graphs only intersect once.

REF: 061636ai  NAT: A.REI.D.11  TOP: Other Systems

329 ANS:

Yes, because the graph of \( f(x) \) intersects the graph of \( g(x) \) at \( x = -2 \).

REF: 011733ai  NAT: A.REI.D.11  TOP: Other Systems

330 ANS: 3

\[ C(t) = 10(1.029)^{24t} = 10(1.029^{24})t \approx 10(1.986)^t \]

REF: 061614ai  NAT: A.SSE.B.3  TOP: Modeling Exponential Functions

331 ANS: 2  REF: 011714ai  NAT: A.SSE.B.3  TOP: Modeling Exponential Functions

332 ANS: 2

\[ V = 15,000(0.81)^t = 15,000((0.9)^3)^t = 15,000(0.9)^{3t} \]

REF: 081716ai  NAT: A.SSE.B.3  TOP: Modeling Exponential Functions

333 ANS: 4  REF: 011821ai  NAT: A.SSE.B.3  TOP: Modeling Exponential Functions

334 ANS: 2  REF: 081801ai  NAT: A.SSE.B.3  TOP: Modeling Exponential Functions
335 ANS: 4
\[ 16^{2t} = n^{4t} \]
\[ (16^2)^t = (n^4)^t \]
\[ ((4^2)^2)^t = ((n^2)^2)^t \]

REF: 011519ai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

336 ANS: 4
\[ 1000(0.5)^{2t} = 1000(0.5^2)^t = 1000(0.25)^t \]

REF: 011923ai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

337 ANS:
\[ f(5) = (8) \cdot 2^5 = 256 \quad f(t) = g(t) \]
\[ g(5) = 2^{5+3} = 256 \quad (8) \cdot 2^t = 2^{t+3} \]
\[ 2^3 \cdot 2^t = 2^{t+3} \]
\[ 2^t + 3 = 2^{t+3} \]

REF: 011632ai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

338 ANS: 3
\[ E(10) = 1(1.11)^{10} \approx 3 \quad S(10) = 30(1.04)^{10} \approx 44 \]
\[ E(53) = 1(1.11)^{53} \approx 252 \quad S(53) = 30(1.04)^{53} \approx 239 \]

REF: 081721ai NAT: A.CED.A.1 TOP: Modeling Exponential Functions

339 ANS:
\[ A = 600(1.016)^2 \approx 619.35 \]

REF: 061529ai NAT: A.CED.A.1 TOP: Modeling Exponential Functions

340 ANS:
\[ V(t) = 25000(0.815)^t \quad V(3) - V(4) \approx 2503.71 \]

REF: 081834ai NAT: A.CED.A.1 TOP: Modeling Exponential Functions

341 ANS:
\[ V = 450(1.025)^t; \quad \text{No, } 450(1.025)^{20} < 2 \cdot 450 \]

REF: 011933ai NAT: A.CED.A.1 TOP: Modeling Exponential Functions

342 ANS: 2 REF: 061617ai NAT: F.BF.A.1 TOP: Modeling Exponential Functions

343 ANS: 1 REF: 011504ai NAT: F.BF.A.1 TOP: Modeling Exponential Functions

344 ANS: 3 REF: 081507ai NAT: F.BF.A.1 TOP: Modeling Exponential Functions

345 ANS: 2 REF: 061712ai NAT: F.BF.A.1 TOP: Modeling Exponential Functions

346 ANS:
\[ B = 3000(1.042)^t \]

REF: 081426ai NAT: F.BF.A.1 TOP: Modeling Exponential Functions
ANS: $y = 0.25(2)^x$. I inputted the four integral values from the graph into my graphing calculator and determined the exponential regression equation.

$y = 0.25(2)^x$. I inputted the four integral values from the graph into my graphing calculator and determined the exponential regression equation.

0.5 represents the rate of decay and 300 represents the initial amount of the compound.

Yes, $f(4) > g(4)$ because $2^4 - 7 > 1.5(4) - 3$. 

$f(-1) = (-1)^2 - 3(-1) + 4 = 8$
363 ANS: 1
\[3(10) + 2 \neq (-2)^2 - 5(-2) + 17\]
\[32 \neq 31\]

REF: 081818ai NAT: A.REI.D.10 TOP: Identifying Solutions

364 ANS: 4
\[-2 \neq (-1)^3 - (-1)\]
\[-2 \neq 0\]

REF: 011806ai NAT: A.REI.D.10 TOP: Identifying Solutions

365 ANS:

No, because (3, 2) is not on the graph.

REF: 061429ai NAT: A.REI.D.10 TOP: Identifying Solutions

366 ANS: 3 Ref: 011813ai NAT: A.APR.A.1 TOP: Operations with Polynomials

KEY: addition

367 ANS: 1
\[2(3x^3 + 2x^2 - 17)\]

REF: 081813ai NAT: A.APR.A.1 TOP: Operations with Polynomials

KEY: addition

368 ANS: 2 Ref: 061403ai NAT: A.APR.A.1 TOP: Operations with Polynomials

KEY: subtraction

369 ANS: 2
\[3(x^2 - 1) - (x^2 - 7x + 10)\]
\[3x^2 - 3 - x^2 + 7x - 10\]
\[2x^2 + 7x - 13\]

REF: 061610ai NAT: A.APR.A.1 TOP: Operations with Polynomials

KEY: subtraction

370 ANS: 4
\[2(3g - 4) - (8g + 3) = 6g - 8 - 8g - 3 = -2g - 11\]

REF: 011707ai NAT: A.APR.A.1 TOP: Operations with Polynomials

KEY: subtraction
371  ANS: 2
\[3(x^2 + 2x - 3) - 4(4x^2 - 7x + 5) = 3x^2 + 6x - 9 - 16x^2 + 28x - 20 = -13x^2 + 34x - 29\]

REF: 061803ai  NAT: A.APR.A.1  TOP: Operations with Polynomials
KEY: subtraction

372  ANS: 3
\[2a^2 - 5 - 2(3 - a) = 2a^2 - 5 - 6 + 2a = 2a^2 + 2a - 11\]

REF: 011911ai  NAT: A.APR.A.1  TOP: Operations with Polynomials
KEY: subtraction

373  ANS:
\[-2x^2 + 6x + 4\]

REF: 011528ai  NAT: A.APR.A.1  TOP: Operations with Polynomials
KEY: subtraction

374  ANS:
\[5x^2 - 10\]

REF: 061725ai  NAT: A.APR.A.1  TOP: Operations with Polynomials
KEY: subtraction

375  ANS: 2

REF: 011510ai  NAT: A.APR.A.1  TOP: Operations with Polynomials
KEY: multiplication

376  ANS: 4
\[3(x^2 - 4x + 4) - 2x + 2 = 3x^2 - 12x + 12 - 2x + 2 = 3x^2 - 14x + 14\]

REF: 081524ai  NAT: A.APR.A.1  TOP: Operations with Polynomials
KEY: multiplication

377  ANS: 3
\[5x^2 - (4x^2 - 12x + 9) = x^2 + 12x - 9\]

REF: 011610ai  NAT: A.APR.A.1  TOP: Operations with Polynomials
KEY: multiplication

378  ANS: 3
\[(2x + 3)(4x^2 - 5x + 6) = 8x^3 - 10x^2 + 12x + 12x^2 - 15x + 18 = 8x^3 + 2x^2 - 3x + 18\]

REF: 081612ai  NAT: A.APR.A.1  TOP: Operations with Polynomials
KEY: multiplication

379  ANS: 3
\[\left(6x^2 + 2x\right)(5x - 6) = 30x^3 - 36x^2 + 10x^2 - 12x = 30x^3 - 26x^2 - 12x\]

REF: 081824ai  NAT: A.APR.A.1  TOP: Operations with Polynomials
KEY: multiplication
380 ANS:
\[(2x^2 + 7x - 10)(x + 5)\]
\[2x^3 + 7x^2 - 10x + 10x^2 + 35x - 50\]
\[2x^3 + 17x^2 + 25x - 50\]

REF: 081428ai  NAT: A.APR.A.1  TOP: Operations with Polynomials
KEY: multiplication

381 ANS:
\[(3x^2 - 2x + 5) - (x^2 + 3x - 2) = 2x^2 - 5x + 7\]
\[\frac{1}{2} x^2 (2x^2 - 5x + 7) = x^4 - \frac{5}{2} x^3 + \frac{7}{2} x^2\]

REF: 061528ai  NAT: A.APR.A.1  TOP: Operations with Polynomials
KEY: multiplication

382 ANS:
\[5x + 4x^2 (2x + 7) - 6x^2 - 9x = -4x + 8x^3 + 28x^2 - 6x^2 = 8x^3 + 22x^2 - 4x\]

REF: 081731ai  NAT: A.APR.A.1  TOP: Operations with Polynomials
KEY: multiplication

383 ANS: 1
REF: 081415ai  NAT: A.SSE.A.2  TOP: Factoring Polynomials
KEY: higher power

384 ANS: 3
REF: 081509ai  NAT: A.SSE.A.2  TOP: Factoring Polynomials
KEY: quadratic

385 ANS: 3
REF: 011612ai  NAT: A.SSE.A.2  TOP: Factoring Polynomials
KEY: higher power
Algebra I Regents Exam Questions by State Standard: Topic
Answer Section

386 ANS: 1 REF: 061810ai NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: quadratic

387 ANS: 3 REF: 081803ai NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: quadratic

388 ANS: 1 REF: 011906ai NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: quadratic

389 ANS: 3 REF: 061601ai NAT: A.SSE.A.2 TOP: Factoring the Difference of Perfect Squares
KEY: higher power

390 ANS: 3 REF: 061706ai NAT: A.SSE.A.2 TOP: Factoring the Difference of Perfect Squares
KEY: higher power

391 ANS: 3 REF: 011809ai NAT: A.SSE.A.2 TOP: Factoring the Difference of Perfect Squares
KEY: higher power

392 ANS: 3 REF: 011522ai NAT: A.SSE.A.2 TOP: Factoring the Difference of Perfect Squares
KEY: higher power

393 ANS: 2 REF: 061503ai NAT: A.SSE.A.2 TOP: Factoring the Difference of Perfect Squares
KEY: multivariable

394 ANS: 2
\[ 36x^2 - 100 = 4(9x^2 - 25) = 4(3x + 5)(3x - 5) \]
REF: 081608ai NAT: A.SSE.A.2 TOP: Factoring the Difference of Perfect Squares
KEY: quadratic

395 ANS: 2
\[ 16x^2 - 36 = 4(2x + 3)(2x - 3) \]
REF: 011701ai NAT: A.SSE.A.2 TOP: Factoring the Difference of Perfect Squares
KEY: quadratic

396 ANS: 3 REF: 081703ai NAT: A.SSE.A.2 TOP: Factoring the Difference of Perfect Squares
KEY: quadratic

397 ANS: 3 REF: 081807ai NAT: A.SSE.A.2 TOP: Factoring the Difference of Perfect Squares
KEY: quadratic

398 ANS:
\[ x^4 + 6x^2 - 7 \]
\[ (x^2 + 7)(x^2 - 1) \]
\[ (x^2 + 7)(x + 1)(x - 1) \]
REF: 061431ai NAT: A.SSE.A.2 TOP: Factoring the Difference of Perfect Squares
KEY: higher power

399 ANS: 3 REF: spr1302ai NAT: A.APR.B.3 TOP: Zeros of Polynomials

400 ANS: 4 REF: 011706ai NAT: A.APR.B.3 TOP: Zeros of Polynomials

401 ANS: 3 REF: 011909ai NAT: A.APR.B.3 TOP: Zeros of Polynomials

402 ANS: 2 REF: 081816ai NAT: A.APR.B.3 TOP: Zeros of Polynomials
(x + 4)(x + 6) = 0

REF: spr1303ai  NAT: A.APR.B.3  TOP: Zeros of Polynomials

403  ANS:  2

x^2 + 10x + 24 = 0

405  ANS:  4

(x + 2)^2 - 25 = 0

REF: 081418ai  NAT: A.APR.B.3  TOP: Zeros of Polynomials

406  ANS:  4

x^2 - 13x - 30 = 0

REF: 061510ai  NAT: A.APR.B.3  TOP: Zeros of Polynomials

407  ANS:  4

3x^2 - 3x - 6 = 0

REF: 081513ai  NAT: A.APR.B.3  TOP: Zeros of Polynomials

408  ANS:  1

2x^2 - 4x - 6 = 0

REF: 011609ai  NAT: A.APR.B.3  TOP: Zeros of Polynomials

409  ANS:  1

f(x) = x^2 - 5x - 6 = (x + 1)(x - 6) = 0

REF: 061612ai  NAT: A.APR.B.3  TOP: Zeros of Polynomials

410  ANS:  3

REF: 061710ai  NAT: A.APR.B.3  TOP: Zeros of Polynomials
ANS: 3
\[ 2x^3 + 12x - 10x^2 = 0 \]
\[ 2x(x^2 - 5x + 6) = 0 \]
\[ 2x(x - 3)(x - 2) = 0 \]

\[ x = 0, 2, 3 \]

REF: 081719ai  NAT: A.APR.B.3  TOP: Zeros of Polynomials

ANS: 3
\[ p(x) = x^2 - 2x - 24 = (x - 6)(x + 4) = 0 \]
\[ x = 6, -4 \]

REF: 061804ai  NAT: A.APR.B.3  TOP: Zeros of Polynomials

ANS:
\[ \frac{1}{2}x^2 - 4 = 0 \]
\[ x^2 - 8 = 0 \]
\[ x^2 = 8 \]
\[ x = \pm\sqrt{8} \]

REF: fall1306ai  NAT: A.APR.B.3  TOP: Zeros of Polynomials

ANS:
\[ (x - 3)^2 - 49 = 0 \]
\[ (x - 3)^2 = 49 \]
\[ x - 3 = \pm 7 \]
\[ x = -4, 10 \]

REF: 081631ai  NAT: A.APR.B.3  TOP: Zeros of Polynomials

ANS:
\[ x^2 + 3x - 18 = 0 \]
The zeros are the x-intercepts of \( r(x) \).
\[ (x + 6)(x - 3) = 0 \]
\[ x = -6, 3 \]

REF: 061733ai  NAT: A.APR.B.3  TOP: Zeros of Polynomials

ANS:
\[ x^2 - 4x + 3 = 0 \]
\[ (x - 3)(x - 1) = 0 \]
\[ x = 1, 3 \]

REF: 011826ai  NAT: A.APR.B.3  TOP: Zeros of Polynomials
417 ANS:
Graph $f(x)$ and find $x$-intercepts. $-3, 1, 8$

REF: 081825ai  NAT: A.APR.B.3  TOP: Zeros of Polynomials

418 ANS:
$3x^3 + 21x^2 + 36x = 0$
$3x(x^2 + 7x + 12) = 0$
$3x(x + 4)(x + 3) = 0$
$x = 0, -4, -3$

REF: 011930ai  NAT: A.APR.B.3  TOP: Zeros of Polynomials

419 ANS: 1
REF: 011524ai  NAT: A.APR.B.3  TOP: Graphing Polynomial Functions

420 ANS: 2
$y = (x - 3)(x + 2)(x - 1)$

REF: 061512ai  NAT: A.APR.B.3  TOP: Graphing Polynomial Functions

421 ANS: 1
$f(x) = (x + 2)(x + 4)(x - 1)$

REF: 081504ai  NAT: A.APR.B.3  TOP: Graphing Polynomial Functions

422 ANS: 1
REF: 081623ai  NAT: A.APR.B.3  TOP: Graphing Polynomial Functions

423 ANS: 1
REF: 081707ai  NAT: A.APR.B.3  TOP: Graphing Polynomial Functions

424 ANS: 2
REF: 061818ai  NAT: A.APR.B.3  TOP: Graphing Polynomial Functions

425 ANS: 1
REF: 081417ai  NAT: F.BF.B.3  TOP: Graphing Polynomial Functions

426 ANS: 2
REF: 011819ai  NAT: F.BF.B.3  TOP: Graphing Polynomial Functions

427 ANS: 2
REF: 011512ai  NAT: F.BF.B.3  TOP: Graphing Polynomial Functions

428 ANS: 2
REF: 011717ai  NAT: F.BF.B.3  TOP: Graphing Polynomial Functions

429 ANS: 1
REF: 081706ai  NAT: F.BF.B.3  TOP: Graphing Polynomial Functions

430 ANS: 2
REF: 081501ai  NAT: F.BF.B.3  TOP: Graphing Polynomial Functions

431 ANS: 3
REF: 081808ai  NAT: F.BF.B.3  TOP: Graphing Polynomial Functions

432 ANS: 3
REF: 011910ai  NAT: F.BF.B.3  TOP: Graphing Polynomial Functions

433 ANS:

(4, -1). $f(x - 2)$ is a horizontal shift two units to the right.

REF: 061428ai  NAT: F.BF.B.3  TOP: Graphing Polynomial Functions
\[ g(x) = x^3 + 2x^2 - 4, \text{ because } g(x) \text{ is a translation down 4 units.} \]

REF: 061632ai  NAT: F.BF.B.3  TOP: Graphing Polynomial Functions

ANS:

\[ \begin{array}{c}
\end{array} \]

REF: 061828ai  NAT: F.BF.B.3  TOP: Graphing Polynomial Functions

ANS: 1

REF: 081401ai  NAT: N.RN.B.3  TOP: Operations with Radicals
KEY: classify

ANS: 2

REF: 061508ai  NAT: N.RN.B.3  TOP: Operations with Radicals
KEY: classify

ANS: 3

\[ \sqrt{576} = 24 \quad \sqrt{684} = 6\sqrt{19} \]

REF: 011808ai  NAT: N.RN.B.3  TOP: Operations with Radicals
KEY: classify

ANS: 3

\[ \sqrt{16} + \sqrt{9} = \frac{7}{1} \text{ may be expressed as the ratio of two integers.} \]

REF: 061413ai  NAT: N.RN.B.3  TOP: Operations with Radicals
KEY: classify

ANS: 2

\[ \frac{1}{\sqrt{4}} + \frac{1}{\sqrt{9}} = \frac{1}{2} + \frac{1}{3} = \frac{5}{6} \]

REF: 081522ai  NAT: N.RN.B.3  TOP: Operations with Radicals
KEY: classify

ANS: 3

\[ \sqrt{36} \div \sqrt{225} = \frac{6}{15} \text{ may be expressed as the ratio of two integers.} \]

REF: 011903ai  NAT: N.RN.B.3  TOP: Operations with Radicals
KEY: classify

ANS: 1

REF: 011604ai  NAT: N.RN.B.3  TOP: Operations with Radicals
KEY: classify
Correct. The sum of a rational and irrational is irrational.

\[3\sqrt{2} \cdot 8\sqrt{18} = 24\sqrt{36} = 144\] is rational, as it can be written as the ratio of two integers.

\[7\sqrt{2}\] is irrational because it cannot be written as the ratio of two integers.

No. The sum of a rational and irrational is irrational.

\[7 - \sqrt{2}\] is irrational because it cannot be written as the ratio of two integers.

\[a + b\] is irrational because it cannot be written as the ratio of two integers. \[b + c\] is rational because it can be written as the ratio of two integers, \[\frac{35}{2}\].

Rational, as \[\sqrt{16} = \frac{4}{7} = \frac{16}{7}\], which is the ratio of two integers.
Graphing Root Functions

REF: 061425ai  NAT: F.IF.C.7  TOP: Graphing Root Functions

REF: 081625ai  NAT: F.IF.C.7  TOP: Graphing Root Functions

REF: 061825ai  NAT: F.IF.C.7  TOP: Graphing Root Functions

REF: fall1304ai  NAT: F.IF.C.7  TOP: Graphing Root Functions
ANS: 3  
**KEY:** ordered pairs  
REF: 061504ai  NAT: F.IF.A.1  TOP: Defining Functions

ANS: 4  
**KEY:** ordered pairs  
REF: 061811ai  NAT: F.IF.A.1  TOP: Defining Functions

ANS: 3  
**KEY:** ordered pairs  
REF: 061709ai  NAT: F.IF.A.1  TOP: Defining Functions

ANS: 2  
**KEY:** graphs  
REF: 011804ai  NAT: F.IF.A.1  TOP: Defining Functions

ANS: 4  
**KEY:** mixed  
REF: 011907ai  NAT: F.IF.A.1  TOP: Defining Functions

ANS: 2  
**KEY:** mixed  
REF: 081511ai  NAT: F.IF.A.1  TOP: Defining Functions

ANS: 
\((-4,1),\) because then every element of the domain is not assigned one unique element in the range.  
REF: 011527ai  NAT: F.IF.A.1  TOP: Defining Functions  
**KEY:** ordered pairs

ANS: 
III and IV are functions. I, for \(x = 6\), has two \(y\)-values. II, for \(x = 1,2\), has two \(y\)-values.  
REF: 081826ai  NAT: F.IF.A.1  TOP: Defining Functions  
**KEY:** graphs

ANS: 
Yes, because every element of the domain is assigned one unique element in the range.  
REF: 061430ai  NAT: F.IF.A.1  TOP: Defining Functions  
**KEY:** ordered pairs

ANS: 
No, because the relation does not pass the vertical line test.  
REF: 011626ai  NAT: F.IF.A.1  TOP: Defining Functions  
**KEY:** graphs

ANS: 
Neither is correct. Nora’s reason is wrong since a circle is not a function because it fails the vertical line test. Mia is wrong since a circle is not a function because multiple values of \(y\) map to the same \(x\)-value.  
REF: 011732ai  NAT: F.IF.A.1  TOP: Defining Functions  
**KEY:** graphs

ANS: 1  
REF: 061420ai  NAT: F.IF.A.2  TOP: Functional Notation

ANS: 1  
REF: 081805ai  NAT: F.IF.A.2  TOP: Functional Notation

ANS: 1  
g\((-3)\) = \(-2(-3)^2 + 3(-3) = -18 - 9 = -27\)  
REF: 011902ai  NAT: F.IF.A.2  TOP: Functional Notation
469  ANS: 2
\[ f(-2) = (-2 - 1)^2 + 3(-2) = 9 - 6 = 3 \]
REF: 081605ai  NAT: F.IF.A.2  TOP: Functional Notation

470  ANS: 3
\[ f(8) = \frac{1}{2}(8)^2 - \left(\frac{1}{4}(8) + 3\right) = 32 - 5 = 27 \]
REF: 081704ai  NAT: F.IF.A.2  TOP: Functional Notation

471  ANS: 4
\[ k(9) = 2(9)^2 - 3\sqrt{9} = 162 - 9 = 153 \]
REF: 061802ai  NAT: F.IF.A.2  TOP: Functional Notation

472  ANS: 3
\[ \sqrt{2 \left(\frac{1}{2}\right) + 3} - 5 = \frac{\sqrt{4}}{-2} = \frac{2}{-2} = -1 \]
REF: 081512ai  NAT: F.IF.A.2  TOP: Functional Notation

473  ANS: 1
\[ f(3) = -2(3)^2 + 32 = -18 + 32 = 14 \]
REF: 061705ai  NAT: F.IF.A.2  TOP: Functional Notation

474  ANS: 1
\[ 25,000(0.86)^2 - 25,000(0.86)^3 = 18490 - 15901.40 = 2588.60 \]
REF: 011508ai  NAT: F.IF.A.2  TOP: Functional Notation

475  ANS:
\[ w(52) - w(38) = 15(x - 40) + 400 = 445 \]  Since \( w(x) > 400, x > 40 \). I substituted 445 for \( w(x) \) and solved
\[ 15(52 - 40) + 400 - 10(38) = 15(x - 40) = 45 \]
\[ 180 + 400 - 380 \]
\[ x - 40 = 3 \]
\[ 200 \]
\[ x = 43 \]
for \( x \).
REF: 061534ai  NAT: F.IF.A.2  TOP: Functional Notation

476  ANS: 3
\[ 119.67(0.61)^5 - 119.67(0.61)^3 \approx 17.06 \]
REF: 011603ai  NAT: F.IF.A.2  TOP: Functional Notation

477  ANS: 4  KEY: graph
REF: 011917ai  NAT: F.IF.A.2  TOP: Domain and Range
ANS: 4  REF: 061509ai  NAT: F.IF.A.2  TOP: Domain and Range
KEY: graph

ANS: 4  REF: 061417ai  NAT: F.IF.A.2  TOP: Domain and Range
KEY: real domain, linear

ANS: 1  
\[ f(2) = 0 \]
\[ f(6) = 8 \]

ANS: 2  REF: 011619ai  NAT: F.IF.A.2  TOP: Domain and Range
KEY: real domain, exponential

ANS: 2  
\[ f(x) = x^2 + 2x - 8 = x^2 + 2x + 1 - 9 = (x + 1)^2 - 9 \]

ANS: 1  REF: 081710ai  NAT: F.IF.A.2  TOP: Domain and Range
KEY: real domain, quadratic

ANS: 3  
\[ f(-2) = 0, f(3) = 10, f(5) = 42 \]

ANS: 3  REF: 061816ai  NAT: F.IF.A.2  TOP: Domain and Range
KEY: real domain, quadratic

ANS: 2  REF: 081806ai  NAT: F.IF.A.2  TOP: Domain and Range
KEY: limited domain

ANS: 2  
\[ f(-2) = f(-1) = -16, f(0) = -12, f(1) = -4 \]

ANS: 4  
There are no negative or fractional cars.

ANS: 4  REF: 061402ai  NAT: F.IF.B.5  TOP: Domain and Range
ANS: 2

\[ 0 = -16t^2 + 144 \]

\[ 16t^2 = 144 \]

\[ t^2 = 9 \]

\[ t = 3 \]

REF: 081423ai NAT: F.IF.B.5 TOP: Domain and Range

ANS: 2 REF: 011506ai NAT: F.IF.B.5 TOP: Domain and Range

ANS: 1 REF: 011615ai NAT: F.IF.B.5 TOP: Domain and Range

ANS: 4 REF: 061623ai NAT: F.IF.B.5 TOP: Domain and Range

ANS: 2 REF: 081620ai NAT: F.IF.B.5 TOP: Domain and Range

ANS: 4 REF: 011719ai NAT: F.IF.B.5 TOP: Domain and Range

ANS: 2 REF: 061821ai NAT: F.IF.B.5 TOP: Domain and Range

\[ P(x) = -0.5x^2 + 800x - 100 - (300x + 250) = -0.5x^2 + 500x - 350 \]

REF: 081406ai NAT: F.BF.A.1 TOP: Operations with Functions

ANS:

\[ g(x) = 2(2x + 1)^2 - 1 = 2(4x^2 + 4x + 1) - 1 = 8x^2 + 8x + 2 - 1 = 8x^2 + 8x + 1 \]

REF: 061625ai NAT: F.BF.A.1 TOP: Operations with Functions

ANS:

Exponential, because the function does not grow at a constant rate.

REF: 081527ai NAT: F.LE.A.1 TOP: Families of Functions

ANS:

Linear, because the function has a constant rate of change.

REF: 011625ai NAT: F.LE.A.1 TOP: Families of Functions

ANS:

Yes, because \( f(x) \) does not have a constant rate of change.

REF: 061826ai NAT: F.LE.A.1 TOP: Families of Functions

ANS:

Linear, because the function grows at a constant rate.

\[
\frac{435 - 348}{14 - 13} = \frac{522 - 435}{15 - 14} = \frac{609 - 522}{16 - 15} = \frac{696 - 609}{17 - 16} = \frac{783 - 696}{18 - 17} = \frac{87}{1}
\]

REF: 011926ai NAT: F.LE.A.1 TOP: Families of Functions
Exponential, because the function does not have a constant rate of change.

\[ f(-1) < g(-1) \]
\[ 3^{-1} < 2(-1) + 5 \]
\[ \frac{1}{3} < 3 \]
\[
\begin{array}{|c|c|c|}
\hline
x & A = 5000(x - 1) + 10000 & B = 500(2)^{x-1} \\
\hline
6 & 35,000 & 16,000 \\
7 & 40,000 & 32,000 \\
8 & 45,000 & 64,000 \\
9 & 50,000 & 128,000 \\
\hline
\end{array}
\]

\[ l(w) = 3.1w - 16.2, \quad l(10) = 3.1(10) - 16.2 = 14.8, \quad l(13) = 3.1(13) - 16.2 = 24.1; \quad p(w) = 2.5(1.52)^{w-6}, \]
\[ p(10) = 2.5(1.52)^{10-6} \approx 13.3, \quad p(13) = 2.5(1.52)^{13-6} \approx 46.9 \]

\[ g(x) \text{ has a greater value: } 2^{20} > 20^5 \]
ANS: 
\[ f(x) = 10 + 100x, \ g(x) = 10(2)^x; \] both, since \( f(7) = 10 + 100(7) = 710 \) and \( g(7) = 10(2)^7 = 1280 \)

528 ANS: 1 REF: 011620ai NAT: F.BF.B.3 TOP: Transformations with Functions

KEY: bimodalgraph

529 ANS: 2 units right and 3 units down.

530 ANS: 3
\[ h(x) = -x^2 + x + 6 \] Maximum of \( f(x) = 9 \) \( k(x) = -5x^2 - 12x + 4 \) Maximum of \( g(x) < 5 \)
\[ x = \frac{-1}{2(-1)} = \frac{1}{2} \quad x = \frac{12}{2(-5)} = -\frac{6}{5} \]
\[ y = -\left(\frac{1}{2}\right)^2 + \frac{1}{2} + 6 \]
\[ = \frac{1}{4} + \frac{2}{4} + 6 \]
\[ = 6 \frac{1}{4} \]
\[ y = -5\left(\frac{6}{5}\right)^2 - 12\left(\frac{6}{5}\right) + 4 \]
\[ = -\frac{36}{5} + 72 + 20 \]
\[ = \frac{56}{5} \]
\[ = 11 \frac{1}{5} \]

531 ANS: 4
1) \( \frac{g(1) - g(-1)}{1 - (-1)} = \frac{4 - 6}{2} = -2 = -1 \) 2) \( g(0) = 6 \) 3) \( x = \frac{-(1)}{2(-1)} = \frac{1}{2}; \ g\left(\frac{1}{2}\right) = -\left(\frac{1}{2}\right)^2 + \frac{1}{2} + 6 = 6 \frac{1}{4} \)
\[ n(1) - n(-1) \quad n(0) = 8 \quad x = 1; \ n(1) = 9 \]
4) \( g(S) = \frac{-(1)}{-1} = -1 \)
\[ n: S = -2 + 4 = 2 \]

532 ANS: 3 
\( x = 3 \)

533 ANS: 3 REF: 011622ai NAT: F.IF.C.9 TOP: Comparing Functions

534 ANS: 4 
1) \( b = 0; \) 2) \( b = 4; \) 3) \( b = -6; \) 4) \( b = 5 \)

535 ANS: 4 REF: 081611ai NAT: F.IF.C.9 TOP: Comparing Functions
535 ANS: 4
1) $y = 3x + 2$; 2) $-\frac{5-2}{3-2} = -7$; 3) $y = -2x + 3$; 4) $y = -3x + 5$

REF: 081615ai NAT: F.IF.C.9 TOP: Comparing Functions

536 ANS: 2

REF: 011723ai NAT: F.IF.C.9 TOP: Comparing Functions

537 ANS: 2

1) $x = -\frac{2}{2(1)} = 1$; 2) $h = \frac{3}{2}$ Using $(0,3)$, $3 = a\left(0 - \frac{3}{2}\right)^2 + k$; Using $(1,5)$, $5 = a\left(1 - \frac{3}{2}\right)^2 + k$

$y = -1^2 + 2(1) + 4 = 5$

$3 = \frac{9}{4}a + k$

$5 = \frac{1}{4}a + k$

vertex $(1,5)$

$k = 3 - \frac{9}{4}a$

$k = 5 - \frac{1}{4}a$

$5 - \frac{1}{4}a = 3 - \frac{9}{4}a \quad k = 5 - \frac{1}{4}(-1) = \frac{21}{4}$; 3) vertex $(5,5)$; 4) Using $c = 1$ 

$-9 = (-2)^2a + (-2)b + 1$

$20 - a = 12 - 9a$

$8a = -8$

vertex $\left\{ \frac{3}{2}, \frac{21}{4} \right\}$

$-10 = 4a - 2b$

$b = 2a + 5$

$a = -1$

$-3 = (-1)^2a + (-1)b + 1 \quad 2a + 5 = a + 4 \quad x = \frac{-3}{2(1)} = \frac{3}{2}$

vertex $\left\{ \frac{3}{2}, \frac{13}{4} \right\}$

$-3 = a - b + 1 \quad a = -1$

$b = a + 4$

$b = -1 + 4 = 3 \quad y = -\left(\frac{3}{2}\right)^2 + 3\left(\frac{3}{2}\right) + 1 = -\frac{9}{4} + \frac{18}{4} + \frac{4}{4} = \frac{13}{4}$

REF: 011823ai NAT: F.IF.C.9 TOP: Comparing Functions

538 ANS: 2

1) $x = -\frac{2}{2(1)} = -1 \quad h(-1) = (-1)^2 + 2(-1) - 6 = -7$; 2) $y = -10$; 3) $k\left(\frac{-5 + -2}{2}\right) = (-3.5 + 5)(-3.5 + 2) = -2.25$; 4) $y = -6$

REF: 061813ai NAT: F.IF.C.9 TOP: Comparing Functions

539 ANS: 2

![Graph](image)

REF: 081718ai NAT: F.IF.C.9 TOP: Comparing Functions

540 ANS: 3

REF: 061820ai NAT: F.IF.C.9 TOP: Comparing Functions
The \( y \)-intercept for \( f(x) \) is \((0,1)\). The \( y \)-intercept for \( g(x) \) is \((0,3)\). The \( y \)-intercept for \( h(x) \) is \((0,-1)\).

\[ g(x) = \frac{3 - 0}{3 - 0} = \frac{3}{3} = 1. \]

Over the interval \( 0 \leq x \leq 3 \), the average rate of change for 
\[ h(x) = \frac{9 - 2}{3 - 0} = \frac{7}{3}, \]
\[ f(x) = \frac{7 - 1}{3 - 0} = \frac{6}{3} = 2, \]
and
\[ g(x) = \frac{3 - 0}{3 - 0} = \frac{3}{3} = 1. \]

\[ f(4) = g(4) = p(4) = 3 \]

\[ y = -\frac{1}{2} (4)^2 + 4(4) + 3 = -8 + 16 + 3 = 11 \]

At 6 hours, \( 3 \frac{1}{2} \) inches of snow have fallen.
548 ANS:

![Graph showing distance over time]

REF: 081528ai  NAT: F.IF.B.4  TOP: Relating Graphs to Events

549 ANS:

$D-E$, because his speed was slower. Craig may have stayed at a rest stop during $B-C$. $\frac{230 - 0}{7 - 0} \approx 32.9$

REF: 061734ai  NAT: F.IF.B.4  TOP: Relating Graphs to Events

550 ANS:

![Graph showing temperature over time]

6am-4pm, $\frac{74 - 56}{6 - 12} = -3$

REF: 011936ai  NAT: F.IF.B.4  TOP: Relating Graphs to Events

551 ANS: 2  REF: 081422ai  NAT: F.IF.C.7  TOP: Graphing Piecewise-Defined Functions

552 ANS: 2  REF: 081516ai  NAT: F.IF.C.7  TOP: Graphing Piecewise-Defined Functions

KEY: bimodalgraph

553 ANS: 4  REF: 081815ai  NAT: F.IF.C.7  TOP: Graphing Piecewise-Defined Functions
Since according to the graph, 8 pencils cost $14 and 10 pencils cost $12.50, the cashier is correct.

REF: fall1312ai NAT: F.IF.C.7 TOP: Graphing Piecewise-Defined Functions

REF: 011530ai NAT: F.IF.C.7 TOP: Graphing Piecewise-Defined Functions

REF: 061832ai NAT: F.IF.C.7 TOP: Graphing Piecewise-Defined Functions

REF: 061507ai NAT: F.IF.C.7 TOP: Graphing Step Functions

KEY: bimodalgraph
The cost for each additional hour increases after the first 2 hours.

ANS: 4
\[ f(1) = 3; f(2) = -5; f(3) = 11; f(4) = -21; f(5) = 43 \]

ANS: 3
\[ f(0 + 1) = -2f(0) + 3 = -2(2) + 3 = -1 \]
\[ f(1 + 1) = -2f(1) + 3 = -2(-1) + 3 = 5 \]

ANS: 3
\[ a_n = 3n + 1 \]
\[ a_5 = 3(5) + 1 = 16 \]

ANS: 2
\[ f(1) = 2; f(2) = -5(2) + 2 = -8; f(3) = -5(-8) + 2 = 42; f(4) = -5(42) + 2 = -208 \]

ANS: 3
1, 3, 6, 10, 15, 21, 28, ...

ANS: 1
\[ d = \frac{37 - 31}{6 - 3} = 2 \]
\[ a_n = 2n + 25 \]
\[ a_{20} = 2(20) + 25 = 65 \]

ANS: 3
\[ a_2 = n(a_{2-1}) = 2 \cdot 1 = 2, a_3 = n(a_{3-1}) = 3 \cdot 2 = 6, a_4 = n(a_{4-1}) = 4 \cdot 6 = 24, a_5 = n(a_{5-1}) = 5 \cdot 24 = 120 \]
Yes, because the sequence has a common ratio, 3.