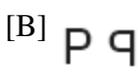
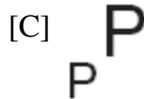
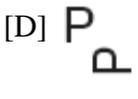


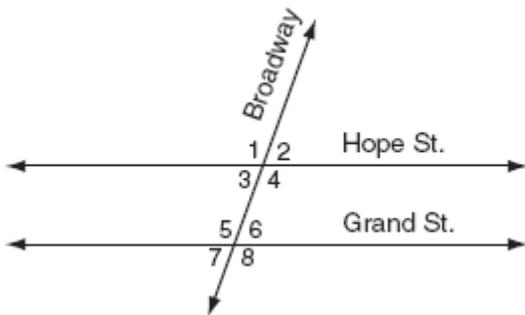
1. 010701a, P.I. G.G.56

Which image represents a line reflection?

- [A]  [B] 
- [C]  [D] 

2. 010702a, P.I. 8.G.5

The accompanying diagram shows two parallel roads, Hope Street and Grand Street, crossed by a transversal road, Broadway.

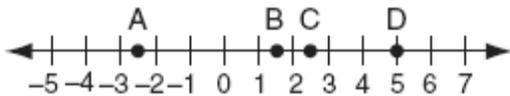


If  $m\angle 1 = 110$ , what is the measure of  $\angle 7$ ?

- [A]  $110^\circ$  [B]  $40^\circ$  [C]  $70^\circ$  [D]  $180^\circ$

3. 010703a, P.I. 7.N.18

Which point on the accompanying number line best represents the position of  $\sqrt{5}$ ?



- [A] C [B] A [C] D [D] B

4. 010704a, P.I. G.G.45

The base of an isosceles triangle is 5 and its perimeter is 11. The base of a similar isosceles triangle is 10. What is the perimeter of the larger triangle?

- [A] 21 [B] 22 [C] 110 [D] 15

5. 010705a, P.I. A.A.22

What is the value of  $n$  in the equation  $3n - 8 = 32 - n$ ?

- [A] 6 [B] -10 [C] -6 [D] 10

6. 010706a, P.I. G.G.25

The statement " $x \geq 4$  and  $2x - 4 < 6$ " is true when  $x$  is equal to

- [A] 1 [B] 10 [C] 5 [D] 4

7. 010707a, P.I. A.A.13

The expression  $(2x^2 + 6x + 5) - (6x^2 + 3x + 5)$  is equivalent to

- [A]  $-4x^2 + 3x$  [B]  $-4x^2 - 3x + 10$   
[C]  $4x^2 - 3x$  [D]  $4x^2 + 3x - 10$

8. 010708a, P.I. A.N.5

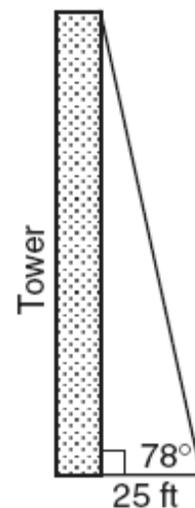
Which equation represents the direct variation relationship of the equation  $\frac{x}{y} = \frac{1}{2}$ ?

- [A]  $y = 2x$  [B]  $x = 2y$   
[C]  $y = 3x$  [D]  $y = x + \frac{1}{2}$

9. 010709a, P.I. A.S.20  
Seth tossed a fair coin five times and got five heads. The probability that the next toss will be a tail is
- [A] 0      [B]  $\frac{1}{6}$       [C]  $\frac{5}{6}$       [D]  $\frac{1}{2}$
10. 010710a, P.I. A.A.23  
The formula for potential energy is  $P = mgh$ , where  $P$  is potential energy,  $m$  is mass,  $g$  is gravity, and  $h$  is height. Which expression can be used to represent  $g$ ?
- [A]  $\frac{P}{mh}$       [B]  $P - mh$   
[C]  $\frac{P}{m} - h$       [D]  $P - m - h$
11. 010711a  
A planned building was going to be 100 feet long, 75 feet deep, and 30 feet high. The owner decides to increase the volume of the building by 10% without changing the dimensions of the depth and the height. What will be the new length of this building?
- [A] 110 ft      [B] 108 ft  
[C] 106 ft      [D] 112 ft
12. 010712a, P.I. A.A.1  
Which expression represents the product of two consecutive odd integers, where  $n$  is an odd integer?
- [A]  $n(n + 2)$       [B]  $2n + 1$   
[C]  $n(n + 3)$       [D]  $n(n + 1)$
13. 010713a, A2.S.10  
Which value is equivalent to  ${}_3P_3$ ?
- [A] 1      [B] 9      [C] 27      [D] 3!
14. 010714a  
The graph of the equation  $x^2 + y^2 = r^2$  forms
- [A] a circle      [B] a parabola  
[C] two intersecting lines  
[D] a straight line
15. 010715a, P.I. G.G.26  
What is the inverse of the statement "If Bob gets hurt, then the team loses the game"?
- [A] If the team does not lose the game, then Bob does not get hurt.  
[B] If the team loses the game, then Bob gets hurt.  
[C] Bob gets hurt if the team loses the game.  
[D] If Bob does not get hurt, then the team does not lose the game.
16. 010716a, P.I. A.A.15  
Which expression is undefined when  $w = 3$ ?
- [A]  $\frac{w + 1}{w^2 - 3w}$       [B]  $\frac{w - 3}{w + 1}$   
[C]  $\frac{w^2 + 2w}{5w}$       [D]  $\frac{3w}{3w^2}$
17. 010717a, P.I. A.G.1  
A circular garden has a diameter of 12 feet. How many bags of topsoil must Linda buy to cover the garden if one bag covers an area of 3 square feet?
- [A] 151      [B] 40      [C] 13      [D] 38

18. 010718a  
The midpoint of  $\overline{AB}$  is  $(-1,5)$  and the coordinates of point  $A$  are  $(-3,2)$ . What are the coordinates of point  $B$ ?
- [A]  $(1,10)$                       [B]  $(0,7)$   
[C]  $(1,8)$                         [D]  $(-5,8)$
19. 010719a, P.I. A.A.22  
What is the value of  $x$  in the equation  $\frac{x}{2} + \frac{x}{6} = 2$ ?
- [A] 3            [B]  $\frac{1}{4}$             [C] 8            [D] 12
20. 010720a, P.I. A.N.1  
If  $M$  and  $A$  represent integers,  $M + A = A + M$  is an example of which property?
- [A] associative                      [B] distributive  
[C] commutative                    [D] closure
21. 010721a, P.I. G.G.39  
A set of five quadrilaterals consists of a square, a rhombus, a rectangle, an isosceles trapezoid, and a parallelogram. Lu selects one of these figures at random. What is the probability that both pairs of the figure's opposite sides are parallel?
- [A]  $\frac{4}{5}$             [B]  $\frac{2}{5}$             [C] 1            [D]  $\frac{3}{4}$
22. 010722a  
If the measures of the angles of a triangle are represented by  $2x$ ,  $3x - 15$ , and  $7x + 15$ , the triangle is
- [A] an acute triangle  
[B] an equiangular triangle  
[C] an isosceles triangle  
[D] a right triangle
23. 010723a, P.I. A2.A.8  
What is the value of  $3^0 + 3^{-2}$ ?
- [A] 0            [B]  $1\frac{1}{9}$             [C] 6            [D]  $\frac{1}{9}$
24. 010724a, P.I. A.A.14  
The expression  $(50x^3 - 60x^2 + 10x) \div 10x$  is equivalent to
- [A]  $5x^2 - 6x$                       [B]  $5x^2 - 6x + 1$   
[C]  $5x^2 - 60x^2 + 10x$             [D]  $5x^3 - 6x^2 + x$
25. 010725a, P.I. G.G.58  
The image of point  $A$  after a dilation of 3 is  $(6,15)$ . What was the original location of point  $A$ ?
- [A]  $(9,18)$                               [B]  $(3,12)$   
[C]  $(18,45)$                             [D]  $(2,5)$
26. 010726a, P.I. A.A.6  
Mario paid \$44.25 in taxi fare from the hotel to the airport. The cab charged \$2.25 for the first mile plus \$3.50 for each additional mile. How many miles was it from the hotel to the airport?
- [A] 13            [B] 10            [C] 12            [D] 11

27. 010727a, P.I. A.A.27  
What is the solution set of the equation  $x^2 - 5x = 0$ ?  
[A] {5} [B] {0,-5} [C] {0,5} [D] {0}
28. 010728a, P.I. A.A.12  
The expression  $(6x^3y^6)^2$  is equivalent to  
[A]  $36x^5y^8$  [B]  $6x^6y^{12}$   
[C]  $36x^6y^{12}$  [D]  $12x^6y^{12}$
29. 010729a, P.I. A2.S.11  
If the Math Olympiad Club consists of eighteen students, how many different teams of four students can be formed for competitions?  
[A] 66 [B] 73,440 [C] 3,060 [D] 72
30. 010730a, P.I. A.N.1  
The multiplicative inverse of  $-\frac{1}{3}$  is  
[A]  $-\frac{1}{3}$  [B] 3 [C] -3 [D]  $\frac{1}{3}$
31. 010731a, P.I. A.S.19  
Kimberly has three pair of pants: one black, one red, and one tan. She also has four shirts: one pink, one white, one yellow, and one green. Draw a tree diagram or list the sample space showing all possible outfits that she could wear, if an outfit consists of one pair of pants and one shirt. How many different outfits can Kimberly wear?
32. 010732a, P.I. A.N.5  
A 14-gram serving of mayonnaise contains 11 grams of fat. What percent of the mayonnaise, to the *nearest tenth of a percent*, is fat?
33. 010733a, P.I. A.A.6  
Every month, Omar buys pizzas to serve at a party for his friends. In May, he bought three more than twice the number of pizzas he bought in April. If Omar bought 15 pizzas in May, how many pizzas did he buy in April?
34. 010734a, P.I. A.M.2  
The formula  $C = \frac{5}{9}(F - 32)$  is used to convert Fahrenheit temperature,  $F$ , to Celsius temperature,  $C$ . What temperature, in degrees Fahrenheit, is equivalent to a temperature of  $10^\circ$  Celsius?
35. 010735a, P.I. A.A.44  
From a point on level ground 25 feet from the base of a tower, the angle of elevation to the top of the tower is  $78^\circ$ , as shown in the accompanying diagram. Find the height of the tower, to the *nearest tenth of a foot*.



36. 010736a, P.I. G.G.48  
The perimeter of a square is 56. Express the length of a diagonal of the square in simplest radical form.

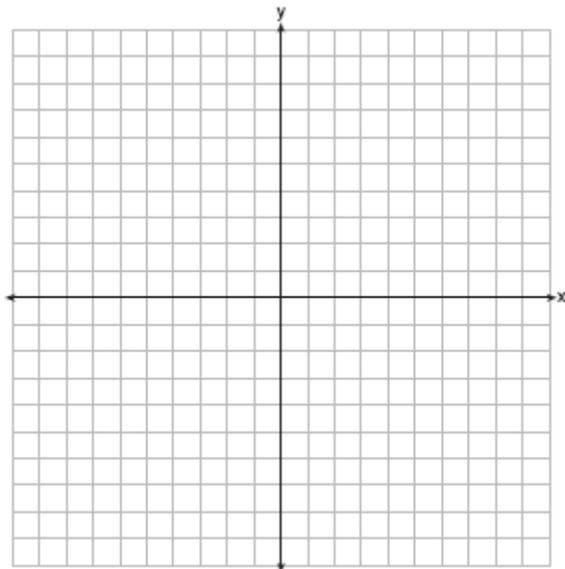
37. 010737a, P.I. A.A.6  
The Eye Surgery Institute just purchased a new laser machine for \$500,000 to use during eye surgery. The Institute must pay the inventor \$550 each time the machine is used. If the Institute charges \$2,000 for each laser surgery, what is the *minimum* number of surgeries that must be performed in order for the Institute to make a profit?

38. 010738a, P.I. A.G.7  
Graph the following systems of inequalities on the accompanying set of axes and label the solution set  $S$ :

$$y > x - 4$$

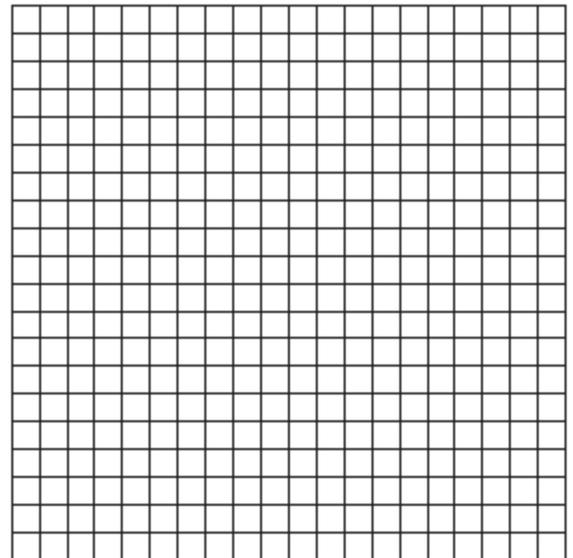
$$y + x \geq 2$$

[Only a graphic solution can receive full credit.]



39. 010739a, P.I. A.S.5  
The accompanying table shows the weights, in pounds, for the students in an algebra class. Using the data, complete the cumulative frequency table and construct a cumulative frequency histogram on the grid below.

Interval	Frequency	Cumulative Frequency
91–100	6	
101–110	3	
111–120	0	
121–130	3	
131–140	0	
141–150	2	
151–160	2	



- [1] B
- [2] C
- [3] A
- [4] B
- [5] D
- [6] D
- [7] A
- [8] A
- [9] D
- [10] A
- [11] A
- [12] A
- [13] D
- [14] A
- [15] D
- [16] A
- [17] D
- [18] C
- [19] A
- [20] C
- [21] A
- [22] C
- [23] B
- [24] B
- [25] D
- [26] A
- [27] C
- [28] C

- [29] C
- [30] C

[2] 12, and a correct tree diagram or a correct sample space is shown.

[1] An incomplete tree diagram or sample space is shown with at least 8 possible combinations shown, and an appropriate number of outfits is found.

or [1] A correct tree diagram or sample space is shown, but the number of possible outfits is missing or is incorrect.

or [1] 12, but  $3 \times 4$  is used to find the number of outfits.

[0] 12, but no work is shown.

or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

- [31] obviously incorrect procedure.

[2] 78.6%, and appropriate work is shown.

[1] Appropriate work is shown, but one computational or rounding error is made.

or [1] Appropriate work is shown, but one conceptual error is made.

or [1] 78.6%, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, incoherent or is a correct response that was obtained by an obviously incorrect

- [32] procedure.

[2] 6, and appropriate work is shown, such as solving the equation  $2x + 3 = 15$  or trial and error with at least three trials and appropriate checks.

[1] Appropriate work is shown, but one computational error is made.

or [1] Appropriate work is shown, but one conceptual error is made.

or [1] A correct equation is written, but no further correct work is shown.

or [1] The trial-and-error method is attempted and at least six systematic trials and appropriate checks are shown, but no solution is found.

or [1] 6, but no work or fewer than three trials and appropriate checks are shown.

[0] A zero response is completely incorrect, irrelevant or incoherent or is a correct response that was obtained by an obviously

[33] incorrect procedure.

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[2] 50, and appropriate work is shown, such as solving the equation  $10 = \frac{5}{9}(F - 32)$ .

[1] Appropriate work is shown, but one computational error is made.

or [1] Appropriate work is shown, but one conceptual error is made.

or [1] Correct substitution is made into the equation, but no further correct work is shown.

or [1] 50, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[34] incorrect procedure.

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[2] 117.6, and appropriate work is shown, such as  $\tan 78^\circ = \frac{x}{25}$ .

[1] Appropriate work is shown, but one computational or rounding error is made.

or [1] Appropriate work is shown, but one conceptual error is made, such as using an incorrect trigonometric function, but an appropriate solution is found.

or [1] A correct trigonometric equation is written, but no further correct work is shown.

or [1] 117.6, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[35] incorrect procedure.

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[3]  $14\sqrt{2}$ , and appropriate work is shown, such as using the Pythagorean theorem or drawing a correctly labeled diagram that shows the isosceles right triangle.

[2] Appropriate work is shown, but one computational error is made.

or [2] Appropriate work is shown, but the answer is expressed as a decimal or the radical is not simplified.

[1] Appropriate work is shown, but two or more computational errors are made.

or [1] Appropriate work is shown, but one computational error is made, and the answer is not expressed as a radical in simplest form.

or [1] Appropriate work is shown, but one conceptual error is made.

or [1] 14, the side of the square is found correctly, but no further correct work is shown.

or [1]  $14\sqrt{2}$ , but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[36] incorrect procedure.

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- [3] 345, and appropriate work is shown, such as solving the inequality  $1450x > 500,000$ , solving an equation, or trial and error with at least three trials and appropriate checks.
- [2] Appropriate work is shown, but one computational or rounding error is made.
- or [2] The trial-and-error method is used to find a correct solution, but only two trials and appropriate checks are shown.
- [1] Appropriate work is shown, but two or more computational or rounding errors are made.
- or [1] Appropriate work is shown, but one conceptual error is made.
- or [1] A correct inequality or equation is written, but no further correct work is shown.
- or [1] The trial-and-error method is attempted and at least six systematic trials and appropriate checks are shown, but no solution is found.
- or [1] 345, but no work or only one trial with an appropriate check is shown.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- 

- [4] Both inequalities are graphed correctly and at least one is labeled, and the solution set is labeled  $S$ .
- [3] Appropriate work is shown, but one graphing error is made, such as drawing a solid line for  $y > x - 4$  or shading incorrectly, but the solution set is labeled  $S$ .
- or [3] Both inequalities are graphed correctly and at least one is labeled, but the solution set is not labeled or is labeled incorrectly.
- or [3] Both inequalities are graphed correctly, the solution set is labeled, but neither inequality is labeled.
- [2] Appropriate work is shown, but two or more graphing errors are made, but an appropriate solution set is labeled.
- or [2] Appropriate work is shown, but one conceptual error is made, such as graphing the lines  $y = -x + 2$  and  $y = x - 4$  and labeling the point of intersection  $S$ .
- [1] One inequality is graphed and shaded correctly, but no further correct work is shown.
- or [1] The lines  $y = -x + 2$  and  $y = x - 4$  are graphed correctly, but no solution is indicated.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
-

[4] The table is completed correctly, and an appropriate cumulative frequency histogram is drawn and labeled.

[3] The table is completed correctly, but one error is made in drawing the cumulative frequency histogram or one or more labeling errors are made.

or [3] The table is not completed correctly, but an appropriate cumulative frequency histogram is drawn, based on the table.

[2] One error is made in completing the table, and one graphing error is made in drawing the cumulative frequency histogram.

or [2] The table is completed correctly, but one conceptual error is made, such as drawing a frequency histogram or a cumulative frequency bar graph.

[1] The table is completed correctly, but no histogram is drawn.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[39] incorrect procedure.