

1. 080101a, P.I. G.G.45

The perimeter of an equilateral triangle varies directly as the length of a side. When the length of a side is doubled, the perimeter of the triangle is

- [A] multiplied by 3    [B] doubled  
[C] divided by 3    [D] halved

2. 080102a, P.I. 7.N.2

Which expression is rational?

- [A]  $\sqrt{\frac{1}{4}}$     [B]  $\sqrt{3}$     [C]  $\sqrt{\frac{1}{2}}$     [D]  $\pi$

3. 080103a, P.I. A2.A.7

Written in simplest factored form, the binomial  $2x^2 - 50$  can be expressed as

- [A]  $2x(x - 50)$     [B]  $(x - 5)(x + 5)$   
[C]  $2(x - 5)(x - 5)$     [D]  $2(x - 5)(x + 5)$

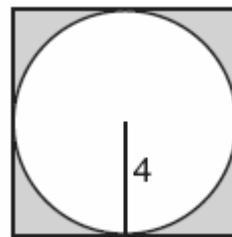
4. 080104a, P.I. G.G.26

Which statement is logically equivalent to "If I did not eat, then I am hungry"?

- [A] If I am hungry, then I did eat.  
[B] If I did not eat, then I am not hungry.  
[C] If I am not hungry, then I did eat.  
[D] If I am not hungry, then I did not eat.

5. 080105a, P.I. A.G.1

In the accompanying diagram, a circle with radius 4 is inscribed in a square.



What is the area of the shaded region?

- [A]  $16 - 8\pi$     [B]  $64 - 16\pi$   
[C]  $16 - 16\pi$     [D]  $64\pi - 8\pi$

6. 080106a

Which letter below has point symmetry, but does not have line symmetry?

- [A] N    [B] H    [C] A    [D] E

7. 080107a, P.I. A.N.6

The value of  $5!$  is

- [A] 120    [B]  $\frac{1}{5}$     [C] 5    [D] 20

8. 080108a, P.I. A.G.1

What is the approximate circumference of a circle with radius 3?

- [A] 18.85    [B] 7.07  
[C] 28.27    [D] 9.42

9. 080109a, P.I. G.G.36  
The sum of the measures of the interior angles of an octagon is  
[A]  $1,080^\circ$       [B]  $360^\circ$   
[C]  $180^\circ$       [D]  $540^\circ$
10. 080110a, P.I. A.A.6  
The exact average of a set of six test scores is 92. Five of these scores are 90, 98, 96, 94, and 85. What is the other test score?  
[A] 91      [B] 89      [C] 86      [D] 92
11. 080111a, P.I. A.N.7  
A certain car comes in three body styles with a choice of two engines, a choice of two transmissions, and a choice of six colors. What is the minimum number of cars a dealer must stock to have one car of every possible combination?  
[A] 72      [B] 36      [C] 42      [D] 13
12. 080112a, P.I. A.N.1  
The operation element @ is determined by the following table:
- |   |   |   |   |
|---|---|---|---|
| @ | a | b | c |
| a | a | b | c |
| b | b | c | a |
| c | c | a | b |
- What is the identity element of this operation?  
[A] c      [B] a and b  
[C] b, only      [D] a, only
13. 080113a, P.I. 7.N.11  
If  $n$  represents an odd number, which computation results in an answer that is an even number?  
[A]  $3 \times n - 2$       [B]  $2 \times n - 1$   
[C]  $3 \times n + 1$       [D]  $2 \times n + 1$
14. 080114a, P.I. A.N.5  
In his will, a man leaves one-half of his money to his wife, one-half of what is then left to his older child, and one-half of what is then left to his younger child. His two cousins divide the remainder equally, each receiving \$2,000. What was the total amount of money in the man's will?  
[A] \$24,000      [B] \$32,000  
[C] \$40,000      [D] \$16,000
15. 080115a  
If  $a + b$  is less than  $c + d$ , and  $d + e$  is less than  $a + b$ , then  $e$  is  
[A] less than  $c$       [B] equal to  $c$   
[C] greater than  $d$       [D] less than  $d$
16. 080116a, P.I. G.G.26  
Which statement is the converse of "If it is a 300 ZX, then it is a car"?  
[A] If it is a car, then it is a 300 ZX.  
[B] If it is a car, then it is not a 300 ZX.  
[C] If it is not a car, then it is not a 300 ZX.  
[D] If it is not a 300 ZX, then it is not a car.

17. 080117a, P.I. A.RP.11

In a class of 450 students, 300 are taking a mathematics course and 260 are taking a science course. If 140 of these students are taking both courses, how many students are not taking either of these courses?

- [A] 140    [B] 110    [C] 30    [D] 40

18. 080118a, P.I. A.A.27

What is the solution set of  $m^2 - 3m - 10 = 0$ ?

- [A] {3,-10}    [B] {2,-5}  
[C] {3,10}    [D] {5,-2}

19. 080119a, P.I. A2.A.9

Which expression is equivalent to  $x^{-1} \cdot y^2$ ?

- [A]  $xy^2$     [B]  $xy^{-2}$     [C]  $\frac{x}{y^2}$     [D]  $\frac{y^2}{x}$

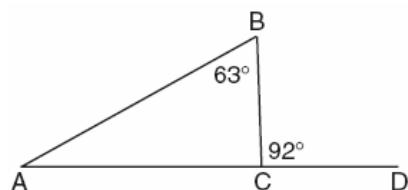
20. 080120a, P.I. G.G.25

What is the smallest integer greater than 1 that is both the square of an integer and the cube of an integer?

- [A] 36    [B] 9    [C] 64    [D] 8

21. 080121a, P.I. G.G.32

Triangle  $ABC$ , with side  $\overline{AC}$  extended to  $D$ , is shown in the accompanying diagram. If  $m\angle ABC = 63^\circ$  and  $m\angle BCD = 92^\circ$ , what is  $m\angle BAC$ ?



22. 080122a, P.I. A.A.45

How many feet from the base of a house must a 39-foot ladder be placed so that the top of the ladder will reach a point on the house 36 feet from the ground?

23. 080123a, P.I. A.A.13

Subtract  $5x^2 - 7x - 6$  from  $9x^2 + 3x - 4$ .

24. 080124a, P.I. A.G.1

An engineer measured the dimensions for a rectangular site by using a wooden pole of unknown length  $x$ . The length of the rectangular site is 2 pole measures increased by 3 feet, while the width is 1 pole measure decreased by 4 feet. Write an algebraic representation, in terms of  $x$ , for the perimeter of the site.

25. 080125a, P.I. A2.A.13

Simplify:  $\sqrt{50r^2s^4}$

26. 080126a, P.I. A2.S.11

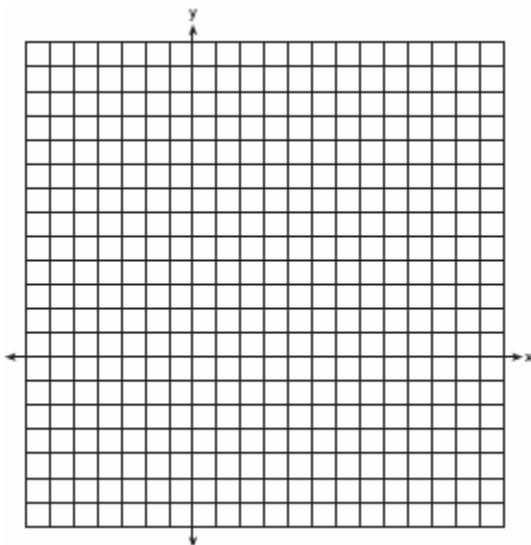
Megan decides to go out to eat. The menu at the restaurant has four appetizers, three soups, seven entrees, and five desserts. If Megan decides to order an appetizer or a soup, and one entree, and two different desserts, how many different choices can she make?

27. 080127a, P.I. A.S.23

There are four students, all of different heights, who are to be randomly arranged in a line. What is the probability that the tallest student will be first in line and the shortest student will be last in line?

28. 080128a, P.I. G.G.58

On the accompanying set of axes, graph  $\Delta ABC$  with coordinates  $A(-1,2)$ ,  $B(0,6)$ , and  $C(5,4)$ . Then graph  $\Delta A'B'C'$ , the image of  $\Delta ABC$  after a dilation of 2.



29. 080129a, P.I. A.N.1

Ramón said that the set of integers is *not* closed for one of the basic operations (addition, subtraction, multiplication, or division). You want to show Ramón that his statement is correct.

For the operation for which the set of integers is *not* closed, write an example using:

- o a positive even integer and a zero
- o a positive and a negative even integer
- o two negative even integers

Be sure to explain why *each* of your examples illustrates that the set of integers is *not* closed for that operation.

30. 080130a, P.I. G.G.63

Shanaya graphed the line represented by the equation  $y = x - 6$ . Write an equation for a line that is parallel to the given line. Write an equation for a line that is perpendicular to the given line. Write an equation for a line that is identical to the given line but has different coefficients.

31. 080131a, P.I. G.G.22

Point  $P$  is located on  $\overrightarrow{AB}$ .

a Describe the locus of points that are

- (1) 3 units from  $\overrightarrow{AB}$
- (2) 5 units from point  $P$

b How many points satisfy both conditions in part a?

32. 080132a, P.I. A.A.7

The ninth graders at a high school are raising money by selling T-shirts and baseball caps. The number of T-shirts sold was three times the number of caps. The profit they received for each T-shirt sold was \$5.00, and the profit on each cap was \$2.50. If the students made a total profit of \$210, how many T-shirts *and* how many caps were sold?

33. 080133a, P.I. A.A.44

A ship on the ocean surface detects a sunken ship on the ocean floor at an angle of depression of  $50^\circ$ . The distance between the ship on the surface and the sunken ship on the ocean floor is 200 meters. If the ocean floor is level in this area, how far above the ocean floor, to the *nearest meter*, is the ship on the surface?

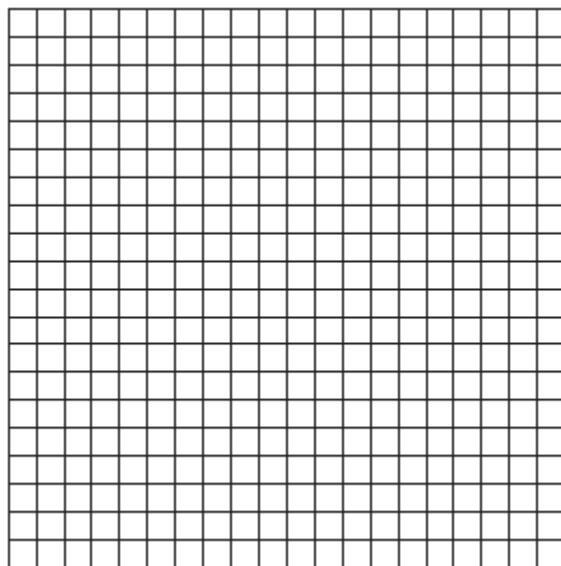
34. 080134a, P.I. A.S.5

The following data consists of the weights, in pounds, of 30 adults:

195, 206, 100, 98, 150, 210, 195, 106, 195,  
168, 180, 212, 104, 195, 100,  
216, 195, 209, 112, 99, 206, 116, 195, 100,  
142, 100, 135, 98, 160, 155

Using the data, complete the accompanying cumulative frequency table and construct a cumulative frequency histogram on the grid below.

Interval	Frequency	Cumulative Frequency
51–100		
101–150		
151–200		
201–250		



35. 080135a, P.I. A.A.11

Solve the following system of equations algebraically:

$$y = x^2 + 4x - 2$$

$$y = 2x + 1$$

- [1] B \_\_\_\_\_
- [2] A \_\_\_\_\_
- [3] D \_\_\_\_\_
- [4] C \_\_\_\_\_
- [5] B \_\_\_\_\_
- [6] A \_\_\_\_\_
- [7] A \_\_\_\_\_
- [8] A \_\_\_\_\_
- [9] A \_\_\_\_\_
- [10] B \_\_\_\_\_
- [11] A \_\_\_\_\_
- [12] D \_\_\_\_\_
- [13] C \_\_\_\_\_
- [14] B \_\_\_\_\_
- [15] A \_\_\_\_\_
- [16] A \_\_\_\_\_
- [17] C \_\_\_\_\_
- [18] D \_\_\_\_\_
- [19] D \_\_\_\_\_
- [20] C \_\_\_\_\_
- [21] [2] 29, and appropriate work is shown, such as  $92 - 63 = 29$ .  
[1] The correct application of the exterior angle theorem is shown, but one or more computational errors are made.  
or [1] The correct application of supplementary angles and the sum of the angles of a triangle are shown, but one or more computational errors are made.  
or [1]  $m\angle BCA$  is calculated incorrectly, but the sum of the angles in a triangle is used appropriately.  
or [1] 29, 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 incorrect procedure.
- 
- [22] [2] 15, and appropriate work is shown, such as using the Pythagorean theorem, Pythagorean triples, or trigonometric functions.  
[1] The data are substituted incorrectly, but an appropriate answer is found and is rounded correctly.  
or [1] Appropriate work is shown, but one or more computational errors are made.  
or [1] 15, 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 incorrect procedure.
- 
- [23] [2]  $4x^2 + 10x + 2$ , and appropriate work is shown, such as  $(9x^2 + 3x - 4) - (5x^2 - 7x - 6)$ .  
[1] The setup is correct, but the distribution of the negative sign is incorrect.  
or [1]  $14x^2 - 4x - 10$ , but appropriate work is shown.  
or [1]  $4x^2 + 10x + 2$ , 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 incorrect procedure.
-

[2]  $6x - 2$  or an equivalent expression, and appropriate work is shown, such as

$$2(2x + 3) + 2(x - 4) = 6x - 2.$$

[1] The length is represented correctly as  $2x + 3$  and the width as  $x - 4$ , but the representation of the perimeter is determined incorrectly.

or [1] The length, the width, and the perimeter are represented appropriately, but by a variable other than  $x$ .

or [1] One or both dimensions are represented incorrectly, but the perimeter is represented appropriately.

[0] One or both dimensions are represented incorrectly, and the perimeter is not determined.

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

---

[24]

[2]  $5rs^2\sqrt{2}$ , and appropriate work is shown.

[1] A partially correct answer is found, such as  $5r\sqrt{2s^4}$  or  $5s^2\sqrt{2r^2}$ , and appropriate work is shown.

or [1]  $7.07rs^2$ , but appropriate work is shown.

or [1]  $5rs^2\sqrt{2}$ , 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 incorrect procedure.

---

[25]

[3] 490, and appropriate work is shown, such as  $7 \cdot 7 \cdot 10$ .

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

or [2] Appropriate work is shown, but an incorrect answer is found, based on an incorrect

number of possible dessert combinations or an incorrect number of soup or appetizer choices.

or [2] Appropriate work is shown, but an incorrect answer is found, based on one error in the tree diagram.

or [2]  $\frac{1}{490}$ , but appropriate work is shown.

[1] 7, 7, and 10 are added instead of multiplied.

or [1] The counting principle is used correctly, but incorrect substitutions are made, but

an appropriate answer is shown.

or [1] 490, 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 incorrect procedure.

---

[26]

- [3]  $\frac{2}{24}$  or an equivalent answer, and an appropriate explanation is given or appropriate work is shown, such as a tree diagram, sample space, or permutations.
- [2] Appropriate work is shown, but one computational error is made.
- or [2] Appropriate work is shown, but only a numerator or a denominator is determined correctly.
- or [2]  $\frac{2}{24}$  or an equivalent answer, but only work for either the numerator or the denominator is shown.
- [1] The probability of the tallest or the probability of the shortest student being in the proper position is correct, such as .
- or [1] Only a tree diagram, sample space, or permutations are shown.
- or [1]  $\frac{2}{24}$  or an equivalent answer, 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 incorrect procedure.
- 
- [27]
- [3]  $\Delta ABC$  and  $\Delta A'B'C'$ ,  $A'(-2,4)$ ,  $B'(0,12)$ ,  $C'(10,8)$ , are graphed correctly.
- [2]  $\Delta ABC$  is graphed correctly, but only two image points are graphed correctly.
- or [2]  $\Delta ABC$  is graphed incorrectly, but  $\Delta A'B'C'$ , is graphed appropriately, based on an incorrect  $\Delta ABC$ .
- [1] Only  $\Delta ABC$  is graphed correctly.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- 
- [28]

- [3] All three examples are illustrated under division correctly, such as  $2 \div 0$ ,  $-2 \div 4$ ,  $-2 \div -4$ , and correct explanations are given.
- [2] Only two of the three examples are illustrated and explained correctly.
- or [2] All three examples are illustrated correctly, but only one explanation is given or is correct.
- or [2] The division examples and explanations are correct, but at most two incorrect examples are also shown, such as examples for addition, subtraction, or multiplication.
- [1] The division examples and explanations are correct, but more than two incorrect examples are shown, such as examples for addition, subtraction, or multiplication.
- or [1] All three examples are illustrated correctly, but no correct explanation is given.
- or [1] Only one correct example with a correct explanation is given.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- 
- [29]

- [3] Three correct equations are shown, such as  $y = x + 7$ ,  $y = -x - 6$ , and  $2y = 2x - 12$ .
- [2] Only two correct equations are shown.
- [1] Only one correct equation 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.
- 
- [30]

- a [3] Two parallel lines, one 3 units above and one 3 units below  $\overline{AB}$ , and a circle with its center at P with a radius of 5 units are described correctly in words or drawn.  
[2] Only one parallel line 3 units above or 3 units below  $\overline{AB}$  and a correct circle are described in words or drawn.  
or [2] Appropriate parallel lines are shown, but the circle is incomplete.  
[1] Both parallel lines and the circle have incomplete descriptions or drawings.  
[0] Only one incomplete locus is described or drawn.
- b [1] 4, and appropriate work is shown.  
or [1] An appropriate answer for an incorrect part a is found.  
a and b [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- 
- [31]

- [4] 36 T-shirts and 12 caps, and appropriate work is shown, such as an appropriate system of equations or a correct trial-and-error method with at least two trials and appropriate checks.  
[3] Appropriate work is shown, but only the correct number of T-shirts or the correct number of caps is determined.  
or [3] One error is made, resulting in an incorrect number of T-shirts or caps, but the corresponding number of the other item is determined appropriately.  
[2] An appropriate method is shown, but no answer is found.  
or [2] The variables are represented correctly, and a correct equation or system of equations is written, but the process is not completed.  
or [2] 36 T-shirts and 12 caps, but only one trial and appropriate checks are shown.  
or [2] The variables are represented correctly, but an incorrect equation is written, but the solution is completed appropriately.  
[1] 36 T-shirts and 12 caps, 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 incorrect procedure.
- 
- [32]

[4] 153, and appropriate work is shown, such as  $\sin 50^\circ = \frac{x}{200}$ .

[3] An appropriate analysis is shown, but one computational or rounding error is made.

[2] An incorrect trigonometric function is

used, such as  $\cos 50^\circ = \frac{x}{200}$ , but it is carried

to an appropriate final answer and is rounded correctly.

[1] An incorrect trigonometric function is used and solved appropriately, but it is rounded incorrectly.

or [1] Only an appropriate diagram is shown.  
or [1] 153, but no work is shown.

[0] Use of the Pythagorean theorem, such as  $200^2 = 50^2 + x^2$ , is shown.

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

[33] obviously incorrect procedure.

[4] Correct cumulative frequencies of 7, 14, 24, and 30 and a fully labeled correct histogram are shown.

[3] Incorrect cumulative frequencies are shown, but the histogram is appropriate for the data.

or [3] Correct cumulative frequencies are shown, but a partially incorrect histogram is shown, such as the axes not being labeled, having nonequal intervals, or the x-axis starting at 50.

[2] Only a frequency histogram is completed correctly.

or [2] Only a correct cumulative frequency table and a correct bar graph are shown.

[1] An appropriate bar graph is shown, but it is based on frequencies, not the cumulative frequency.

or [1] Only a correct cumulative frequency table 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.

[4]  $(-3, -5)$  and  $(1, 3)$ , and appropriate algebraic work is shown.

[3] Appropriate algebraic work is shown, but  $x = -3$  and  $x = 1$  are given as the solution.

or [3] Appropriate algebraic work is shown, but only one correct solution is given, such as  $(1, 3)$ .

[2]  $(-3, -5)$  and  $(1, 3)$ , but a graphic solution is shown.

or [2] Correct substitution and an algebraic equation set equal to zero are shown, but the result is not factored, such as  $x^2 + 2x - 3 = 0$ .  
[1] Any correct substitution is shown, such as  $2x + 1 = x^2 + 3x - 2$ .

or [1]  $(-3, -5)$  and  $(1, 3)$ , but no algebraic 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.