1. 010201a, P.I. A.A.19

Expressed in factored form, the binomial $4a^2 - 9b^2$ is equivalent to

[A] $(2a - 9b)(2a + b)$

[B] $(2a + 3b)(2a - 3b)$

[C] $(2a - 3b)(2a - 3b)$

[D] $(4a - 3b)(a + 3b)$

2. 010202a, P.I. A.A.45

If the length of the legs of a right triangle are 5 and 7, what is the length of the hypotenuse?

[A] $2\sqrt{6}$ [B] $2\sqrt{3}$

[C] $\sqrt{2}$ [D] $\sqrt{74}$

3. 010203a, P.I. A.A.37

What is the slope of the line whose equation is $2y = 5x + 4$?

[A] 2   [B] $\dfrac{5}{2}$ [C] 5   [D] $\dfrac{2}{5}$

4. 010204a, P.I. A.A.22

What is the value of x in the equation $\dfrac{3}{4}x + 2 = \dfrac{5}{4}x - 6$?

[A] 4   [B] -16   [C] 16   [D] -4

5. 010205a, P.I. A.A.12

The product of $3x^2y$ and $-4xy^3$ is

[A] $12x^3y^4$ [B] $-12x^3y^4$

[C] $-12x^2y^3$ [D] $12x^2y^3$

6. 010206a, P.I. 7.N.5

The approximate number of seconds in a year is 32,000,000. When this number is written in scientific notation, the numerical value of the exponent is

[A] 8   [B] 7   [C] 6   [D] -7

7. 010207a, P.I. A.N.1

Which expression must be added to $3x - 7$ to equal 0?

[A] $-3x - 7$ [B] $-3x + 7$

[C] 0   [D] $3x + 7$

8. 010208a

What is the greatest possible number of points of intersection of a triangle and a circle?

[A] 4   [B] 3   [C] 2   [D] 6

9. 010209a, P.I. A.S.20

A fair coin is tossed three times. What is the probability that the coin will land tails up on the second toss?

[A] $\dfrac{2}{3}$ [B] $\dfrac{1}{3}$ [C] $\dfrac{1}{2}$ [D] $\dfrac{3}{4}$

10. 010210a, P.I. A.A.26

There are 357 seniors in Harris High School. The ratio of boys to girls is 7:10. How many boys are in the senior class?

[A] 147   [B] 210   [C] 107   [D] 117

11. 010211a, P.I. 7.A.10

If x and y are defined as indicated by the accompanying table, which equation correctly represents the relationship between x and y?

x	y
2	1
3	3
5	7
7	11

[A] $y = 2x + 3$ [B] $y = x + 2$

[C] $y = 2x + 2$ [D] $y = 2x - 3$

12. 010212a, P.I. A.G.1

What is the area of a square whose perimeter is represented by $12x$?

[A] $6x\sqrt{2}$ [B] $9x^2$

[C] $144x^2$ [D] $12x^2$

13. 010213a, P.I. 7.N.3

Which inequality is true if $x = \dfrac{3.04}{1.48}$, $y = 1.99 + 0.33$, and $z = (1.3)^3$?

[A] $x < y < z$ [B] $y < z < x$

[C] $y < x < z$ [D] $x < z < y$

14. 010214a

Frank, George, and Hernando are a plumber, a cabinet maker, and an electrician, though not necessarily in that order. Each can do all work appropriate to his own field, but no work in other fields. Frank was not able to install a new electric line in his home. Hernando was not able to make cabinets. George is also a building contractor who hired one of the other people to do his electrical work. Which statement must be true?

[A] Hernando is an electrician.

[B] George is a cabinet maker.

[C] Frank is an electrician.

[D] Frank is a plumber.

15. 010215a, P.I. A.A.27

What is the solution set of the equation $3x^2 = 48$?

[A] {2,8}   [B] {4,4}

[C] {4,-4}   [D] {-2,-8}

16. 010216a, P.I. G.G.36

In the accompanying diagram, $\overleftrightarrow{ABCD}$ is a straight line, and angle E in triangle BEC is a right angle.

What does $a° + d°$ equal?

[A] 270°   [B] 180°

[C] 135°   [D] 160°

17. 010217a, P.I. A.N.1
Which set is closed under division?

[A] integers   [B] whole numbers

[C] {1}   [D] counting numbers

18. 010218a
When Kimberly bought her new car, she found that there were 72 different ways her car could be equipped. Her choices included four choices of engine and three choices of transmission. If her only other choice was color, how many choices of color did she have?

[A] 60   [B] 12   [C] 65   [D] 6

19. 010219a, P.I. 7.N.2
Which is an irrational number?

[A] $\sqrt{9}$ [B] $\sqrt{3}$ [C] 3.14   [D] $\dfrac{3}{4}$

20. 010220a, P.I. G.G.26
Which statement is logically equivalent to "If the team has a good pitcher, then the team has a good season"?

[A] The team has a good pitcher and the team does not have a good season.

[B] If the team has a good season, then the team has a good pitcher.

[C] If the team does not have a good pitcher, then the team does not have a good season.

[D] If the team does not have a good season, then the team does not have a good pitcher.

21. 010221a, P.I. G.G.25
Seth is thinking of a number between 20 and 30. The number is prime and not more than 2 away from a perfect square. What is the number?

22. 010222a, P.I. A.A.26
A 12-foot tree casts a 16-foot shadow. How many feet tall is a nearby tree that casts a 20-foot shadow at the same time?

23. 010223a, P.I. G.G.30
Vertex angle A of isosceles triangle ABC measures 20° more than three times $m\angle B$. Find $m\angle C$.

24. 010224a, P.I. A.A.1
Ashanti and Maria went to the store to buy snacks for their back-to-school party. They bought bags of chips, pretzels, and nachos. They bought three times as many bags of pretzels as bags of chips, and two fewer bags of nachos than bags of pretzels. If x represents the number of bags of chips they bought, express, in terms of x, how many bags of snacks they bought in all.

25. 010225a
Construct a triangle with sides of lengths a, b, and c, as shown below. Be sure the longest side of your triangle lies on $\overline{PQ}$ and that point P is one of the triangle's vertices. [*Show all arcs necessary for a valid construction.*]

a ———————
b ———————
c ———————————

P •————————————————————————• Q

26. 010226a, P.I. G.G.67

Jerry and Jean Jogger start at the same time from point A shown on the accompanying set of axes. Jerry jogs at a rate of 5 miles per hour traveling from point A to point R to point S and then to point C. Jean jogs directly from point A to point C on $\overline{AC}$ at the rate of 3 miles per hour. Which jogger reaches point C first? Explain or show your reasoning.
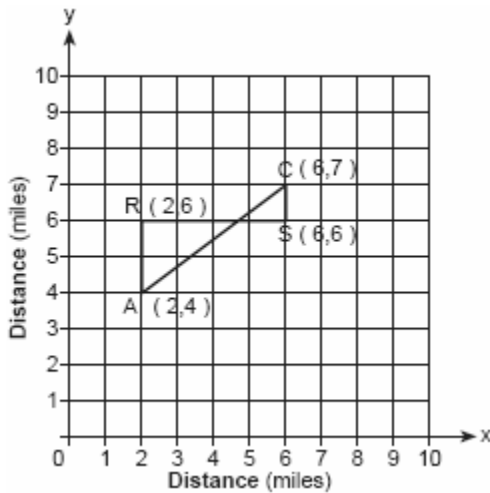
27. 010227a, P.I. A.G.2

In the accompanying diagram, a rectangular container with the dimensions 10 inches by 15 inches by 20 inches is to be filled with water, using a cylindrical cup whose radius is 2 inches and whose height is 5 inches. What is the maximum number of full cups of water that can be placed into the container without the water overflowing the container?
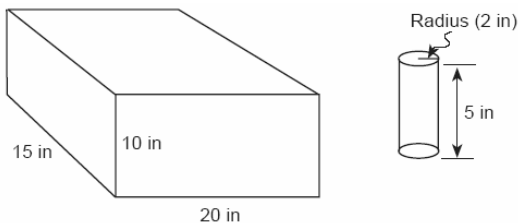
28. 010228a, P.I. A.A.7

A total of 600 tickets were sold for a concert. Twice as many tickets were sold in advance than were sold at the door. If the tickets sold in advance cost $25 each and the tickets sold at the door cost $32 each, how much money was collected for the concert?

29. 010229a, P.I. 8.G.1

In the accompanying diagram, $\overline{AB}$ and $\overline{CD}$ intersect at E. If $m\angle AEC = 4x - 40$ and $m\angle BED = x + 50$, find the number of degrees in $\angle AEC$.
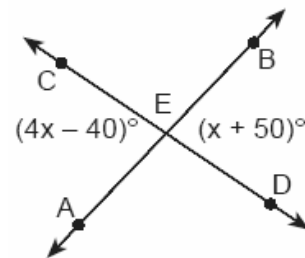

30. 010230a, P.I. A.A.6

The students in Woodland High School's meteorology class measured the noon temperature every schoolday for a week. Their readings for the first 4 days were Monday, 56°; Tuesday, 72°; Wednesday, 67°; and Thursday, 61°. If the mean (average) temperature for the 5 days was exactly 63°, what was the temperature on Friday?

31. 010231a, P.I. A2.S.13

A square dartboard is represented in the accompanying diagram. The entire dartboard is the first quadrant from $x = 0$ to 6 and from $y = 0$ to 6. A triangular region on the dartboard is enclosed by the graphs of the equations $y = 2$, $x = 6$, and $y = x$. Find the probability that a dart that randomly hits the dartboard will land in the triangular region formed by the three lines.
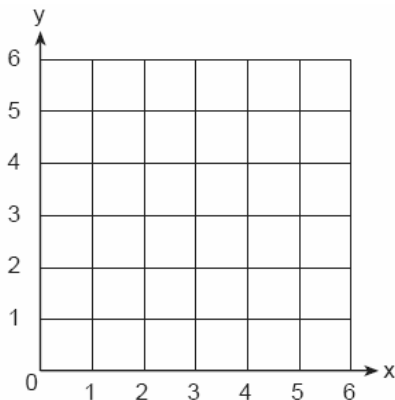

32. 010232a, P.I. A.A.7

When Tony received his weekly allowance, he decided to purchase candy bars for all his friends. Tony bought three Milk Chocolate bars and four Creamy Nougat bars, which cost a total of $4.25 without tax. Then he realized this candy would not be enough for all his friends, so he returned to the store and bought an additional six Milk Chocolate bars and four Creamy Nougat bars, which cost a total of $6.50 without tax. How much did *each* type of candy bar cost?

33. 010233a, P.I. A.A.8

Javon's homework is to determine the dimensions of his rectangular backyard. He knows that the length is 10 feet more than the width, and the total area is 144 square feet. Write an equation that Javon could use to solve this problem. Then find the dimensions, in feet, of his backyard.

34. 010234a, P.I. A.G.7

A company manufactures bicycles and skateboards. The company's daily production of bicycles cannot exceed 10, and its daily production of skateboards must be less than or equal to 12. The combined number of bicycles and skateboards cannot be more than 16. If x is the number of bicycles and y is the number of skateboards, graph on the accompanying set of axes the region that contains the number of bicycles and skateboards the company can manufacture daily.
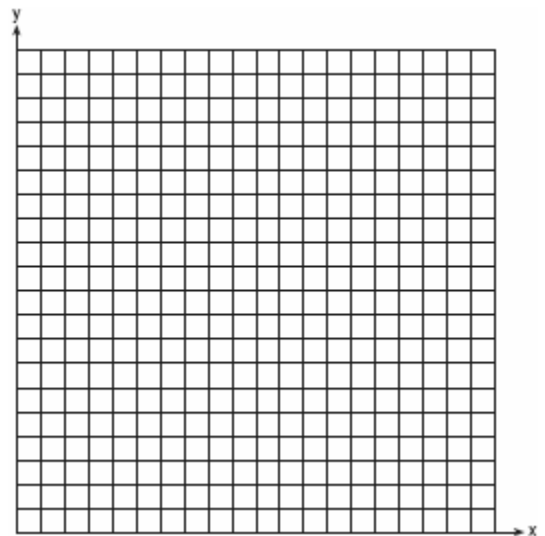
35. 010235a, P.I. A.A.44

Draw and label a diagram of the path of an airplane climbing at an angle of 11° with the ground. Find, to the *nearest foot*, the ground distance the airplane has traveled when it has attained an altitude of 400 feet.

[1] B

[2] D

[3] B

[4] C

[5] B

[6] B

[7] B

[8] D

[9] C

[10] A

[11] D

[12] B

[13] D

[14] A

[15] C

[16] A

[17] C

[18] D

[19] B

[20] D

[2] 23, and appropriate work is shown.
[1] Appropriate work is shown, but no answer or an incorrect answer is found.
or [1] 23, 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
[21] incorrect procedure.

[2] 15, and any equivalent proportion, equation, or fraction conversion is shown, such as $\dfrac{12}{16} = \dfrac{x}{20}$.
[1] An appropriate proportion, equation, or fraction conversion is shown, but one computational or conceptual error is made.
or [1] An incorrect proportion, equation, or fraction conversion is shown, but an appropriate answer is found for the incorrect proportion.
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
[22] incorrect procedure.

[2] 32, and appropriate work is shown, such as a diagram or "let" statements and an appropriate equation, such as $5x + 20 = 180$.
or [2] 32, and an appropriate trial-and-error method with at least two trials and appropriate checks are shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] An incorrect equation set equal to 180° is shown, but it is solved appropriately, such as $4x + 20 = 180$; or an incorrect equation set equal to 360° is shown, such as $5x + 20 = 360$.
or [1] 32, and an appropriate trial-and-error method with less than two trials and appropriate checks are shown.
or [1] 32, 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
[23] incorrect procedure.

[2] 7x - 2 or x + 3x + 3x - 2, and appropriate work is shown, such as x + 3x + 3x - 2 when chips = x, pretzels = 3x, and nachos = 3x - 2.
[1] The expressions for snacks are represented correctly, but one computational error is made in adding the expressions.
or [1] The expressions for snacks are represented incorrectly, but the expressions are added appropriately.
or [1] 7x- 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
[24] incorrect procedure.

[2] A correct triangle with the longest side on $\overline{PQ}$ and a vertex at P is drawn, and three appropriate arcs are shown.
[1] A correct triangle is constructed on $\overline{PQ}$, but P is not a vertex.
or [1] A correct triangle is constructed with no sides on $\overline{PQ}$.
[0] A triangle that is not congruent to the correct solution or a triangle with less than three arcs is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[25] obviously incorrect procedure.

[3] Jerry, and appropriate work is shown, such as the following explanation: Jerry traveled 7 miles at a rate of 5 miles per hour and his time was $1\frac{2}{5}$ hours; Jean traveled 5 miles at a rate of 3 miles per hour for a time of $1\frac{2}{3}$ hours.
[2] The time for each jogger is calculated appropriately, but an error is made in determining one of the distances, but an appropriate answer is found.
or [2] The time for each jogger is calculated correctly, but the question of which person reached C first is not answered.
or [2] Both distances are calculated correctly, but an error is made in determining times, but an appropriate answer is found.
[1] Only the distances are calculated correctly. No answer to the question is found or an answer is found based on distance only.
or [1] The time for only one jogger is calculated correctly, and the question of which person reached C first is not answered.
or [1] The time for both joggers is calculated appropriately, but multiple computational errors are made.
or [1] Jerry and $1\frac{2}{5}$ hours and $1\frac{2}{3}$ hours, but no work is shown.
[0] Jerry, 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
[26] obviously incorrect procedure.

[3] 47, and appropriate work is shown.
[2] Appropriate work is shown, but one computational or rounding error is made.
or [2] The correct numerical value of the volume of the cup (20π or its equivalent) and the volume of the tank (3,000) are shown, but the solution is not completed.
[1] The correct volume of only the cup or only the tub is shown.
or [1] 47, 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

[27] incorrect procedure.

[3] $16,400, and appropriate work is shown, such as
200 tickets sold at the door $32 = $ 6,400
400 tickets sold in advance $25 = $10,000
$16,400
[2] The correct number of tickets is shown, but one computational error is made in computing the total amount of money collected.
or [2] $6,400 and $10,000 are calculated correctly, but they are not added to obtain the total.
[1] The numbers of tickets, 200 and 400, are calculated correctly.
or [1] An appropriate solution is found, but it is based on incorrect numbers of tickets.
or [1] $16,400, 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

[28] incorrect procedure.

[3] 80, and appropriate work is shown.
[2] $x = 30$ is shown, but the student fails to substitute to find $m\angle AEC$.
or [2] $x = 30$ is shown, but the student states that the answer is $100°$, by finding the supplement of $\angle AEC$.
or [2] The student makes one computational error in the solution of the correct equation $4x - 40 = x + 50$ but appropriately substitutes the incorrect value to solve for $m\angle AEC$.
[1] The student makes one computational error in the solution of the correct equation $4x - 40 = x + 50$ and fails to substitute to find $m\angle AEC$.
or [1] The student makes more than one computational error in the solution of the correct equation $4x - 40 = x + 50$, but appropriately substitutes the incorrect value to solve for $m\angle AEC$.
or [1] 80, 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

[29] incorrect procedure.

[3] 59 or 59º, and appropriate work is shown, such as $63 = \dfrac{256 + x}{5}$ or
$56 + 72 + 67 + 61 = 256$, $63 \times 5 = 315$, and $315 - 256 = 59$.
[2] Appropriate work is shown, but one computational error is made.
or [2] A value is chosen for Friday's temperature that rounds to 63, such as 57 or 61,
but whose mean is not exactly 63, and appropriate work is shown.
[1] A limited understanding of the concept of the mean is shown, such as the sum of the temperatures must be 315, but the given temperatures are not subtracted.
or [1] The correct mean of the four given temperatures is calculated.
or [1] 59 or 59º, 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

[30] incorrect procedure.

[4] $\dfrac{8}{36}$ or $\dfrac{2}{9}$ or 2:9, and all three lines are
graphed correctly and the triangle's area is
shown to be 8 and the square's area is shown
to be 36.
[3] The three lines are graphed correctly, but
one area is incorrect, but the probability is
appropriate, based on this error.
or [3] The graphs and areas are correct, but
the probability is incorrect, based on one
computational error.
or [3] The three lines are graphed correctly
and both areas are calculated correctly, but
the probability is not found.
or [3] One equation is graphed incorrectly,
but the area is appropriate, based on the
graph, and the probability is appropriate,
based on the areas.
[2] The three lines are graphed correctly, but
the area of the smaller triangle is used, but the
probability is appropriate, such as $\dfrac{2}{36}$.
or [2] Two or three lines are graphed
incorrectly, but the areas and the probability
are appropriate.
or [2] The lines are graphed correctly, but the
areas are incorrect, but the probability is
appropriate, based on the errors.
[1] All graphs and the areas are incorrect, but
the probability is appropriate.
or [1] $\dfrac{8}{36}$ or $\dfrac{2}{9}$ or 2:9, 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
[31]   incorrect procedure.
_____

[4] Milk Chocolate bar = $0.75 and Creamy
Nougat bar = $0.50, and appropriate work is
shown, such as equations, a trial-and-error
method with at least two trials and
appropriate checks, or an algebraic or graphic
solution.
[3] Appropriate work is shown, but one
computational error is made.
[2] The cost of one candy bar is determined
correctly with appropriate work shown, but
no attempt is made to find the cost of the
other candy bar.
or [2] Appropriate work is shown, but more
than one computational error is made.
[1] Appropriate work is shown, but no answer
is found.
or [1] Milk Chocolate bar = $0.75 and
Creamy Nougat bar = $0.50, 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
[32]   incorrect procedure.
_____

[4] $x(x+10) = 144$ or an equivalent equation
and 8 = width and 18 = length, and
appropriate work is shown.
[3] Appropriate work is shown, but one
computational error is made.
or [3] A correct equation is used and a correct
solution is found, but only one dimension is
identified.
[2] An appropriate solution is found to an
incorrect equation of equal difficulty.
or [2] A correct equation set equal to zero is
shown, with no further work or incorrect
work.
[1] A conceptual error is made, such as
writing the equation $2x+2(x+10) = 144$, but
the dimensions are found appropriately.
or [1] $x(x+10) = 144$ and 8 = width and 18 =
length, 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
[33]   incorrect procedure.
_____

[4] The inequalities $x \leq 10$, $y \leq 12$, and $x + y \leq 16$ are graphed and shaded correctly on the given set of axes.
[3] All inequalities are graphed and shaded correctly, but one incorrect type of line (dashed or broken) is used.
or [3] All three inequalities are graphed correctly, but one inequality is not shaded or is shaded incorrectly.
or [3] The inequality $x + y \leq 16$ is graphed correctly, but an error is made in graphing either the horizontal or vertical line, but they are shaded appropriately.
or [3] Only two of the three inequalities are graphed correctly, but all three are shaded appropriately.
[2] All three inequalities are graphed correctly, but two are shaded incorrectly.
or [2] Only two of the three inequalities are graphed and shaded correctly.
[1] Only one of the three inequalities is graphed and shaded correctly.
[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] 2,058, and appropriate work is shown, such as the accompanying diagram and equation.

$\tan 11° = \dfrac{400}{x}$

[3] Appropriate work is shown, including a correct diagram and the use of the tangent function, but one computational error is made.
or [3] Appropriate work is shown, including a correct diagram and the use of the tangent function, but the answer is not rounded or is rounded incorrectly.
[2] A correct diagram is drawn, but an incorrect trigonometric function is selected, but it is solved and rounded appropriately.
or [2] A correct diagram is drawn and the tangent function is selected, but no further work is shown.
or [2] An incorrect diagram is drawn, but the appropriate trigonometric function, based on the drawing, is selected, solved, and rounded appropriately.
[1] An incorrect diagram is drawn and an incorrect trigonometric function is selected, but it is solved and rounded appropriately.
or [1] Only a correct diagram is drawn.
or [1] 2,058, 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.