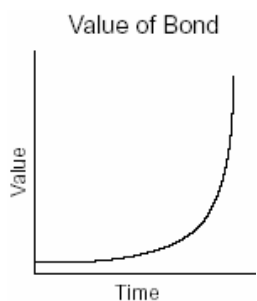


1. 010201b, P.I. A2.A.2
The roots of a quadratic equation are real, rational, and equal when the discriminant is
[A] -2 [B] 4 [C] 0 [D] 2
2. 010202b, P.I. A.G.1
Chad had a garden that was in the shape of a rectangle. Its length was twice its width. He decided to make a new garden that was 2 feet longer and 2 feet wider than his first garden. If x represents the original width of the garden, which expression represents the difference between the area of his new garden and the area of the original garden?
[A] 8 [B] $6x + 4$
[C] $x^2 + 3x + 2$ [D] $2x^2$
3. 010203b, P.I. A.G.4
The accompanying graph represents the value of a bond over time.



Which type of function does this graph best model?

- [A] trigonometric [B] quadratic
[C] logarithmic [D] exponential

4. 010204b, P.I. A2.A.69
An object that weighs 2 pounds is suspended in a liquid. When the object is depressed 3 feet from its equilibrium point, it will oscillate according to the formula $x = 3\cos(8t)$, where t is the number of seconds after the object is released. How many seconds are in the period of oscillation?
[A] 2π [B] 3 [C] $\frac{\pi}{4}$ [D] π
5. 010205b, P.I. A2.A.56
If θ is an angle in standard position and its terminal side passes through the point $(\frac{1}{2}, \frac{\sqrt{3}}{2})$ on a unit circle, a possible value of θ is
[A] 150° [B] 30° [C] 60° [D] 120°
6. 010206b, P.I. A2.A.17
The expression $\frac{\frac{a}{1} - \frac{b}{1}}{\frac{1}{a} + \frac{1}{b}}$ is equivalent to
[A] $a + b$ [B] ab
[C] $\frac{a-b}{ab}$ [D] $a - b$
7. 010207b, P.I. A2.A.42
If $f(x) = 5x^2$ and $g(x) = \sqrt{2x}$, what is the value of $(f \circ g)(8)$?
[A] $8\sqrt{10}$ [B] 1,280 [C] 16 [D] 80
8. 010208b, P.I. A2.A.19
Which expression is *not* equivalent to $\log_b 36$?
[A] $\log_b 72 - \log_b 2$ [B] $2\log_b 6$
[C] $6\log_b 2$ [D] $\log_b 9 + \log_b 4$

9. 010209b, P.I. A2.A.44

If a function is defined by the equation $y = 3x + 2$, which equation defines the inverse of this function?

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

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

10. 010210b, P.I. G.G.61

Which transformation is *not* an isometry?

[A] D_2 [B] $r_{y=x}$ [C] $R_{0,90^\circ}$ [D] $T_{3,6}$

11. 010211b, P.I. A2.A.38

Which relation is a function?

[A] $x = 4$ [B] $x = y^2 + 1$

[C] $x^2 + y^2 = 16$ [D] $y = \sin x$

12. 010212b, P.I. A2.A.73

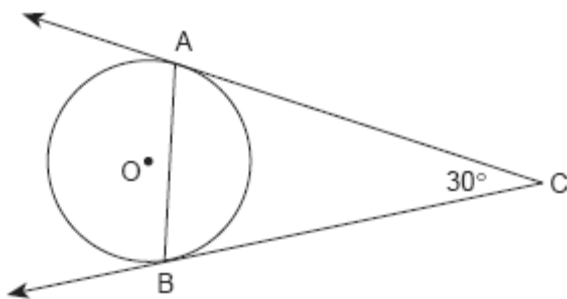
In $\triangle ABC$, $m\angle A = 33$, $a = 12$, and $b = 15$.

What is $m\angle B$ to the nearest degree?

[A] 41 [B] 48 [C] 43 [D] 44

13. 010213b, P.I. G.G.50

The accompanying diagram represents circular pond O with docks located at points A and B . From a cabin located at C , two sightings are taken that determine an angle of 30° for tangents \overline{CA} and \overline{CB} .

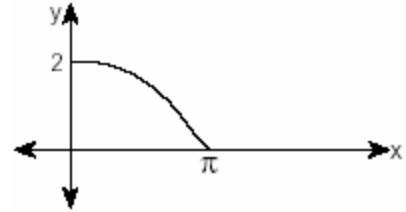


What is $m\angle CAB$?

[A] 150 [B] 75 [C] 30 [D] 60

14. 010214b, P.I. A2.A.72

The accompanying diagram shows a section of a sound wave as displayed on an oscilloscope.



Which equation could represent this graph?

[A] $y = 2 \cos \frac{x}{2}$ [B] $y = 2 \sin \frac{x}{2}$

[C] $y = \frac{1}{2} \cos 2x$ [D] $y = \frac{1}{2} \sin \frac{\pi}{2} x$

15. 010215b, P.I. A.G.1

Every time the pedals go through a 360° rotation on a certain bicycle, the tires rotate three times. If the tires are 24 inches in diameter, what is the minimum number of complete rotations of the pedals needed for the bicycle to travel at least 1 mile?

[A] 12 [B] 561 [C] 281 [D] 5,280

16. 010216b

Which type of symmetry does the equation $y = \cos x$ have?

[A] line symmetry with respect to the x -axis

[B] line symmetry with respect to $y = x$

[C] point symmetry with respect to $(\frac{\pi}{2}, 0)$

[D] point symmetry with respect to the origin

17. 010217b, P.I. A2.N.1

The value of $(\frac{3^0}{-\frac{2}{27}})^{-1}$ is

[A] -9 [B] 9 [C] $\frac{1}{9}$ [D] $-\frac{1}{9}$

18. 010218b, P.I. A2.A.39

What is the domain of $h(x) = \sqrt{x^2 - 4x - 5}$?

- [A] $\{x \mid x \geq 5 \text{ or } x \leq -1\}$
[B] $\{x \mid -1 \leq x \leq 5\}$ [C] $\{x \mid -5 \leq x \leq 1\}$
[D] $\{x \mid x \geq 1 \text{ or } x \leq -5\}$

19. 010219b, P.I. A2.N.9

The expression $(-1+i)^3$ is equivalent to

- [A] $-2 - 2i$ [B] $-1 - i$
[C] $-3i$ [D] $2 + 2i$

20. 010220b, P.I. A.A.6

The revenue, $R(x)$, from selling x units of a product is represented by the equation $R(x) = 35x$, while the total cost, $C(x)$, of making x units of the product is represented by the equation $C(x) = 20x + 500$. The total profit, $P(x)$, is represented by the equation $P(x) = R(x) - C(x)$. For the values of $R(x)$ and $C(x)$ given above, what is $P(x)$?

- [A] $10x + 100$ [B] $15x + 500$
[C] $15x - 500$ [D] $15x$

21. 010221b

Explain how a person can determine if a set of data represents inverse variation and give an example using a table of values.

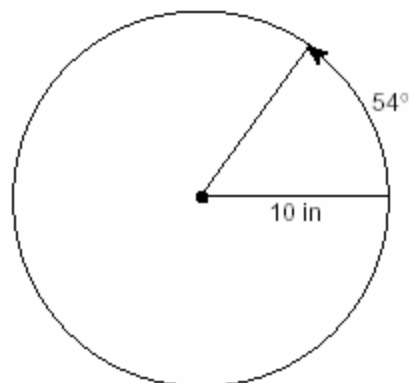
22. 010222b, P.I. A2.A.25

Solve for x in simplest $a + bi$ form:

$$x^2 + 8x + 25 = 0$$

23. 010223b, P.I. A2.A.61

A ball is rolling in a circular path that has a radius of 10 inches, as shown in the accompanying diagram. What distance has the ball rolled when the subtended arc is 54° ? Express your answer to the *nearest hundredth of an inch*.

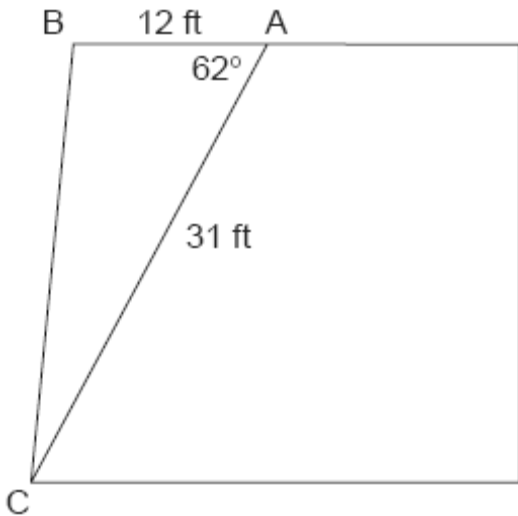


24. 010224b, P.I. A2.A.23

A rectangle is said to have a golden ratio when $\frac{w}{h} = \frac{h}{w-h}$, where w represents width and h represents height. When $w = 3$, between which two consecutive integers will h lie?

25. 010225b, P.I. A2.A.73

The accompanying diagram shows the floor plan for a kitchen. The owners plan to carpet all of the kitchen except the "work space," which is represented by scalene triangle ABC . Find the area of this work space to the *nearest tenth of a square foot*.

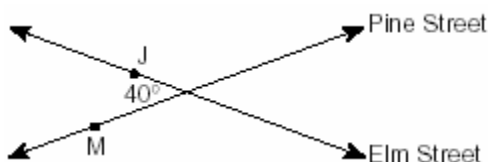


26. 010226b, P.I. A2.S.5

A set of normally distributed student test scores has a mean of 80 and a standard deviation of 4. Determine the probability that a randomly selected score will be between 74 and 82.

27. 010227b, P.I. A2.A.73

Two straight roads, Elm Street and Pine Street, intersect creating a 40° angle, as shown in the accompanying diagram. John's house (J) is on Elm Street and is 3.2 miles from the point of intersection. Mary's house (M) is on Pine Street and is 5.6 miles from the intersection. Find, to the *nearest tenth of a mile*, the direct distance between the two houses.



28. 010228b, P.I. A.A.7

At the local video rental store, José rents two movies and three games for a total of \$15.50. At the same time, Meg rents three movies and one game for a total of \$12.05. How much money is needed to rent a combination of one game and one movie?

29. 010229b, P.I. A2.S.15

Team A and team B are playing in a league. They will play each other five times. If the probability that team A wins a game is $\frac{1}{3}$, what is the probability that team A will win *at least* three of the five games?

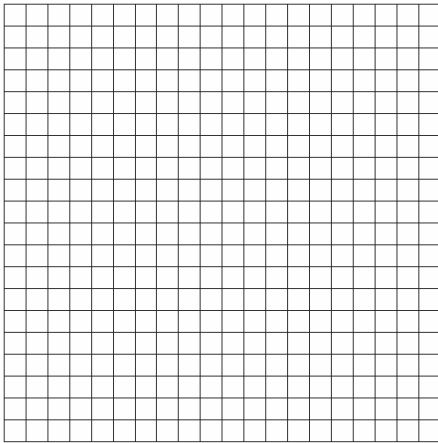
30. 010230b, P.I. A2.A.27

Depreciation (the decline in cash value) on a car can be determined by the formula $V = C(1 - r)^t$, where V is the value of the car after t years, C is the original cost, and r is the rate of depreciation. If a car's cost, when new, is \$15,000, the rate of depreciation is 30%, and the value of the car now is \$3,000, how old is the car to the *nearest tenth of a year*?

31. 010231b, P.I. A2.A.4

When a baseball is hit by a batter, the height of the ball, $h(t)$, at time t , $t \geq 0$, is determined by the equation $h(t) = -16t^2 + 64t + 4$. For which interval of time is the height of the ball greater than or equal to 52 feet?

32. 010232b, P.I. G.G.61
 a On the accompanying grid, graph the equation $2y = 2x^2 - 4$ in the interval $-3 \leq x \leq 3$ and label it a .
 b On the same grid, sketch the image of a under $T_{5,-2} \circ r_{x\text{-axis}}$ and label it b .

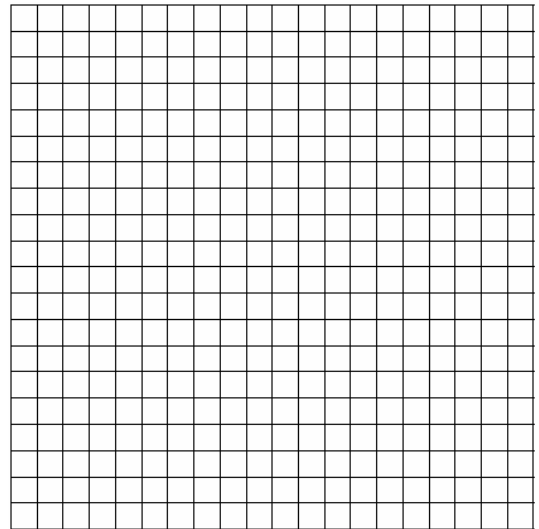


33. 010233b, P.I. G.G.27
 Prove that the diagonals of a parallelogram bisect each other.

34. 010234b, P.I. A2.S.7
 Two different tests were designed to measure understanding of a topic. The two tests were given to ten students with the following results:

Test x	75	78	88	92	95	67	58	72	74	81
Test y	81	73	85	88	89	73	66	75	70	78

Construct a scatter plot for these scores, and then write an equation for the line of best fit (round slope and intercept to the *nearest hundredth*).



Find the correlation coefficient.
 Predict the score, to the *nearest integer*, on test y for a student who scored 87 on test x .

- [1] C
- [2] B
- [3] D
- [4] C
- [5] C
- [6] D
- [7] D
- [8] C
- [9] B
- [10] A
- [11] D
- [12] C
- [13] B
- [14] A
- [15] C
- [16] C
- [17] B
- [18] A
- [19] D
- [20] C

- [2] An explanation is given that indicates that a set of data can represent inverse variation if the product of two variables is constant, and a correct table of values is shown.
- [1] The rule for direct rather than inverse variation is stated, but an appropriate equation and table of values are shown.
- or [1] An example of inverse variation is shown, but no explanation of why it is an inverse variation is given.
- or [1] An explanation is given that indicates that a set of data can represent inverse variation, but no table of values 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.
-
- [21]
- [2] $-4 \pm 3i$, and appropriate work is shown.
- [1] The quadratic formula is used correctly, but one computational error is made.
- or [1] $\frac{-8 \pm 6i}{2}$, but appropriate work is shown.
- or [1] $-4 \pm 3i$, 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] 9.42, and appropriate work is shown, such as changing the angle to radians and finding s .
- [1] The formula $s = \theta r$ is stated, but 54° is not converted to radian measure.
- or [1] Appropriate work is shown, but one computational or rounding error is made.
- or [1] 9.42, 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] 1 and 2, $1 < h < 2$, or $1 < 1.854 < 2$, and appropriate work is shown.

[1] $\frac{3}{h} = \frac{h}{3-h}$ is shown, but one

computational error is made.

or [1] The positive root, 1.854, is obtained from the quadratic, but the two correct consecutive integers are not stated.

or [1] 1 and 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] 164.2, and appropriate work is shown.

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

or [1] 164.2, 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

[25] incorrect procedure.

[2] 0.624 or 62.4%, and appropriate work is shown.

[1] The correct standard deviations of -1.5 and +0.5 are found, but an incorrect probability is calculated.

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

or [1] 0.624 or 62.4%, 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

[26] incorrect procedure.

[4] 3.8, and the Law of Cosines is used.

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

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

or [2] The Law of Cosines is shown, but sine is used instead of cosine, such as

$x^2 = 3.2^2 + 5.6^2 - 2(3.2)(5.6)(\sin 40)$, but an appropriate answer is determined, based on that error.

[1] Substitution into the Law of Cosines is used, but no further work is shown.

or [1] 3.8, 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.

[4] \$6.15, and appropriate work is shown, such as solving simultaneous equations or using a trial-and-error method.

[3] \$2.95 (movie) and \$3.20 (game) are found, but they are not added.

or [3] Appropriate work is shown, but one computational error is made.

[2] The system of equations is set up correctly, but one conceptual error leads to an appropriate solution.

or [2] \$2.95 (movie) or \$3.20 (game), and appropriate work is shown.

[1] \$6.15, 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

[28] incorrect procedure.

- [4] $\frac{51}{243}$, and appropriate work is shown.
- [3] Appropriate work is shown, but one computational error is made.
- [2] Appropriate work is shown, but the probabilities for the teams are switched.
- or [2] Correct substitution is made, but no further work is shown.
- or [2] Correct substitution is made, but an incorrect mathematical operation is used, such as multiplication instead of addition.
- or [2] The probability for “at most three” or “more than 3” is found, but appropriate work is shown.
- [1] $\frac{40}{243}$, and exactly three games are shown.
- or [1] $\frac{51}{243}$, 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.
-
- [29] [4] 4.5, and appropriate work is shown, such as using logs to solve the equation $0.2 = 0.7^t$.
- [3] Appropriate work is shown, but one computational or rounding error is made.
- [2] Substitution with $r = 30$ is shown and the log of both sides is determined, but the domain error is not recognized, such as $\log 0.2 = t \log(-29)$.
- or [2] The order of operations is used incorrectly and an exponential function is maintained, but t is solved for appropriately, using logs.
- [1] Substitution with $r = 0.3$ is shown, resulting in $0.2 = 0.7^t$, but no further work is shown.
- or [1] 4.5, 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.
-
- [30] [4] $1 \leq t \leq 3$, and appropriate work is shown, such as $-16t^2 + 64t + 4 \geq 52$.
- [3] Appropriate work is shown, but one computational error is made.
- or [3] An incorrect inequality is written, but the resulting quadratic inequality is solved appropriately.
- [2] Appropriate work is shown, but more than one computational error is made.
- or [2] The quadratic equation $-16t^2 + 64t + 4 = 52$ is solved appropriately, and both solutions are found.
- [1] An incorrect quadratic equation of equal difficulty is solved appropriately, but one computational error is made.
- or [1] $1 \leq t \leq 3$, 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.
-
- [31] a [2] The equation $2y = 2x^2 - 4$ is graphed correctly over the required interval and labeled.
- [1] An appropriate graph is shown, but less than the required interval is drawn.
- or [1] An appropriate graph is shown, but one coordinate is calculated incorrectly.
- b [2] A correct composition of transformations of the graph drawn in part a is sketched and labeled.
- [1] Only one of the transformations is correct.
- or [1] The composition of transformations is correct, but done in reverse order.
- 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.
-
- [32] [4] $1 \leq t \leq 3$, and appropriate work is shown, such as $-16t^2 + 64t + 4 \geq 52$.
- [3] Appropriate work is shown, but one computational error is made.
- or [3] An incorrect inequality is written, but the resulting quadratic inequality is solved appropriately.
- [2] Appropriate work is shown, but more than one computational error is made.
- or [2] The quadratic equation $-16t^2 + 64t + 4 = 52$ is solved appropriately, and both solutions are found.
- [1] An incorrect quadratic equation of equal difficulty is solved appropriately, but one computational error is made.
- or [1] $1 \leq t \leq 3$, 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.
-

- [6] Either a correct Euclidean proof is written, with a concluding statement that the diagonals bisect each other, or a correct analytic proof using coordinate geometry is written, with a concluding statement that the diagonals bisect each other.
- [5] One reason is omitted or incorrect.
or [5] Appropriate work is shown, but one computational error is made.
- [4] The appropriate triangles are proven to be congruent, but the corresponding parts and a final statement that indicates why the diagonals are bisected are omitted.
or [4] Appropriate work is shown, but two computational errors are made.
or [4] A correct analytic proof using coordinate geometry is written, but no concluding statement is made.
- [3] An appropriate conclusion is drawn, including a statement that indicates why the diagonals are bisected; but only a partial proof is written, with two steps missing, and errors in the statements or reasons are made.
or [3] An analytic proof using coordinate geometry with more than two errors is written, but an appropriate concluding statement is made.
or [3] The diagram in an analytic proof is labeled incorrectly or numerically, but the rest of the proof is correct.
- [2] Statements for the Euclidean proof are written, but no valid reasons are given.
or [2] A congruence proof is written with some valid statements and reasons, but a concluding statement that the diagonals bisect each other is not made.
- [1] A correctly labeled diagram for a Euclidean proof is shown, but no proof is written.
or [1] An analytic proof using coordinate geometry with more than two errors is written, but no concluding statement is made.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
-
- [33] incorrect procedure.
- [6] A correct scatter plot, $y = 0.62x + 29.18$, $r = 0.92$, and 83; and appropriate work is shown.
- [5] Appropriate work is shown, but one computational or rounding error is made.
or [5] A correct scatter plot, equation, and score are shown, but no r -value is found.
- [4] A correct scatter plot and equation are shown, but the r -value and score are missing or incorrect.
or [4] An incorrect equation is shown, but all further work is appropriate.
or [4] The scatter plot is missing or incorrect, but all further work is appropriate.
- [3] The scatter plot is incorrect, but a correct equation and either a correct r -value or score are found.
or [3] The scatter plot is correct, but an incorrect equation and either an appropriate r -value or score based on the incorrect equation are found.
- [2] Only a correct scatter plot is shown, and all further work is missing or incorrect.
or [2] Only a correct equation is shown, and all further work is missing or incorrect.
- [1] An incorrect equation is shown, but an appropriate score is found.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
-
- [34] incorrect procedure.