1. 060301b
For which value of x is $y = \log x$ undefined?

[A] $\frac{1}{10}$ [B] 1.483 [C] π [D] 0

2. 060302b, P.I. A2.A.58
If $\sin\theta > 0$ and $\sec\theta < 0$, in which quadrant does the terminal side of angle θ lie?

[A] I [B] III [C] IV [D] II

3. 060303b, P.I. A2.A.27
What is the value of x in the equation $81^{x+2} = 27^{5x+4}$?

[A] $-\frac{4}{11}$ [B] $-\frac{3}{2}$ [C] $\frac{4}{11}$ [D] $-\frac{2}{11}$

4. 060304b, P.I. A2.N.9
The relationship between voltage, E, current, I, and resistance, Z, is given by the equation $E = IZ$. If a circuit has a current $I = 3 + 2i$ and a resistance $Z = 2 - i$, what is the voltage of this circuit?

[A] 8 + i [B] 4 + i [C] 8 + 7i [D] 4 - i

5. 060305b, P.I. A2.N.5
Which expression is equivalent to $\frac{4}{3+\sqrt{2}}$?

[A] $\frac{12-4\sqrt{2}}{7}$ [B] $\frac{12+4\sqrt{2}}{7}$

[C] $\frac{12-4\sqrt{2}}{11}$ [D] $\frac{12+4\sqrt{2}}{11}$

6. 060306b, P.I. G.G.54
What are the coordinates of point P, the image of point (3,-4) after a reflection in the line $y = x$?

[A] (4,-3) [B] (3,4)

[C] (-4,3) [D] (-3,4)

7. 060307b, P.I. A2.A.2
The roots of the equation $ax^2 + 4x = -2$ are real, rational, and equal when a has a value of

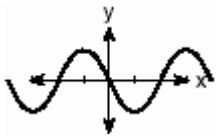
[A] 2 [B] 1 [C] 4 [D] 3

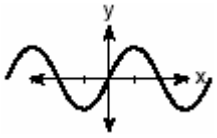
8. 060308b, P.I. A.N.4
Two objects are 2.4×10^{20} centimeters apart. A message from one object travels to the other at a rate of 1.2×10^{5} centimeters per second. How many seconds does it take the message to travel from one object to the other?

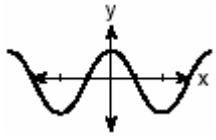
[A] 2.88×10^{25} [B] 1.2×10^{15}

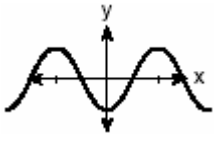
[C] 2.0×10^{15} [D] 2.0×10^{4}

9. 060309b, P.I. G.G.61
If f(x) = cos x, which graph represents f(x) under the composition $r_{y-axis} \circ r_{x-axis}$?

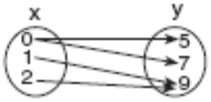
[A] 

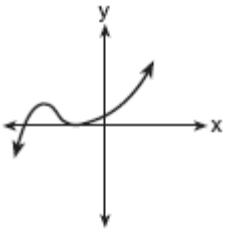
[B] 

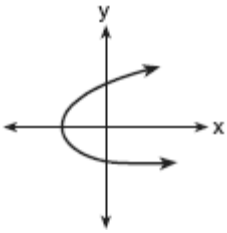
[C] 

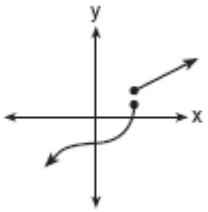
[D] 

10. 060310b, P.I. A.G.3
Which diagram represents a relation in which each member of the domain corresponds to only one member of its range?

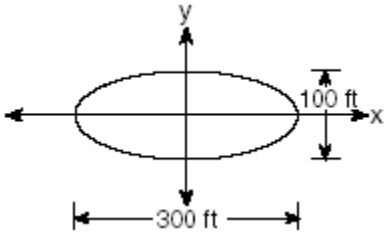
[A] 

[B] 

[C] 

[D] 

11. 060311b
The accompanying diagram represents the elliptical path of a ride at an amusement park.



Which equation represents this path?

[A] $\frac{x^2}{150^2}-\frac{y^2}{50^2}=1$ [B] $\frac{x^2}{150^2}+\frac{y^2}{50^2}=1$

[C] $y=x^2+100x+300$

[D] $x^2+y^2=300$

12. 060312b, P.I. A2.A.76
If A and B are positive acute angles, $\sin A=\frac{5}{13}$, and $\cos B=\frac{4}{5}$, what is the value of $\sin(A+B)$?

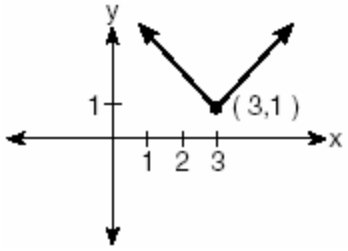
[A] $-\frac{16}{65}$ [B] $\frac{63}{65}$ [C] $\frac{33}{65}$ [D] $\frac{56}{65}$

13. 060313b, P.I. G.G.54
Which transformation is an opposite isometry?

[A] dilation [B] rotation of 90°

[C] translation [D] line reflection

14. 060314b, P.I. A.G.4
Which equation is represented by the accompanying graph?



[A] $y=|x-3|+1$ [B] $y=|x|-3$

[C] $y=|x+3|-1$ [D] $y=(x-3)^2+1$

15. 060315b, P.I. A2.N.9
What is the value of $i^{99}-i^3$?

[A] $-i$ [B] 0 [C] i^{96} [D] 1

16. 060316b, P.I. A2.A.19
If $\log a = 2$ and $\log b = 3$, what is the numerical value of $\log\frac{\sqrt{a}}{b^3}$?

[A] -25 [B] 8 [C] -8 [D] 25

17. 060317b, P.I. A2.A.17
In simplest form, $\dfrac{\frac{1}{x^2}-\frac{1}{y^2}}{\frac{1}{y}+\frac{1}{x}}$ is equal to

[A] $\dfrac{x-y}{xy}$ [B] $\dfrac{y-x}{xy}$

[C] $y-x$ [D] $x-y$

18. 060318b, P.I. A2.A.1
What is the solution set of the inequality $|3-2x| \geq 4$?

[A] $\{x|-\frac{1}{2} \leq x \leq \frac{7}{2}\}$

[B] $\{x|x \leq -\frac{1}{2} \text{ or } x \geq \frac{7}{2}\}$

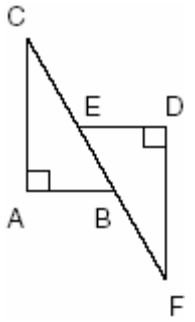
[C] $\{x|x \leq \frac{7}{2} \text{ or } x \geq \frac{1}{2}\}$

[D] $\{x|\frac{7}{2} \leq x \leq -\frac{1}{2}\}$

19. 060319b, P.I. A2.A.68
What value of x in the interval $0° \leq x \leq 180°$ satisfies the equation $\sqrt{3}\tan x + 1 = 0$?

[A] 60° [B] -30° [C] 150° [D] 30°

20. 060320b, P.I. G.G.28
In the accompanying diagram, $\overline{CA} \perp \overline{AB}$, $\overline{ED} \perp \overline{DF}$, $\overline{ED} \parallel \overline{AB}$, $\overline{CE} \cong \overline{BF}$, $\overline{AB} \cong \overline{ED}$ and $m\angle CAB = m\angle FDE = 90$.



Which statement would *not* be used to prove $\Delta ABC \cong \Delta DEF$?

[A] $SSS \cong SSS$ [B] $HL \cong HL$

[C] $SAS \cong SAS$ [D] $AAS \cong AAS$

21. 060321b, P.I. A.A.41
Vanessa throws a tennis ball in the air. The function $h(t) = -16t^2 + 45t + 7$ represents the distance, in feet, that the ball is from the ground at any time *t*. At what time, to the *nearest tenth of a second*, is the ball at its maximum height?

22. 060322b, P.I. A2.A.42
If $f(x) = 2^x - 1$ and $g(x) = x^2 - 1$, determine the value of $(f \circ g)(3)$.

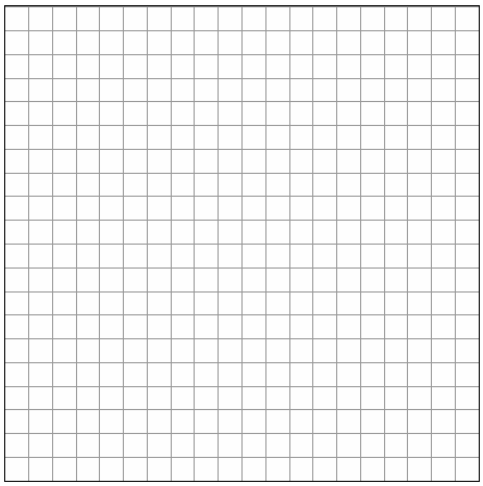
23. 060323b, P.I. A2.A.5
When air is pumped into an automobile tire, the pressure is inversely proportional to the volume. If the pressure is 35 pounds when the volume is 120 cubic inches, what is the pressure, in pounds, when the volume is 140 cubic inches?

24. 060324b, P.I. A2.S.5
In a certain school district, the ages of all new teachers hired during the last 5 years are normally distributed. Within this curve, 95.4% of the ages, centered about the mean, are between 24.6 and 37.4 years. Find the mean age and the standard deviation of the data.

25. 060325b
Express the following rational expression in simplest form: $\frac{9-x^2}{10x^2-28x-6}$

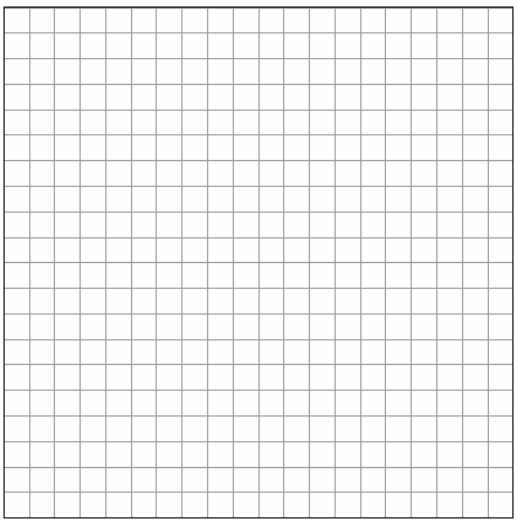
26. 060326b, P.I. A2.N.10
Evaluate: $2\sum_{n=1}^{5}(2n-1)$

27. 060327b, P.I. G.G.69
The coordinates of quadrilateral *ABCD* are *A*(-1,-5), *B*(8,2), *C*(11,13), and *D*(2,6). Using coordinate geometry, prove that quadrilateral *ABCD* is a rhombus. [The use of the grid is optional.]



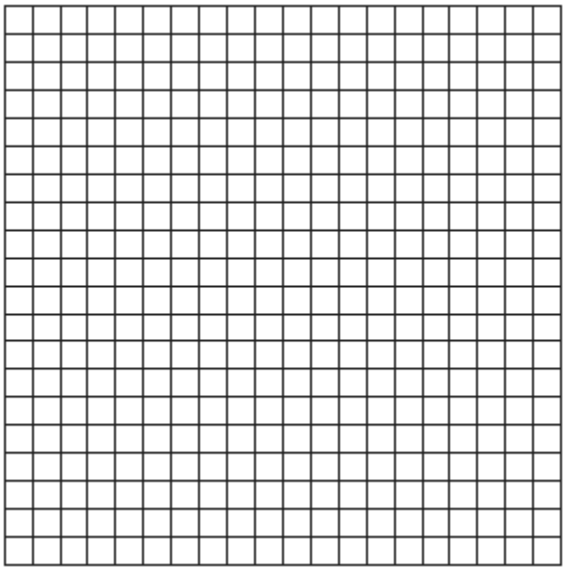
28. 060328b, P.I. G.G.70

The price of a stock, $A(x)$, over a 12-month period decreased and then increased according to the equation $A(x) = 0.75x^2 - 6x + 20$, where x equals the number of months. The price of another stock, $B(x)$, increased according to the equation $B(x) = 2.75x + 1.50$ over the same 12-month period. Graph and label both equations on the accompanying grid. State all prices, to the *nearest dollar*, when both stock values were the same.



29. 060329b

A pair of figure skaters graphed part of their routine on a grid. The male skater's path is represented by the equation $m(x) = 3\sin\frac{1}{2}x$, and the female skater's path is represented by the equation $f(x) = -2\cos x$. On the accompanying grid, sketch both paths and state how many times the paths of the skaters intersect between $x = 0$ and $x = 4\pi$.

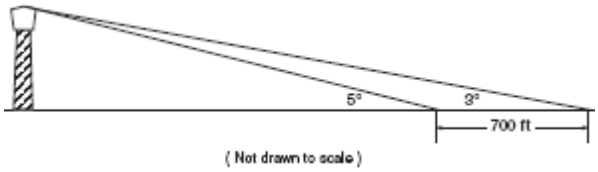


30. 060330b, P.I. A2.A.27

Sean invests $10,000 at an annual rate of 5% compounded continuously, according to the formula $A = Pe^{rt}$, where A is the amount, P is the principal, e = 2.718, r is the rate of interest, and t is time, in years. Determine, to the *nearest dollar*, the amount of money he will have after 2 years. Determine how many years, to the *nearest year*, it will take for his initial investment to double.

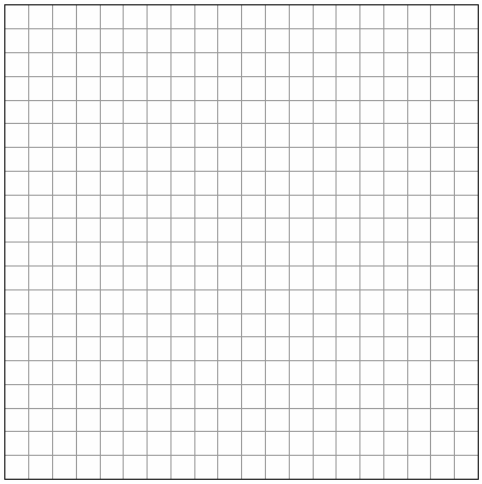
31. 060331b, P.I. A2.S.15
On any given day, the probability that the entire Watson family eats dinner together is $\frac{2}{5}$. Find the probability that, during any 7-day period, the Watsons eat dinner together *at least* six times.

32. 060332b, P.I. A2.A.73
While sailing a boat offshore, Donna sees a lighthouse and calculates that the angle of elevation to the top of the lighthouse is 3°, as shown in the accompanying diagram. When she sails her boat 700 feet closer to the lighthouse, she finds that the angle of elevation is now 5°. How tall, to the *nearest tenth of a foot*, is the lighthouse?



33. 060333b, P.I. A2.A.73
A farmer has determined that a crop of strawberries yields a yearly profit of $1.50 per square yard. If strawberries are planted on a triangular piece of land whose sides are 50 yards, 75 yards, and 100 yards, how much profit, to the *nearest hundred dollars*, would the farmer expect to make from this piece of land during the next harvest?

34. 060334b, P.I. G.G.74
For a carnival game, John is painting two circles, *V* and *M*, on a square dartboard.
a On the accompanying grid, draw and label circle *V*, represented by the equation $x^2 + y^2 = 25$, and circle *M*, represented by the equation $(x-8)^2 + (y+6)^2 = 4$.



b A point, (*x*,*y*), is randomly selected such that $-10 \le x \le 10$ and $-10 \le y \le 10$. What is the probability that point (*x*,*y*) lies outside both circle *V* and circle *M*?

[1] D

[2] D

[3] A

[4] A

[5] A

[6] C

[7] A

[8] C

[9] D

[10] B

[11] B

[12] D

[13] D

[14] A

[15] B

[16] C

[17] B

[18] B

[19] C

[20] A

[21]
[2] 1.4, and appropriate work is shown, such as finding the axis of symmetry.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] 1.4, 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 incorrect procedure.

[22]
[2] 255, and appropriate work is shown, such as $g(3) = 3^2 - 1$ and $f(8) = 2^8 - 1 = 255$.
[1] Appropriate work is shown, but one computational error is made.
or [1] One conceptual error is made, such as evaluating $(g \circ f)(3)$.
or [1] 255, 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] 30, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] 30, but no work is shown.
[0] Direct variation is used to find a solution.
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] Mean = 31 and standard deviation = 3.2, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Either the mean or the standard deviation is determined correctly, and appropriate work is shown.
or [1] Mean = 31 and standard deviation = 3.2, but no work is shown.
[0] Mean = 31 or standard deviation = 3.2, 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 obviously incorrect procedure.

[25]

[2] $\frac{-x-3}{10x+2}$ or an equivalent answer in simplest form, and appropriate work is shown.
[1] Either the numerator or the denominator is factored completely.
or [1] Appropriate work is shown, but $\frac{3-x}{x-3}=-1$ is not recognized.
or [1] $\frac{-x-3}{10x+2}$ or an equivalent answer in simplest form, 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]

[2] 50, and appropriate work is shown, such as 2(1 + 3 + 5 + 7 + 9).
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but (1 + 3 + 5 + 7 + 9) is not multiplied by 2, resulting in an answer of 25.
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 incorrect procedure.

[27]

[4] Appropriate work is shown, and an appropriate concluding statement is made to prove quadrilateral *ABCD* is a rhombus.
[3] The proof is completed appropriately, but one computational error is made, but an appropriate concluding statement is made.
or [3] Appropriate work is shown to prove quadrilateral *ABCD* is a rhombus, but the concluding statement is missing, incomplete, or incorrect.
[2] The proof is completed appropriately, but more than one computational error is made, but an appropriate concluding statement is made.
or [2] Appropriate work is shown, but one of the formulas used is incorrect.
or [2] Appropriate work is shown to prove quadrilateral *ABCD* is a parallelogram, and an appropriate concluding statement is made, but the sides are not proved to be equal.
or [2] Quadrilateral *ABCD* is proved to be a rhombus by assuming quadrilateral *ABCD* is a parallelogram.
[1] Appropriate work is shown to prove quadrilateral *ABCD* is a parallelogram, and the concluding statement is missing, incomplete, or incorrect.
or [1] The definition of a rhombus is stated, but no proof 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.

[4] 9 and 26, and appropriate work is shown, such as graphing and labeling the equations and identifying the points of intersection.
[3] Both functions are graphed correctly, and the points of intersection are indicated, but the prices are not stated.
or [3] The parabola is graphed correctly, but the line is graphed incorrectly, but appropriate prices are stated.
[2] The line and the parabola are graphed and labeled, but a conceptual error is made, such as only one price is found because the graph of the parabola is incomplete.
or [2] The line is graphed correctly, but the parabola is graphed incorrectly, but appropriate prices are stated.
or [2] 9 and 26, but only an algebraic solution is shown.
[1] Both the line and the parabola are graphed incorrectly, but appropriate prices are stated.
or [1] 9 and 26, but no work is shown.
[0] 9 or 26, 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 obviously incorrect procedure.

[28]

[4] Two, and the paths are sketched and labeled correctly, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or graphing error is made, but the appropriate number of points of intersection is stated.
or [3] Only one path is sketched correctly, but the correct interval is used, and an appropriate number of points of intersection is stated.
or [3] The paths are sketched correctly, but an incorrect interval is used, but the appropriate number of points of intersection is stated.
or [3] The paths are sketched correctly in the correct interval, but the number of points of intersection is not stated or is stated incorrectly.
[2] Appropriate work is shown, but more than one computational or graphing error is made, but the appropriate number of points of intersection is stated.
or [2] Only one path is sketched correctly in the correct interval, and the number of points of intersection is not stated or is stated incorrectly.
or [2] Only one path is sketched appropriately in an incorrect interval, but an appropriate number of points of intersection is stated.
[1] A basic sine and cosine curve are sketched, but they do not have the correct traits of the equation, but an appropriate number of points of intersection is stated.
or [1] One path is sketched correctly in the correct interval, but the second graph is not sketched.
[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] 11,052 and 14, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] 14, and appropriate work is shown, but the amount of money he will have after 2 years is not found.
[2] Appropriate work is shown, but more than one computational or rounding error is made.
or [2] 11,052, and appropriate work is shown, and a correct log equation, such as $\log 2 = .05x \log 2.718$ is written, but it is not solved.
[1] 11,052, and appropriate work is shown, but the number of years to double his investment is not found or is found incorrectly.
or [1] Appropriate substitutions are made for both equations, but neither equation is solved.
or [1] 11,052 and 14, but no work is shown.
[0] 11,052 or 14, 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 obviously incorrect procedure.

[30]

[4] $\frac{1,472}{78,125}$, and appropriate work is shown, such as ${}_7C_6(\frac{2}{5})^6(\frac{3}{5})^1 + {}_7C_7(\frac{2}{5})^7(\frac{3}{5})^0$.
[3] Appropriate work is shown, but one computational error is made.
or [3] The probabilities for exactly six times and exactly seven times are calculated correctly, but they are not added.
or [3] The probability for at most six times is calculated correctly.
[2] Appropriate work is shown, but more than one computational error is made.
or [2] Appropriate work is shown, but one conceptual error is made, such as multiplying the probabilities.
[1] A correct expression is written for finding the probability, but no further correct work is shown.
or [1] The probability for exactly six times is calculated correctly.
or [1] $\frac{1,472}{78,125}$, 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]

[4] 91.5, and appropriate work is shown, such as using the Law of Sines to find either side of the obtuse triangle and then using the sine function to find the height of the lighthouse.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] The angles in the obtuse triangle are found incorrectly, but appropriate work is shown, and an appropriate height of the lighthouse is found.
[2] Appropriate work is shown, but more than one computational or rounding error is made.
or [2] A correct length of a side of the obtuse triangle is found, but no further correct work is shown.
[1] An appropriate equation is set up for one triangle, but it is not solved.
or [1] 91.5, 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.

[32]

[6] 2,700, and appropriate work is shown, such as using the Law of Cosines and finding the area of the triangle.
[5] Appropriate work is shown, but one computational or rounding error is made.
[4] Appropriate work is shown, but more than one computational or rounding error is made.
or [4] Appropriate work is shown, and the area of the triangle is determined correctly, but the dollar amount is not determined or is determined incorrectly.
or [4] The Law of Cosines is used correctly to determine an angle, but an incorrect procedure is used to find the area, but an appropriate dollar amount is found.
or [4] The Law of Cosines is used incorrectly to determine an angle, but a correct procedure is used to find the area, and an appropriate dollar amount is found.
[3] The Law of Cosines is used correctly to determine an angle, but an incorrect procedure is used to find the area, and the dollar amount is not determined or is determined incorrectly.
[2] The Law of Cosines is used correctly to determine an angle, but no further correct work is shown.
[1] A correct equation using the Law of Cosines is written, but no further correct work is shown.
or [1] 2,700, 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.

[33]

a [2] Both circles are drawn and labeled correctly.
[1] Both circles are drawn, but one conceptual error is made.
or [1] Only one circle is drawn and labeled correctly.
b [4] 0.7722345326 or an equivalent decimal answer, and appropriate work is shown, such as $\frac{400-29\pi}{400}$.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] The probability that point (x,y) lies inside the circles is found, and appropriate work is shown.
[2] Appropriate work is shown, but more than one computational or rounding error is made.
or [2] Only the correct areas of the square and the circles are found.
[1] Only the correct area of the square or the circles is found.
or [1] 0.7722345326 or an equivalent answer, but no work is shown.
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.

[34]