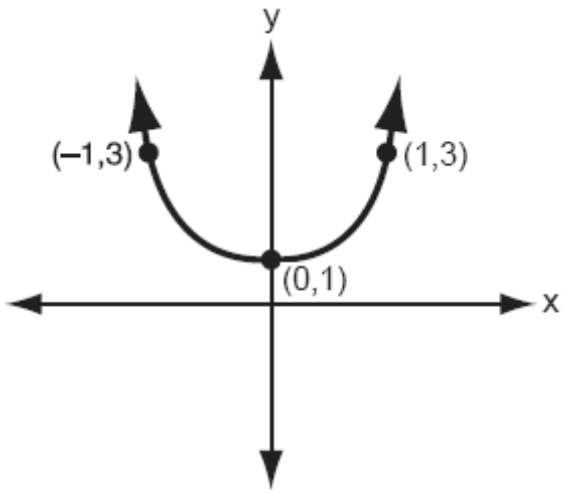
1. 010801b, P.I. A.G.4
Which equation is represented by the accompanying graph?



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

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

2. 010802b, P.I. A2.A.22
What is the value of x in the equation $\sqrt{3+x} - 5 = -2$?

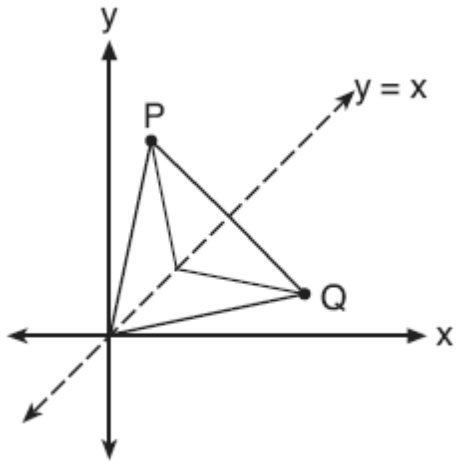
[A] 12 [B] 3 [C] 6 [D] 46

3. 010803b, P.I. G.G.58
Under a dilation where the center of dilation is the origin, the image of $A(-2,-3)$ is $A'(-6,-9)$. What are the coordinates of B', the image of $B(4,0)$ under the same dilation?

[A] (-12,0) [B] (4,0)

[C] (-4,0) [D] (12,0)

4. 010804b, P.I. A2.A.46
Matthew is a fan of the Air Force's Thunderbirds flying team and is designing a jacket patch for the team, as shown in the accompanying diagram.



If P has the coordinates (a,b), what are the coordinates of Q, the reflection of P in the line $y = x$?

[A] $(-a,b)$ [B] (b,a)

[C] (a,b) [D] (y,x)

5. 010805b, P.I. A2.S.15
Sean tells prospective clients that the probability of rain at the dive location is .2 each day. Which expression can be used to calculate the probability that it will rain on *exactly* 5 days of the 7 days at the dive location?

[A] ${}_7C_2(.5)(.7)$ [B] ${}_7C_5(.5)(.7)$

[C] ${}_7C_5(.2)^5(.8)^2$ [D] ${}_7C_5(.2)^2(.8)^5$

6. 010806b
Jack wants to plant a border of flowers in the shape of an arc along the edge of a circular walkway. If the circle has a radius of 5 yards and the angle subtended by the arc measures $1\frac{1}{2}$ radians, what is the length, in yards, of the border?

[A] 2 [B] 5 [C] 0.5 [D] 7.5

7. 010807b, P.I. A2.S.3

Mayken collected data about the size of the honors classes in her school building. This set of data is shown in the accompanying table.

Class Size	Frequency
8	1
10	3
14	2

Which statement about the range of this sample is true?

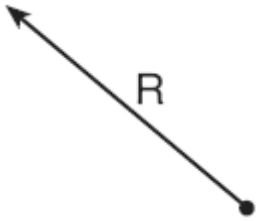
[A] range = mean [B] range > mean

[C] range < mean

[D] range < standard deviation

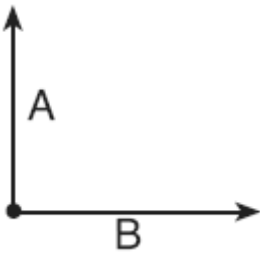
8. 010808b

The accompanying diagram shows a resultant force vector, *R*.

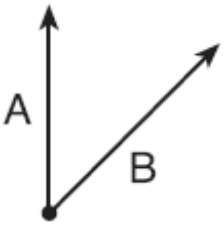


Which diagram best represents the pair of component force vectors, *A* and *B*, that combined to produce the resultant force vector *R*?

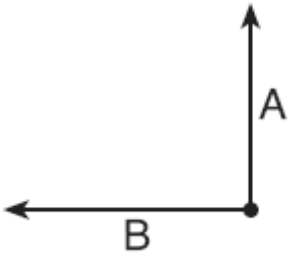
[A]



[B]



[C]



[D]

9. 010809b, P.I. A2.S.5
On a standardized test with a normal distribution, the mean was 64.3 and the standard deviation was 5.4. What is the best approximation of the percent of scores that fell between 61.6 and 75.1?

[A] 68.2% [B] 95%

[C] 38.2% [D] 66.8%

10. 010810b, P.I. A2.A.69
A wave displayed by an oscilloscope is represented by the equation $y = 3\sin x$. What is the period of this function?

[A] 2 [B] 3 [C] 3π [D] 2π

11. 010811b, P.I. A2.N.9
The expression $\frac{10}{3+i}$ is equivalent to

[A] $3-i$ [B] $3+i$

[C] $\frac{15+5i}{4}$ [D] $\frac{5}{4}$

12. 010812b, P.I. A2.A.42
The accompanying tables define functions f and g.

x	1	2	3	4	5
$f(x)$	3	4	5	6	7

x	3	4	5	6	7
$g(x)$	4	6	8	10	12

What is (g o f)(3)?

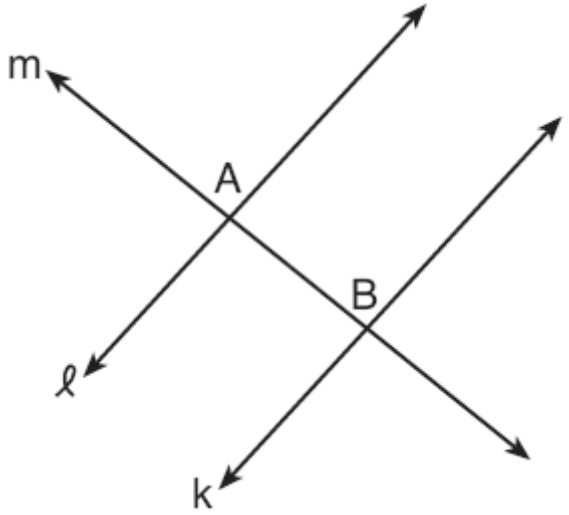
[A] 4 [B] 2 [C] 6 [D] 8

13. 010813b
A radioactive substance has an initial mass of 100 grams and its mass halves every 4 years. Which expression shows the number of grams remaining after *t* years?

[A] $100(4)^{\frac{t}{4}}$ [B] $100(\frac{1}{2})^{\frac{t}{4}}$

[C] $100(4)^{-2t}$ [D] $100(\frac{1}{2})^{4t}$

14. 010814b, P.I. G.G.27
In the accompanying diagram, line ℓ is perpendicular to line *m* at *A*, line *k* is perpendicular to line *m* at *B*, and lines ℓ, *m*, and *k* are in the same plane.



Which statement is the first step in an indirect proof to prove that ℓ is parallel to *k*?

[A] Assume that ℓ is not perpendicular to *m*.

[B] Assume that ℓ is perpendicular to *k*.

[C] Assume that ℓ, *m*, and *k* are not in the same plane.

[D] Assume that ℓ is not parallel to *k*.

15. 010815b, P.I. A.S.3
Which method of collecting data would most likely result in an unbiased random sample?

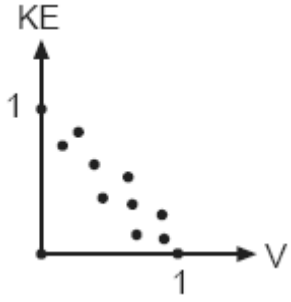
[A] placing a survey in a local newspaper to determine how people voted in the 2004 presidential election

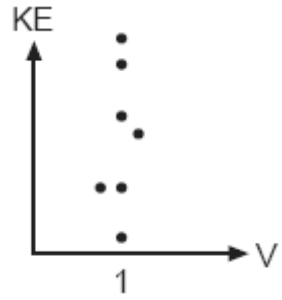
[B] selecting every third teenager leaving a movie theater to answer a survey about entertainment

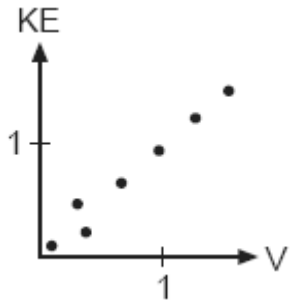
[C] selecting students by the last digit of their school ID number to participate in a survey about cafeteria food

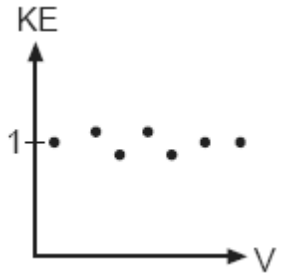
[D] surveying honor students taking Mathematics B to determine the average amount of time students in a school spend doing homework each night

16. 010816b, P.I. A2.S.8
In the physics lab, Thelma determined the kinetic energy, *KE*, of an object at various velocities, *V*, and found the linear correlation coefficient between *KE* and *V* to be +0.8. Which graph shows this relationship?

[A]


[B]


[C]


[D]


17. 010817b, P.I. A2.A.2
Which equation has roots that are real, rational, and unequal?

[A] $x^2 - 4x + 4 = 0$ [B] $x^2 - 2 = 0$

[C] $x^2 + x + 1 = 0$ [D] $x^2 - 4 = 0$

18. 010818b, P.I. A2.A.57
The expression $\cos(\pi - x)$ is equivalent to

[A] -sin *x* [B] sin *x*

[C] cos *x* [D] -cos *x*

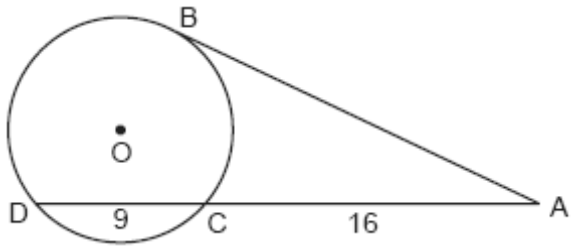
19. 010819b, P.I. A2.A.28
If $\log_x 9 = -2$, what is the value of *x*?

[A] $\frac{1}{3}$ [B] $\frac{1}{81}$ [C] 3 [D] 81

20. 010820b, P.I. A2.A.36
What is the coefficient of the fifth term in the expansion of $(x+1)^8$?

[A] 70 [B] 28 [C] 8 [D] 56

21. 010821b, P.I. G.G.53
In the accompanying diagram, $\overline{AB}$ is tangent to circle *O* at *B*. If *AC* = 16 and *CD* = 9, what is the length of $\overline{AB}$?



22. 010822b, A2.A.1
Solve for all values of *x*: $|2x-5| = 3$

23. 010823b, P.I. A2.A.5
The amount of money each member of a band earns playing at a graduation party varies inversely as the number of members in the band. If the band has five members, each member earns $70. Write an equation that models the relationship between the number of members in a band, *n*, and the amount each member earns, *d*. Use the equation to calculate the amount each member earns if there are four members in the band.

24. 010824b, P.I. A.A.12
Simplify the expression $(m^6)^{-\frac{2}{3}}$ and write your answer using a positive exponent.

25. 010825b, P.I. A2.N.10
If $i = \sqrt{-1}$, what is the value of the expression $\sum_{n=1}^{20} i^{4n}$?

26. 010826b, P.I. A2.A.17
Express in simplest form: $\dfrac{x - \dfrac{4}{x}}{\dfrac{2+x}{x}}$

27. 010827b, P.I. A2.A.73
The measures of the angles between the resultant and two applied forces are 65° and 42°, and the magnitude of the resultant is 24 pounds. Find, to the *nearest pound*, the magnitude of the larger force.

28. 010828b, P.I. A2.A.27
The number of houses in Central Village, New York, grows every year according to the function $H(t) = 540(1.039)^t$, where H represents the number of houses, and *t* represents the number of years since January 1995. A civil engineering firm has suggested that a new, larger well must be built by the village to supply its water when the number of houses exceeds 1,000. During which year will this first happen?

29. 010829b, P.I. A2.A.68
Find all values of *x* in the interval $0° \le x \le 360°$ that satisfy the equation $3\cos x + \sin 2x = 0$.

30. 010830b, P.I. A2.A.21
Write a quadratic equation such that the sum of its roots is -5 and the product of its roots is 6. What are the roots of this equation?

31. 010831b, P.I. A2.S.7

Water is draining from a tank maintained by the Yorkville Fire Department. Students measured the depth of the water in 15-second intervals and recorded the results in the accompanying table.

Time (x) (in seconds)	Depth of Water (y) (in feet)
15	11.8
30	9.9
45	8.2
60	6.3
75	5.9

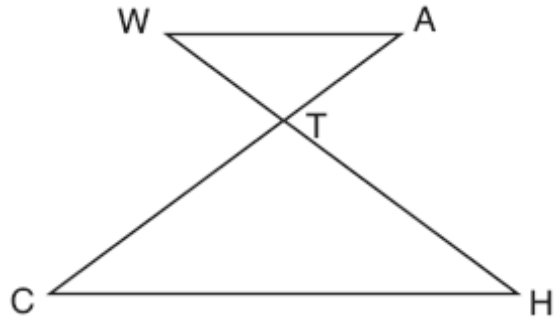
Write the power regression equation for this set of data, rounding all values to the *nearest ten thousandth.* Using this equation, predict the depth of the water at 2 minutes, to the *nearest tenth of a foot.*

32. 010832b, P.I. A2.A.68

The horizontal distance, in feet, that a golf ball travels when hit can be determined by the formula $d = \frac{v^2 \sin 2\theta}{g}$, where v equals initial velocity, in feet per second; g equals acceleration due to gravity; θ equals the initial angle, in degrees, that the path of the ball makes with the ground; and d equals the horizontal distance, in feet, that the ball will travel. A golfer hits the ball with an initial velocity of 180 feet per second and it travels a distance of 840 feet. If g = 32 feet per second per second, what is the smallest initial angle the path of the ball makes with the ground, to the *nearest degree*?

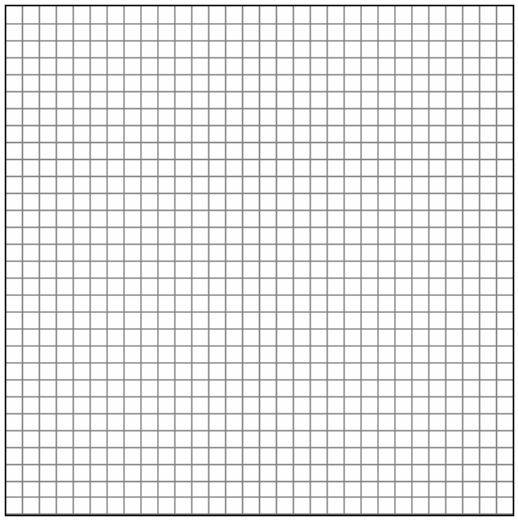
33. 010833b, P.I. G.G.44

In the accompanying diagram, $\overline{WA} \| \overline{CH}$ and $\overline{WH}$ and $\overline{AC}$ intersect at point T. Prove that $(WT)(CT) = (HT)(AT)$.



34. 010834b, P.I. A.A.41

The members of the Lincoln High School Prom Committee are trying to raise money for their senior prom. They plan to sell teddy bears. The senior advisor told them that the profit equation for their project is $y = -0.1x^2 + 9x - 50$, where x is the price at which the teddy bears will be sold and y is the profit, in dollars. On the grid below, graph this relationship so that $0 \le x \le 90$ and $-50 \le y \le 160$. How much profit can the committee expect to make if they sell the teddy bears for \$20 each? What price should they charge for the teddy bears to make the maximum profit possible?



[1] A

[2] C

[3] D

[4] B

[5] C

[6] D

[7] C

[8] C

[9] D

[10] D

[11] A

[12] D

[13] B

[14] D

[15] C

[16] C

[17] D

[18] D

[19] A

[20] A

[21] [2] 20, and appropriate work is shown.
[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] 20, 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] [21 1 and 4, and appropriate work is shown.
[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] 1 and 4, but no work is shown.
[0] 1 or 4, but no work is shown.
or [01 A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[23] [2] $nd = 350$ or an equivalent equation and \$87.50, and appropriate work is shown, such as the equation $350 = 4d$.
[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] \$87.50, 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.

[24] [2] $\frac{1}{m^4}$ or $(\frac{1}{m})^4$, and appropriate work is shown.
[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] Appropriate work is shown, but the answer is expressed with a negative exponent, such as m^{-4}.
[1] $\frac{1}{m^4}$ or $(\frac{1}{m})^4$, 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.

[2] 20, and appropriate work is shown or an appropriate explanation is written.
[l] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 20, but no work is shown or no explanation is written.
[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] x - 2, and appropriate work is shown.
[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] x - 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.
[26]

[4] 23, and appropriate work is shown, such as using the Law of Sines.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as finding 17, the smaller force.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made,
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 incorrect procedure.
[27]

[4] 2011, and appropriate work is shown, such as solving a logarithmic equation or trial and error with at least three trials and appropriate checks.
[3] Appropriate work is shown, but one computational or rounding error is made.
[3] Appropriate work is shown to find t but the year is not stated or is stated incorrectly.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] The trial-and-error method is used to find the correct solution, but only two trials and appropriate checks are shown.
or [2] The trial-arid-error method is attempted and at least six systematic trials and appropriate checks are shown, but no solution is found.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
[1] 2011, 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.
[28]

[4] 90° and 270°, and appropriate work is shown, such as solving the equation $3\cos x + 2\sin x \cos x = 0$ or sketching a graph and finding the *x*-intercepts.
[3] Appropriate work is shown, but one computational, factoring, or graphing error is made.
or [3] Appropriate work is shown, but the answers are expressed in radian measure.
[2] Appropriate work is shown, but two or more computational, factoring, or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made,
or [2] An appropriate graph is sketched, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational, factoring, or graphing error are made.
or [1] Correct substitution is made for sin 2*x*, but no further correct work is shown.
or [1] 90° and 270°, but no work is shown.
[0] 90° or 270°, 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
[29] obviously incorrect procedure.

[4] $x^2 + 5x + 6 = 0$ or an equivalent equation and -3 and -2, and appropriate work is shown, such as using the sum and product formulas or factoring the equation.
[3] Appropriate work is shown, but one computational or factoring error is made.
or [3] The expression $x^2 + 5x + 6 = 0$ is written and -3 and -2, and appropriate work is shown.
[2] Appropriate work is shown, but two or more computational or factoring errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] A correct quadratic equation is written, and appropriate work is shown, but the roots are not found.
or [2] Appropriate work is shown to find -3 and -2, but no quadratic equation is written.
[1] Appropriate work is shown, but one conceptual error and one computational or factoring error are made.
or [1] $x^2 + 5x + 6 = 0$ or an equivalent equation and -3 and -2, but no work is shown.
[0] A correct quadratic equation or -3 and -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
[30] obviously incorrect procedure.

[4] $y = 42.2326x^{-0.4494}$ and 4.9, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] A correct regression equation is written and 4.9, but the substitution is not shown.
or [3] The expression $42.2326x^{-0.4494}$ is written and 4.9, and the substitution is shown.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as not changing 2 minutes to 120 seconds.
or [2] An incorrect power regression equation is solved appropriately, and the substitution is shown.
or [2] A correct regression equation is written, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] An incorrect equation of a lesser degree of difficulty is solved appropriately.
or [1] 4.9, 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 incorrect procedure.

[31]

[4] 28, and appropriate work is shown, such as substituting into the given equation or solving the equation graphically.
[3] Appropriate work is shown, but one computational, rounding, or graphing error is made.
or [3] Appropriate work is shown, but 56, the value of 2θ, is given as the answer.
[2] Appropriate work is shown but two or more computational, rounding, or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
[1] Appropriate work is shown, but one conceptual error and one computational, rounding, or graphing error are made.
or [1] Appropriate work is shown to find the value of sin 2θ, but no further correct work is shown.
or [1] 28, 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] A complete and correct proof that includes a concluding statement is written.
[5] A proof is written that demonstrates a thorough understanding of the method of proof and contains no conceptual errors, but one statement or reason is missing or is incorrect or no concluding statement is written.
or [5] $\frac{WT}{HT} = \frac{AT}{CT}$ or an equivalent proportion is proven, but no further correct work is shown.
[4] A proof is written that demonstrates a good understanding of the method of proof and contains no conceptual errors, but two statements and/or reasons are missing or are incorrect.
[3] A proof is written that demonstrates a good understanding of the method of proof, but one conceptual error is made.
or [3] $\Delta WAT \sim \Delta HCT$ is proven, but no further correct work is shown.
[2] Some correct relevant statements about the proof are made, but three or four statements and/or reasons are missing or are incorrect.
[1] Only one correct statement and reason are written, other than the given and/or the prove statements.
[0] A zero response is completely incorrect, irrelevant or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[33]

[6] A correct graph is drawn, 90 and 45, and appropriate work is shown.
[5] Appropriate work is shown to answer all three parts of the question, but one computational or graphing error is made.
[4] Appropriate work is shown, but two or more computational or graphing errors are made.
or [4] A correct graph is drawn, and 90 or 45, and appropriate work is shown.
[3] Appropriate work is shown, but one conceptual error is made.
or [3] 90 and 45, and appropriate work is shown, but no graph is drawn.
or [3] A correct graph is drawn, but no further correct work is shown.
[2] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.
[1] 90 or 45, and appropriate work is shown.
or [1] 90 and 45, but no work is shown and no graph is drawn.
[0] 90 or 45, 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.

[34]