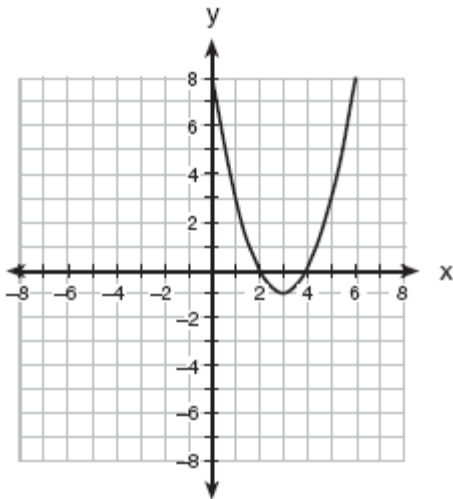


1. 010901b, P.I. G.G.54

The parabola shown in the accompanying diagram undergoes a reflection in the  $y$ -axis.



What will be the coordinates of the turning point after the reflection?

- [A] (-3,1)                      [B] (3,1)  
[C] (-3,-1)                    [D] (3,-1)

2. 010902b, P.I. A2.N.5

The expression  $\frac{5}{3+\sqrt{2}}$  is equivalent to

- [A]  $15-5\sqrt{2}$                       [B]  $\frac{15-5\sqrt{2}}{7}$   
[C]  $\frac{5\sqrt{2}-15}{5}$                               [D]  $\frac{\sqrt{2}-15}{3}$

3. 010903b, P.I. A2.S.15

If the probability that the Islanders will beat the Rangers in a game is  $\frac{2}{5}$ , which expression represents the probability that the Islanders will win *exactly* four out of seven games in a series against the Rangers?

- [A]  $(\frac{2}{5})^4(\frac{3}{5})^3$                       [B]  ${}_7C_4(\frac{2}{5})^4(\frac{3}{5})^3$   
[C]  ${}_7C_4(\frac{2}{5})^4(\frac{2}{5})^3$                     [D]  ${}_5C_2(\frac{4}{7})^2(\frac{3}{7})^3$

4. 010904b, P.I. A2.A.4

What is the solution of the inequality  $x^2 - x - 6 < 0$ ?

- [A]  $1 < x < 6$                       [B]  $-3 < x < 2$   
[C]  $-2 < x < 3$                     [D]  $-3 < x < -2$

5. 010905b, P.I. A2.N.7

Which expression is equivalent to  $i^{55}$ ?

- [A]  $-i$     [B]  $i$     [C]  $1$     [D]  $-1$

6. 010906b, P.I. G.G.54

What is the translation that maps the function  $f(x) = x^2 - 1$  onto the function  $g(x) = x^2 + 1$ ?

- [A]  $T_{0,2}$     [B]  $T_{0,1}$     [C]  $T_{-1,1}$     [D]  $T_{1,-1}$

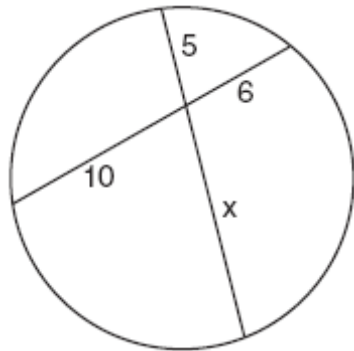
7. 010907b, P.I. A.A.41

The height of a swimmer's dive off a 10-foot platform into a diving pool is modeled by the equation  $y = 2x^2 - 12x + 10$ , where  $x$  represents the number of seconds since the swimmer left the diving board and  $y$  represents the number of feet above or below the water's surface. What is the farthest depth below the water's surface that the swimmer will reach?

- [A] 12 feet                      [B] 8 feet  
[C] 10 feet                      [D] 6 feet

8. 010908b, P.I. G.G.53

The accompanying diagram shows two intersecting paths within a circular garden.



What is the length of the portion of the path marked  $x$ ?

- [A] 11      [B] 12      [C]  $8\frac{1}{3}$       [D] 3

9. 010909b, P.I. A2.A.42

If  $f(x) = 3x - 5$  and  $g(x) = x - 9$ , which expression is equivalent to  $(f \circ g)(x)$ ?

- [A]  $3x - 14$       [B]  $4x - 14$   
[C]  $3x^2 - 32x + 45$       [D]  $3x - 32$

10. 010910b, P.I. A2.A.61

A central angle of a circular garden measures 2.5 radians and intercepts an arc of 20 feet. What is the radius of the garden?

- [A] 8 ft      [B] 100 ft  
[C] 125 ft      [D] 50 ft

11. 010911b, P.I. A2.A.58

What is a value of  $\text{Arc sin}(-\frac{\sqrt{2}}{2})$ ?

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

12. 010912b, P.I. G.G.74

A graphic designer is drawing a pattern of four concentric circles on the coordinate plane. The center of the circles is located at  $(-2,1)$ . The smallest circle has a radius of 1 unit. If the radius of each of the circles is one unit greater than the largest circle within it, what would be the equation of the fourth circle?

- [A]  $(x - 2)^2 + (y + 1)^2 = 4$   
[B]  $(x + 2)^2 + (y - 1)^2 = 4$   
[C]  $(x - 2)^2 + (y + 1)^2 = 16$   
[D]  $(x + 2)^2 + (y - 1)^2 = 16$

13. 010913b, P.I. A2.A.5

Carol notices that the number of customers who visit her coffee shop varies inversely with the average daily temperature. Yesterday, the average temperature was  $40^\circ$  and she had 160 customers. If today's average temperature is  $25^\circ$ , how many customers should she expect?

- [A] 256      [B] 1,000      [C] 145      [D] 100

14. 010914b, P.I. A2.A.44

Given the relation

$$A: \{(3,2), (5,3), (6,2), (7,4)\}$$

Which statement is true?

- [A] Only  $A^{-1}$  is a function.  
[B] Neither  $A$  nor  $A^{-1}$  are functions.  
[C] Only  $A$  is a function.  
[D] Both  $A$  and  $A^{-1}$  are functions.

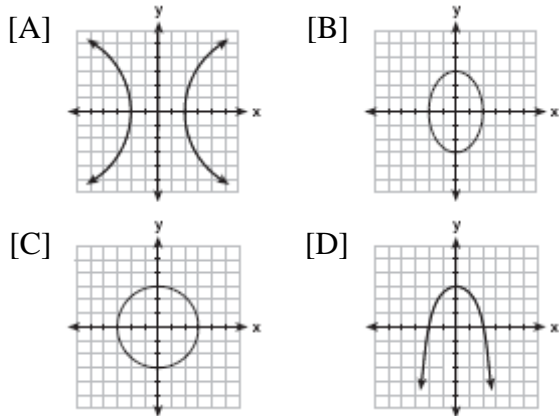
15. 010915b

The expression  $\cot \theta \cdot \sec \theta$  is equivalent to

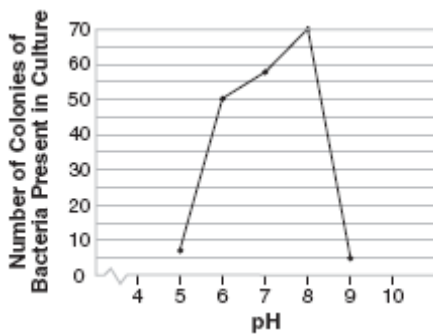
- [A]  $\csc \theta$       [B]  $\frac{\sin \theta}{\cos^2 \theta}$   
[C]  $\sin \theta$       [D]  $\frac{\cos \theta}{\sin^2 \theta}$

16. 010916b  
If  $z_1 = -3 + 2i$  and  $z_2 = 4 - 3i$ , in which quadrant does the graph of  $(z_2 - z_1)$  lie?  
[A] IV [B] I [C] III [D] II

17. 010917b  
Which graph represents the equation  $9x^2 = 36 - 4y^2$ ?



18. 010918b, P.I. A2.A.51  
The accompanying graph illustrates the presence of a certain strain of bacteria at various pH levels.



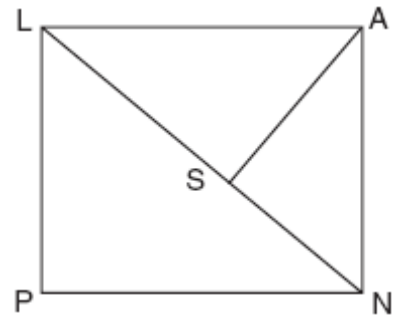
What is the range of this set of data?

- [A]  $5 \leq y \leq 70$  [B]  $0 \leq y \leq 70$   
[C]  $5 \leq x \leq 9$  [D]  $5 \leq x \leq 70$

19. 010919b, P.I. A2.A.21  
Juan has been told to write a quadratic equation where the sum of the roots is equal to  $-3$  and the product of the roots is equal to  $-9$ . Which equation meets these requirements?

- [A]  $2x^2 + 6x - 18 = 0$   
[B]  $x^2 - 12x + 27 = 0$   
[C]  $x^2 + 3x + 9 = 0$  [D]  $(x + 3)(x + 9) = 0$

20. 010920b, P.I. G.G.47  
The accompanying diagram shows part of the architectural plans for a structural support of a building.  $PLAN$  is a rectangle and  $\overline{AS} \perp \overline{LN}$ .



Which equation can be used to find the length of  $\overline{AS}$ ?

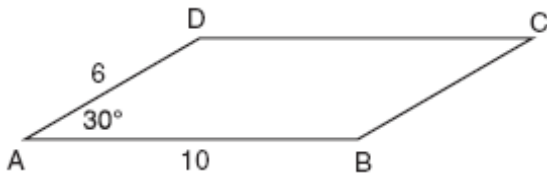
- [A]  $\frac{AS}{LS} = \frac{LS}{SN}$  [B]  $\frac{AN}{LN} = \frac{AS}{LS}$   
[C]  $\frac{LS}{AS} = \frac{AS}{SN}$  [D]  $\frac{AS}{SN} = \frac{AS}{LS}$

21. 010921b, P.I. A2.A.22  
Solve for  $x$ :  $\sqrt{x + 18} - 2 = 2$

22. 010922b, P.I. A2.N.10  
Evaluate:  $\sum_{n=1}^3 \left( \sin \frac{n\pi}{2} \right)$

23. 010923b, P.I. A2.A.27  
Given a starting population of 100 bacteria, the formula  $b = 100(2^t)$  can be used to find the number of bacteria,  $b$ , after  $t$  periods of time. If each period is 15 minutes long, how many minutes will it take for the population of bacteria to reach 51,200?

24. 010924b  
In the accompanying diagram of parallelogram  $ABCD$ ,  $m\angle A = 30^\circ$ ,  $AB = 10$ , and  $AD = 6$ . What is the area of parallelogram  $ABCD$ ?



25. 010925b, P.I. A2.A.1  
What is the solution of the inequality  $|2x - 5| \leq 11$ ?
26. 010926b, P.I. A.A.23  
The volume of Earth can be calculated by using the formula  $V = \frac{4}{3}\pi r^3$ . Solve for  $r$  in terms of  $V$ .
27. 010927b, P.I. A2.S.4  
The average monthly high temperatures, in degrees Fahrenheit, for Binghamton, New York, are given below.

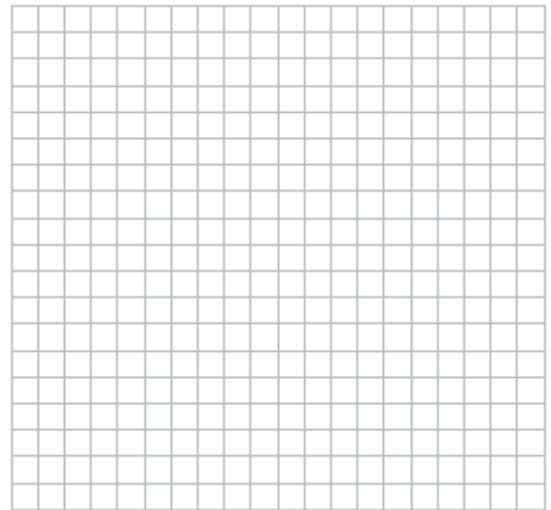
January	28	July	78
February	31	August	76
March	41	September	68
April	53	October	57
May	68	November	44
June	73	December	33

For these temperatures, find, to the *nearest tenth*, the mean, the population standard deviation, and the number of months that fall within one standard deviation of the mean.

28. 010928b, P.I. A.A.18  
Perform the indicated operations and express in simplest form:

$$\frac{3x^2 + 12x - 15}{x^2 + 2x - 15} \div \frac{3x^2 - 3x}{3x - x^2}$$

29. 010929b, P.I. A2.A.73  
In  $\triangle ABC$ ,  $a = 24$ ,  $b = 36$ , and  $c = 30$ . Find  $m\angle A$  to the *nearest tenth of a degree*.
30. 010930b, P.I. G.G.61  
Farmington, New York, has plans for a new triangular park. If plotted on a coordinate grid, the vertices would be  $A(3,3)$ ,  $B(5,-2)$ , and  $C(-3,-1)$ . However, a tract of land has become available that would enable the planners to increase the size of the park, which is based on the following transformation of the original triangular park,  $R_{270^\circ} \circ D_2$ . On the grid below, graph and label both the original park  $\triangle ABC$  and its image, the new park  $\triangle A''B''C''$ , following the transformation.



31. 010931b, P.I. A2.A.25  
Find the roots of the equation  $x^2 + 7 = 2x$  and express your answer in simplest  $a + bi$  form.

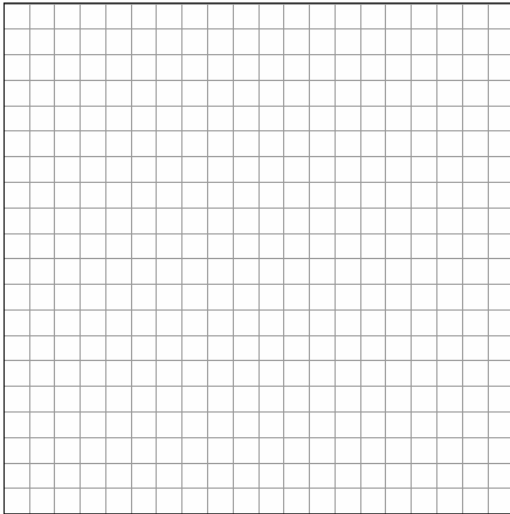
32. 010932b, P.I. A.G.9

On the accompanying grid, graph the following system of equations over the interval  $-6 \leq x \leq 6$ .

$$x^2 + y^2 = 25$$

$$xy = 12$$

State the points of intersection.



33. 010933b, P.I. A2.S.7

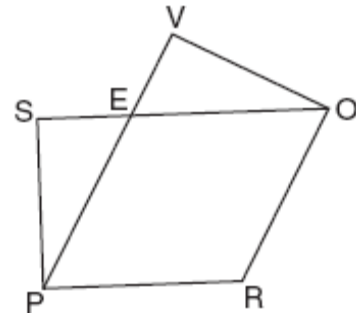
The accompanying table shows wind speed and the corresponding wind chill factor when the air temperature is  $10^\circ\text{F}$ .

Wind Speed (mi/h) $x$	Wind Chill Factor ( $^\circ\text{F}$ ) $y$
4	3
5	1
12	-5
16	-7
22	-10
31	-12

Write the logarithmic regression equation for this set of data, rounding coefficients to the *nearest ten thousandth*. Using this equation, find the wind chill factor, to the *nearest degree*, when the wind speed is 50 miles per hour. Based on your equation, if the wind chill factor is  $0^\circ$ , what is the wind speed, to the *nearest mile per hour*?

34. 010934b, P.I. G.G.27

Given:  $\overline{PROE}$  is a rhombus,  $\overline{SEO}$ ,  $\overline{PEV}$ ,  
 $\angle SPR \cong \angle VOR$



Prove:  $\overline{SE} \cong \overline{EV}$

[1] C \_\_\_\_\_

[2] B \_\_\_\_\_

[3] B \_\_\_\_\_

[4] C \_\_\_\_\_

[5] A \_\_\_\_\_

[6] A \_\_\_\_\_

[7] B \_\_\_\_\_

[8] B \_\_\_\_\_

[9] D \_\_\_\_\_

[10] A \_\_\_\_\_

[11] A \_\_\_\_\_

[12] D \_\_\_\_\_

[13] A \_\_\_\_\_

[14] C \_\_\_\_\_

[15] A \_\_\_\_\_

[16] A \_\_\_\_\_

[17] B \_\_\_\_\_

[18] A \_\_\_\_\_

[19] A \_\_\_\_\_

[20] C \_\_\_\_\_

[2] -2, and appropriate work is shown, such as solving the equation algebraically, graphically or using trial and error with at least three trials and appropriate checks.

[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] The trial-and-error method is attempted and at least six systematic trials and appropriate checks are shown, but no solution is found.

or [1] -2, but no work or fewer than three trials and appropriate checks are 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] 0, 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] 0, 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] 135, 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 to find 9, the number of periods, but it is not converted to minutes.

or [1] 135, 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] 30, 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, such as finding only half the area of the parallelogram.  
or [1] The altitude of the parallelogram is found to be 3, but no further correct work is shown.  
or [1] 30, 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]  $-3 \leq x \leq 8$  or an equivalent expression, 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 only  $x \leq 8$  or  $-3 \leq x$  is found.  
or [1]  $-3 \leq x \leq 8$ , 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 incorrect procedure.
- 

- [2]  $r = \sqrt[3]{\frac{3V}{4\pi}}$  or an equivalent answer, 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]  $r = \sqrt[3]{\frac{3V}{4\pi}}$  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.
- 

- [4]  $\bar{x} = 54.2$ ,  $\sigma = 17.6$ , and the number of months is 6, and appropriate work is shown.  
[3]  $\bar{x} = 54.2$ ,  $\sigma = 17.6$ , but one computational error is made in determining the number of months.  
or [3]  $\bar{x} = 54.2$ , but  $\sigma$  is incorrect, but work is shown to find an appropriate number of months.  
or [3]  $\bar{x} = 54.2$ ,  $\sigma = 17.6$ , and the number of months is 6, but no work is shown.  
[2]  $\bar{x}$  and  $\sigma$  are incorrect, but work is shown to find an appropriate number of months.  
or [2]  $\bar{x} = 54.2$ ,  $\sigma = 17.6$ , but the number of months is not determined.  
[1] 6, 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.
- 
- [4] -1, and appropriate work is shown.  
[3] Appropriate work is shown, but one computational, factoring, or simplification error is made.  
[2] Appropriate work is shown, but two or more computational, factoring, or simplification errors are made.  
or [2] Appropriate work is shown, but one conceptual error is made, such as not factoring out -1 or not multiplying by the reciprocal.  
[1] Appropriate work is shown, but one conceptual error and one computational, factoring, or simplification error are made.  
or [1] -1, 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.
-

- [4] 41.4, and appropriate work is shown.  
[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.  
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.  
or [1] A correct substitution is made into the Law of Cosines, but no further correct work is shown.  
or [1] 41.4, 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.
- 

- [4] Triangles  $ABC$  and  $A''B''C''$  are graphed and labeled correctly. [Students are not required to state the coordinates  $A''(6,-6)$ ,  $B''(-4,-10)$ , and  $C''(-2,6)$ .]  
[3] Appropriate work is shown, but one computational or graphing error is made.  
or [3] Only triangle  $A''B''C''$  is graphed and labeled correctly.  
[2] Appropriate work is shown, but two or more computational or graphing errors are made.  
or [2] Appropriate work is shown, but one conceptual error is made.  
or [2] Triangle  $ABC$  is graphed and labeled correctly, and either the rotation or dilation is graphed and labeled correctly.  
or [2] The coordinates  $A''(6,-6)$ ,  $B''(-4,-10)$ , and  $C''(-2,6)$  are stated, but no further correct work is shown.  
[1] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.  
or [1] Triangle  $ABC$  is graphed and labeled correctly, but no further correct 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.
-



- [4]  $1 \pm i\sqrt{6}$ , and appropriate work is shown.  
[3] Appropriate work is shown, but one computational error is made.  
or [3] Appropriate work is shown, but the solution is expressed as  $\frac{2 \pm 2i\sqrt{6}}{2}$ .  
[2] Appropriate work is shown, but two or more computational errors are made.  
or [2] Appropriate work is shown, but one conceptual error is made.  
or [2] Appropriate work is shown, but the solution is expressed as  $\frac{2 \pm \sqrt{-24}}{2}$ .  
[1] Appropriate work is shown, but one conceptual error and one computational error are made.  
or [1] A correct substitution is made in the quadratic formula, but no further correct work is shown.  
or [1]  $1 \pm i\sqrt{6}$ , 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.
- 

- [4] (3,4), (4,3), (-3,-4), and (-4,-3), and appropriate graphs are drawn.  
[3] Appropriate work is shown, but one computational or graphing error is made.  
or [3] Appropriate graphs are drawn, but only two or three points of intersection are identified.  
[2] Appropriate work is shown, but two or more computational or graphing errors are made.  
or [2] Appropriate work is shown, but one conceptual error is made, such as only graphing half of the hyperbola and finding two points of intersection.  
or [2] Appropriate graphs are drawn, but no points of intersection are identified.  
[1] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.  
or [1] Either the circle or the hyperbola is graphed correctly, but no further correct work is shown.  
or [1] (3,4), (4,3), (-3,-4), and (-4,-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]  $y = 13.0134 - 7.3135 \ln x$ , -16, and 6, and appropriate work is shown.
- [5] Appropriate work is shown, but one computational or rounding error is made.  
or [5] The expression  $13.0134 - 7.3135 \ln x$  is written and -16 and 6 are found, and appropriate work is shown.
- [4] Appropriate work is shown, but two or more computational or rounding errors are made.  
or [4] A correct logarithmic regression equation is written, but either the wind chill factor or the wind speed is not found, but appropriate work is shown.
- [4] An incorrect logarithmic regression equation of equal difficulty is written, but appropriate answers are found for the wind chill factor and the wind speed, and appropriate work is shown.
- [3] Appropriate work is shown, but one conceptual error is made.  
or [3]  $y = 13.0134 - 7.3135 \ln x$ , -16, and 6, but no work is shown.  
or [3] The expression  $13.0134 - 7.3135 \ln x$  is written and either -16 or 6 is found, and appropriate work is shown.
- [2] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.  
or [2]  $y = 13.0134 - 7.3135 \ln x$ , but no further correct work is shown.  
or [2] An incorrect logarithmic regression equation of equal difficulty is written, but an appropriate answer is found for either the wind chill factor or the wind speed, and appropriate work is shown.
- [2] An incorrect regression equation of a lesser degree of difficulty is written, but appropriate answers are found for the wind chill factor and the wind speed, and appropriate work is shown.
- or [2] -16 and 6, but no equation is written and no work is shown.
- [1] An incorrect regression equation of a lesser degree of difficulty is written, but an appropriate answer is found for either the
- [33] wind chill factor or the wind speed, and

- appropriate work, is shown.  
or [1] The expression  $13.0134 - 7.3135 \ln x$  is written, but no further correct work is shown.  
or [1] -16 or 6, but no equation is written and 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] A complete and correct proof that includes a conclusion 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 and/or reason is missing or is incorrect.  
or [5]  $\Delta SEP \cong \Delta VEO$  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.
- [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.
- [0] The "given" and/or the "prove" statements are rewritten in the style of a formal proof, but no further correct relevant statements are written.  
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] obviously incorrect procedure.