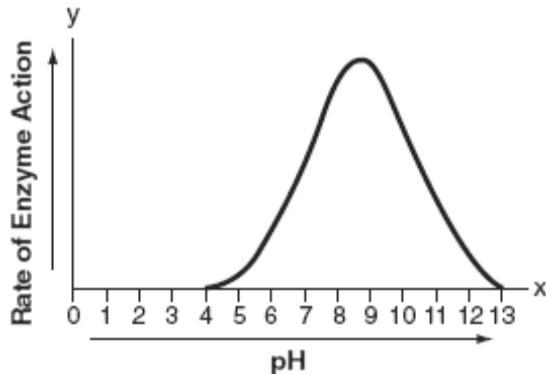1. 010601b, P.I. A2.N.10

What is the value of $\sum\limits_{n=1}^{5}(-2n+100)$?

[A] 130   [B] 70   [C] 470   [D] 530

2. 010602b, P.I. A2.A.51

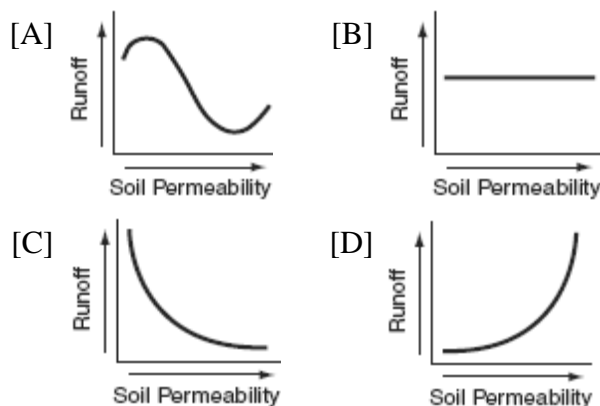The effect of pH on the action of a certain enzyme is shown on the accompanying graph.

What is the domain of this function?

[A] $4 \le x \le 13$ [B] $y \ge 0$

[C] $4 \le y \le 13$ [D] $x \ge 0$

3. 010603b

Which graph shows that soil permeability varies inversely to runoff?

4. 010604b

On a standardized test, a score of 86 falls exactly 1.5 standard deviations below the mean. If the standard deviation for the test is 2, what is the mean score for this test?

[A] 84.5   [B] 87.5   [C] 84   [D] 89

5. 010605b, P.I. G.G.61

Which transformation of the graph of $y = x^2$ would result in the graph of $y = x^2 + 2$?

[A] D_2 [B] $T_{0,2}$ [C] $R_{0,90}$ [D] $r_{y=2}$

6. 010606b, P.I. A2.A.69

A sound wave is modeled by the curve $y = 3\sin 4x$. What is the period of this curve?

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

7. 010607b, P.I. A2.A.22

If $\sqrt{2x-1}+2 = 5$, then x is equal to

[A] 5   [B] 1   [C] 4   [D] 2

8. 010608b, P.I. A2.A.67

The expression $(1 + \cos x)(1 - \cos x)$ is equivalent to

[A] $\csc^2 x$ [B] 1

[C] $\sec^2 x$ [D] $\sin^2 x$

9. 010609b, P.I. A2.A.77

If θ is a positive acute angle and $\sin 2\theta = \dfrac{\sqrt{3}}{2}$, then $(\cos\theta + \sin\theta)^2$ equals

[A] 1   [B] 30°   [C] $1+\dfrac{\sqrt{3}}{2}$ [D] 60°

10. 010610b, P.I. A2.A.1

What is the solution of the inequality $|y+8| > 3$?

[A] $y > -5$ or $y < -11$ [B] $-5 < y < 11$

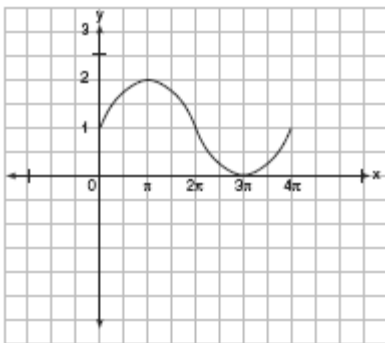[C] $-11 < y < -5$ [D] $y > -5$

11. 010611b, P.I. A2.A.19

The speed of sound, v, at temperature T, in degrees Kelvin, is represented by the equation $v = 1087\sqrt{\dfrac{T}{273}}$. Which expression is equivalent to $\log v$?

[A] $1087 + \dfrac{1}{2}\log T - \log 273$

[B] $1087(\dfrac{1}{2}\log T - \dfrac{1}{2}\log 273)$

[C] $\log 1087 + \dfrac{1}{2}\log T - \dfrac{1}{2}\log 273$

[D] $\log 1087 + 2\log(T + 273)$

12. 010612b, P.I. A2.A.72

In physics class, Eva noticed the pattern shown in the accompanying diagram on an oscilloscope.

Which equation best represents the pattern shown on this oscilloscope?

[A] $y = 2\sin(-\dfrac{1}{2}x) + 1$

[B] $y = 2\sin x + 1$

[C] $y = \sin x + 1$ [D] $y = \sin(\dfrac{1}{2}x) + 1$

13. 010613b, P.I. A2.N.5

The expression $\dfrac{5}{\sqrt{5} - 1}$ is equivalent to

[A] $\dfrac{5}{4}$ [B] $\dfrac{5\sqrt{5} - 5}{4}$

[C] $\dfrac{5\sqrt{5} - 5}{6}$ [D] $\dfrac{5\sqrt{5} + 5}{4}$

14. 010614b, P.I. A2.A.2

The roots of the equation $2x^2 - 5 = 0$ are

[A] real and irrational   [B] imaginary

[C] real, rational, and unequal

[D] real, rational, and equal

15. 010615b

What is the radian measure of the angle formed by the hands of a clock at 2:00 p.m.?

[A] $\dfrac{\pi}{6}$ [B] $\dfrac{\pi}{2}$ [C] $\dfrac{\pi}{3}$ [D] $\dfrac{\pi}{4}$

16. 010616b, P.I. A2.A.62

If θ is an angle in standard position and $P(-3,4)$ is a point on the terminal side of θ, what is the value of $\sin \theta$?

[A] $\dfrac{4}{5}$ [B] $-\dfrac{4}{5}$ [C] $\dfrac{3}{5}$ [D] $-\dfrac{3}{5}$

17. 010617b, P.I. A2.A.8

When simplified, the expression $(\sqrt[3]{m^4})(m^{-\frac{1}{2}})$ is equivalent to

[A] $\sqrt[4]{m^3}$ [B] $\sqrt[5]{m^{-4}}$

[C] $\sqrt[6]{m^5}$ [D] $\sqrt[3]{m^{-2}}$

18. 010618b, P.I. G.G.61

What are the coordinates of point A', the image of point $A(-4,1)$ after the composite transformation $R_{90°} \circ r_{y=x}$ where the origin is the center of rotation?

[A] $(-1,-4)$ [B] $(4,1)$

[C] $(1,4)$ [D] $(-4,-1)$

19. 010619b, P.I. G.G.47

The accompanying diagram shows a 24-foot ladder leaning against a building. A steel brace extends from the ladder to the point where the building meets the ground. The brace forms a right angle with the ladder.
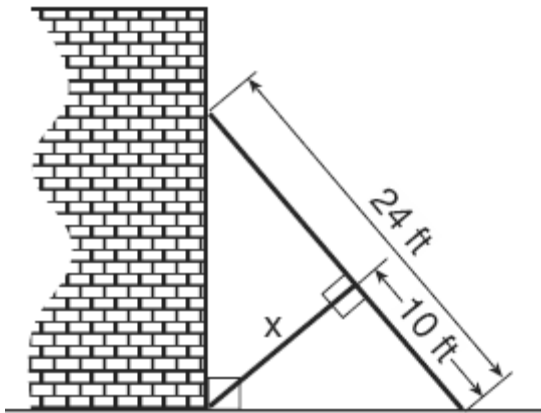
If the steel brace is connected to the ladder at a point that is 10 feet from the foot of the ladder, which equation can be used to find the length, x, of the steel brace?

[A] $10^2 + x^2 = 14^2$ [B] $\dfrac{10}{x} = \dfrac{x}{24}$

[C] $\dfrac{10}{x} = \dfrac{x}{14}$ [D] $10^2 + x^2 = 24^2$

20. 010620b, P.I. G.G.73

The center of a circle represented by the equation $(x-2)^2 + (y+3)^2 = 100$ is located in Quadrant

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

21. 010621b, P.I. A2.A.42

If $f(x) = 5x^2 - 1$ and $g(x) = 3x - 1$, find $g(f(1))$.

22. 010622b, P.I. A2.A.37

On the accompanying diagram, draw a mapping of a relation from set A to set B that is *not* a function. Explain why the relationship you drew is *not* a function.
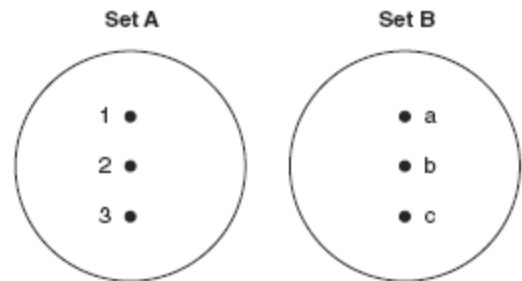
23. 010623b, P.I. G.G.53

In the accompanying diagram, $\overline{PA}$ is tangent to circle O at A, secant $\overline{PBC}$ is drawn, $PB = 4$, and $BC = 12$. Find PA.
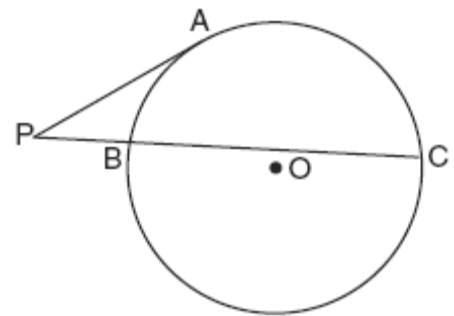

24. 010624b, P.I. A2.A.5

The time it takes to travel to a location varies inversely to the speed traveled. It takes 4 hours driving at an average speed of 55 miles per hour to reach a location. To the *nearest tenth of an hour*, how long will it take to reach the same location driving at an average speed of 50 miles per hour?

25. 010625b, P.I. A2.S.15

During a recent survey, students at Franconia College were asked if they drink coffee in the morning. The results showed that two-thirds of the students drink coffee in the morning and the remainder do not. What is the probability that of six students selected at random, *exactly* two of them drink coffee in the morning? Express your answer as a fraction or as a decimal rounded to *four decimal places*.

26. 010626b, P.I. A2.A.27

Solve algebraically for *x*: $8^{2x} = 4^6$

27. 010627b, P.I. A2.A.25

In physics class, Taras discovers that the behavior of electrical power, *x*, in a particular circuit can be represented by the function $f(x) = x^2 + 2x + 7$. If $f(x) = 0$, solve the equation and express your answer in simplest $a + bi$ form.

28. 010628b

On the accompanying grid, sketch the graphs of $y = 2^x$ and $3y = 7x + 3$ over the interval $-3 \le x \le 4$. Identify and state the coordinates of all points of intersection.
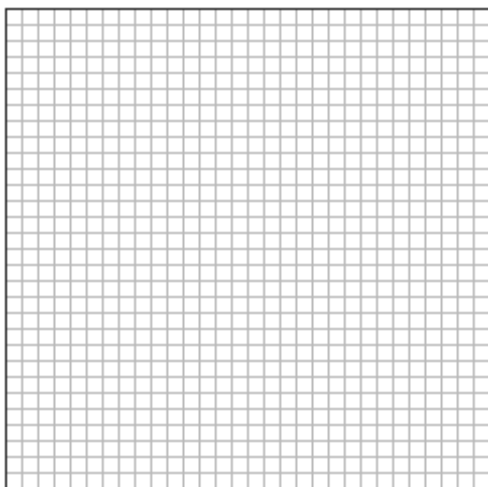
29. 010629b, P.I. A2.A.17

Simplify completely: $\dfrac{\dfrac{1-m}{m}}{m - \dfrac{1}{m}}$

30. 010630b, P.I. A2.A.68

An architect is using a computer program to design the entrance of a railroad tunnel. The outline of the opening is modeled by the function $f(x) = 8\sin x + 2$, in the interval $0 \le x \le \pi$, where *x* is expressed in radians. Solve algebraically for all values of *x* in the interval $0 \le x \le \pi$, where the height of the opening, f(*x*), is 6. Express your answer in terms of π. If the *x*-axis represents the base of the tunnel, what is the maximum height of the entrance of the tunnel?

31. 010631b, P.I. A2.A.73

The Vietnam Veterans Memorial in Washington, D.C., is made up of two walls, each 246.75 feet long, that meet at an angle of 125.2°. Find, to the *nearest foot*, the distance between the ends of the walls that do not meet.

32. 010632b, P.I. A2.A.27

The current population of Little Pond, New York, is 20,000. The population is *decreasing*, as represented by the formula $P = A(1.3)^{-0.234t}$, where P = final population, t = time, in years, and A = initial population. What will the population be 3 years from now? Round your answer to the *nearest hundred people*. To the *nearest tenth of a year*, how many years will it take for the population to reach half the present population? [The use of the grid is optional.]
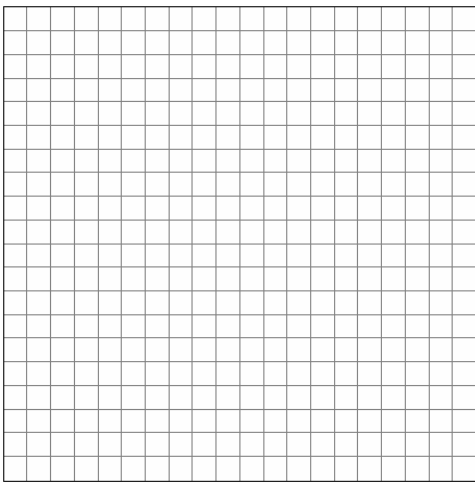
33. 010633b, P.I. A2.S.7

Since 1990, fireworks usage nationwide has grown, as shown in the accompanying table, where t represents the number of years since 1990, and p represents the fireworks usage per year, in millions of pounds.

Number of Years Since 1990 (t)	Fireworks Usage per Year, In Millions of Pounds (p)
0	67.6
2	88.8
4	119.0
6	120.1
7	132.5
8	118.3
9	159.2
11	161.6

Find the equation of the linear regression model for this set of data, where t is the independent variable. Round values to *four decimal places*. Using this equation, determine in what year fireworks usage would have reached 99 million pounds. Based on this linear model, how many millions of pounds of fireworks would be used in the year 2008? Round your answer to the *nearest tenth*.

34. 010634b, P.I. G.G.27

Given: parallelogram *FLSH*, diagonal $\overline{FGAS}$, $\overline{LG} \perp \overline{FS}$, $\overline{HA} \perp \overline{FS}$
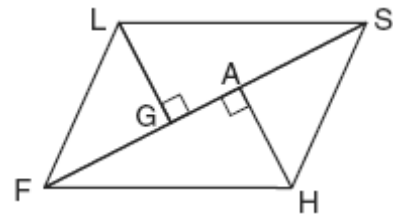
Prove: $\triangle LGS \cong \triangle HAF$

[1]   C

[2]   A

[3]   C

[4]   D

[5]   B

[6]   D

[7]   A

[8]   D

[9]   C

[10] A

[11] C

[12] D

[13] D

[14] A

[15] C

[16] A

[17] C

[18] B

[19] C

[20] A

[21] [2] 11, and appropriate work is shown, such as f(l) = 4 and g(4) = 11.
[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 solving for f(g(l)).
or [1] 11, 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] A mapping is drawn that maps at least one element of set A to more than one element of set B, and an appropriate explanation of the difference between functions and relations is written.
[1] An appropriate mapping is drawn, but no explanation is written.
or [1] An incorrect mapping is drawn, but an appropriate 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.

[23] [2] 8, and appropriate work is shown, such as $(PA)^2 = 4 \times 16 = 64$.
[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 failing to reject the negative root.
or [1] 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.

[24] [2] 4.4, 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] Only the constant of variation, 220, is found.
or [1] 4.4, but no work is shown.
[0] Direct variation is used.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[2] $\frac{60}{729}$ or $\frac{20}{243}$ or .0823, and appropriate

work is shown, such as $_6C_2(\frac{2}{3})^2(\frac{1}{3})^4$.

[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] A correct expression is written, such as

$_6C_2(\frac{2}{3})^2(\frac{1}{3})^4$, but no further correct

work is shown.

or [1] $\frac{60}{729}$ or $\frac{20}{243}$ or .0823, 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] 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] 2, but a method other than an algebraic solution is used.
or [1] 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
[26] incorrect procedure.
_____

[4] $-1\pm i\sqrt{6}$, and appropriate work is shown, such as appropriately substituting for $a, b,$ and c in the quadratic formula, solving the equation, and simplifying the answer correctly.
[3] Appropriate work is shown, but one computational or simplification error is made.
[2] Appropriate work is shown, but two or more computational or simplification errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as writing the quadratic formula incorrectly.
[1] Appropriate work is shown, but one conceptual error and one computational or simplification error are made.
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
[27] incorrect procedure.
_____

[4] (0,1) and (3,8), and both graphs are sketched correctly.
[3] Appropriate work is shown, but one graphing error is made, but all appropriate points of intersection are identified.
[2] Appropriate work is shown, but two or more graphing errors are made, but all appropriate points of intersection are identified.
or [2] Appropriate work is shown, but one conceptual error is made, such as failing to draw the graph over the specified interval, resulting in only one point of intersection.
or [2] Both graphs are sketched correctly, and the two points of intersection are indicated, but the coordinates are not stated or are stated incorrectly.
[1] Only the graph of the exponential function is sketched correctly, and no further correct work is shown.
or [1] (0,1) and (3,8), but no graph is sketched.
[0] (0,1) or (3,8), but no graph is sketched.
or [0] Only the line is graphed correctly.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[28] obviously incorrect procedure.

[4] $\dfrac{-1}{m+1}$ or $\dfrac{1}{-m-1}$, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or simplification error is made.
[2] Appropriate work is shown, but two or more computational or simplification 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 simplification error are made.
or [1] $\dfrac{-1}{m+1}$ or $\dfrac{1}{-m-1}$, 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
[29] incorrect procedure.

[4] $\dfrac{\pi}{6}$ and $\dfrac{5\pi}{6}$ and 10, and appropriate work is shown.
[3] Appropriate work is shown, but one computational error is made.
or [3] $x = 0.52$ and $x = 2.62$ or $x = 30°$ and $x = 150°$ and 10, and appropriate work is shown.

or [3] $\dfrac{\pi}{6}$ and $\dfrac{5\pi}{6}$, and appropriate work is shown, but the maximum height is missing.
[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] $x = 0.52$ and $x = 2.62$ or $x = 30°$ and $x = 150°$, and appropriate work is shown, but the maximum height is missing.

or [2] $\dfrac{\pi}{6}$ or $\dfrac{5\pi}{6}$ and 10, and appropriate work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or [1] 30° or 150° and 10, and appropriate work is shown.

or [1] $\dfrac{\pi}{6}$ and $\dfrac{5\pi}{6}$ and 10, 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] 438, and appropriate work is shown, such as using the Law of Cosines or 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.
or [2] Correct substitution is made into the Law of Cosines or the Law of Sines, 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] 438, but no work is shown.
[0] Right triangle trigonometry is used inappropriately.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[31]   obviously incorrect procedure.

[4] 16,600 and 11.3, and appropriate work is shown.

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

[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.

or [2] Either 16,600 or 11.3 is found, and appropriate work is shown, but the other answer is not found.

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

or [1] Correct substitutions are made into both formulas, but no further correct work is shown.

or [1] 16,600 and 11.3, but no work is shown.

[0] 16,600 or 11.3, 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

[32]   obviously incorrect procedure.

[6] $p = 8.1875t + 72.7860$, 1993, and 220.2, and appropriate work is shown.

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

or [5] The expression $8.1875t + 72.7860$ is written and 1993 and 220.2 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 equation is written, but either the year or the predicted value for 2008 is not found, but appropriate work is shown.

or [4] An incorrect equation is solved appropriately.

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

or [3] $p = 8.1875t + 72.7860$, 1993, and 220.2, but no work is shown.

or [3] The expression $8.1875t + 72.7860$ is written and either 1993 or 220.2 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] A correct equation is written, but no further correct work is shown.

or [2] 1993 and 220.2, but no work is shown.

[1] The expression $8.1875t + 72.7860$ is written, but no further correct work is shown.

or [1] 1993 or 220.2, 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

[33]   incorrect procedure.

[6] A complete and correct proof 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 the concluding statement is missing.
[4] A proof is written that demonstrates a good understanding of the method of proof and contains no conceptual errors, but two statements 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 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
[34] obviously incorrect procedure.