1. 060101b, P.I. A.A.8
An archer shoots an arrow into the air such that its height at any time, *t*, is given by the function $h(t) = -16t^2 + kt + 3$. If the maximum height of the arrow occurs at time $t = 4$, what is the value of *k*?

[A] 128 [B] 4 [C] 8 [D] 64

2. 060102b, P.I. A2.A.28
The magnitude (*R*) of an earthquake is related to its intensity (*I*) by $R = \log(\frac{I}{T})$, where *T* is the threshold below which the earthquake is not noticed. If the intensity is doubled, its magnitude can be represented by

[A] 2 log *I* - log *T* [B] log *I* - log *T*

[C] log 2 + log *I* - log *T*

[D] 2(log *I* - log *T*)

3. 060103b, P.I. A2.A.2
Jacob is solving a quadratic equation. He executes a program on his graphing calculator and sees that the roots are real, rational, and unequal. This information indicates to Jacob that the discriminant is

[A] not a perfect square [B] zero

[C] a perfect square [D] negative

4. 060104b, P.I. A2.A.5
Camisha is paying a band $330 to play at her graduation party. The amount each member earns, *d*, varies inversely as the number of members who play, *n*. The graph of the equation that represents the relationship between *d* and *n* is an example of

[A] a line [B] a hyperbola

[C] an ellipse [D] a parabola

5. 060105b, P.I. A2.A.69
A modulated laser heats a diamond. Its variable temperature, in degrees Celsius, is given by $f(t) = T\sin at$. What is the period of the curve?

[A] $\frac{2\pi}{a}$ [B] $\frac{1}{a}$ [C] $|T|$ [D] $\frac{2a\pi}{a}$

6. 060106b
The circumference of a circular plot of land is increased by 10%. What is the best estimate of the total percentage that the area of the plot increased?

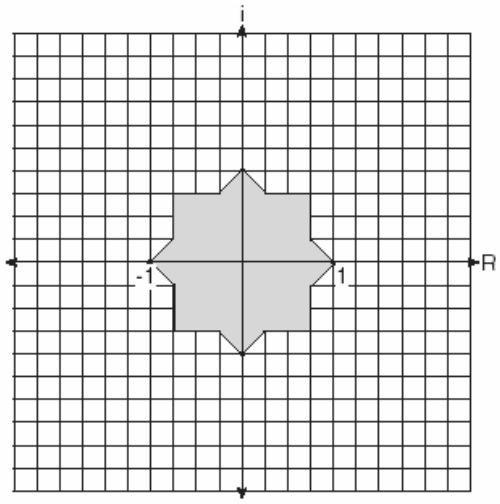
[A] 25% [B] 10% [C] 21% [D] 31%

7. 060107b
Which equation states that the temperature, *t*, in a room is less than 3° from 68°?

[A] |3 - t| < 68 [B] |3 + t| < 68

[C] |68 - t| < 3 [D] |68 + t| < 3

8. 060108b
Fractal geometry uses the complex number plane to draw diagrams, such as the one shown in the accompanying graph.



Which number is *not* included in the shaded area?

[A] -0.5*i* [B] -0.9 - 0.9*i*

[C] -0.9 [D] -0.5 - 0.5*i*

9. 060109b, P.I. A2.S.8
The relationship of a woman's shoe size and length of a woman's foot, in inches, is given in the accompanying table.

Woman's Shoe Size	5	6	7	8
Foot Length (in)	9.00	9.25	9.50	9.75

The linear correlation coefficient for this relationship is

[A] 1 [B] 0 [C] 0.5 [D] -1

10. 060110b
The center of a circular sunflower with a diameter of 4 centimeters is $(-2,1)$. Which equation represents the sunflower?

[A] $(x+2)^2+(y-1)^2=2$

[B] $(x-2)^2+(y-1)^2=4$

[C] $(x+2)^2+(y-1)^2=4$

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

11. 060111b, P.I. A2.N.9
Melissa and Joe are playing a game with complex numbers. If Melissa has a score of $5-4i$ and Joe has a score of $3+2i$, what is their total score?

[A] 8 - 6*i* [B] 8 - 2*i*

[C] 8 + 6*i* [D] 8 + 2*i*

12. 060112b, P.I. A2.A.17
In a science experiment, when resistor *A* and resistor *B* are connected in a parallel circuit, the total resistance is $\frac{1}{\frac{1}{A}+\frac{1}{B}}$. This complex fraction is equivalent to

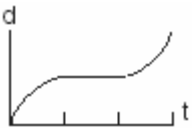
[A] $\frac{AB}{A+B}$ [B] $A + B$ [C] 1 [D] AB

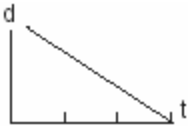
13. 060113b, P.I. A.A.1
A store advertises that during its Labor Day sale $15 will be deducted from every purchase over $100. In addition, after the deduction is taken, the store offers an early-bird discount of 20% to any person who makes a purchase before 10 a.m. If Hakeem makes a purchase of *x* dollars, $x>100$, at 8 a.m., what, in terms of *x*, is the cost of Hakeem's purchase?

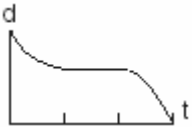
[A] $0.20x - 15$ [B] $0.80x - 12$

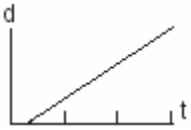
[C] $0.85x - 20$ [D] $0.20x - 3$

14. 060114b, P.I. 8.A.3
A bug travels up a tree, from the ground, over a 30-second interval. It travels fast at first and then slows down. It stops for 10 seconds, then proceeds slowly, speeding up as it goes. Which sketch best illustrates the bug's distance (*d*) from the ground over the 30-second interval (*t*)?

[A] 

[B] 

[C] 

[D] 

15. 060115b, P.I. A2.A.44
The inverse of a function is a logarithmic function in the form $y=\log_b x$. Which equation represents the original function?

[A] $x=b^y$ [B] $y=bx$

[C] $y=b^x$ [D] $by=x$

16. 060116b, P.I. A.M.1
On her first trip, Sari biked 24 miles in *T* hours. The following week Sari biked 32 miles in *T* hours. Determine the ratio of her average speed on her second trip to her average speed on her first trip.

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

17. 060117b, P.I. A2.N.10

What is the value of $\sum_{m=1}^{3}(2m+1)^{m-1}$?

[A] 55 [B] 245 [C] 57 [D] 15

18. 060118b

If θ is an obtuse angle and $\sin\theta = b$, then it can be concluded that

[A] $\cos 2\theta > b$ [B] $\cos\theta > b$

[C] $\sin 2\theta < b$ [D] $\tan\theta > b$

19. 060119b, P.I. A2.A.75

Main Street and Central Avenue intersect, making an angle measuring 34°. Angela lives at the intersection of the two roads, and Caitlin lives on Central Avenue 10 miles from the intersection. If Leticia lives 7 miles from Caitlin, which conclusion is valid?

[A] Leticia can live at one of three locations on Main Street.

[B] Leticia can live at one of two locations on Main Street.

[C] Leticia can live at only one location on Main Street.

[D] Leticia cannot live on Main Street.

20. 060120b

Through how many radians does the minute hand of a clock turn in 24 minutes?

[A] 0.8π [B] 0.6π

[C] 0.2π [D] 0.4π

21. 060121b

Gregory wants to build a garden in the shape of an isosceles triangle with one of the congruent sides equal to 12 yards. If the area of his garden will be 55 square yards, find, to the *nearest tenth of a degree*, the *three* angles of the triangle.

22. 060122b, P.I. A2.S.15

At a certain intersection, the light for eastbound traffic is red for 15 seconds, yellow for 5 seconds, and green for 30 seconds. Find, to the *nearest tenth*, the probability that out of the next eight eastbound cars that arrive randomly at the light, exactly three will be stopped by a red light.

23. 060123b, P.I. A.A.7

The cost of a long-distance telephone call is determined by a flat fee for the first 5 minutes and a fixed amount for each additional minute. If a 15-minute telephone call costs \$3.25 and a 23-minute call costs \$5.17, find the cost of a 30-minute call.

24. 060124b, P.I. A.A.18

A rectangular prism has a length of $\frac{2x^2+2x-24}{4x^2+x}$, a width of $\frac{x^2+x-6}{x+4}$, and a height of $\frac{8x^2+2x}{x^2-9}$. For all values of x for which it is defined, express, in terms of x, the volume of the prism in simplest form.

25. 060125b, P.I. A2.A.18

The scientists in a laboratory company raise amebas to sell to schools for use in biology classes. They know that one ameba divides into two amebas every hour and that the formula $t = \log_2 N$ can be used to determine how long in hours, t, it takes to produce a certain number of amebas, N. Determine, to the *nearest tenth of an hour*, how long it takes to produce 10,000 amebas if they start with one ameba.

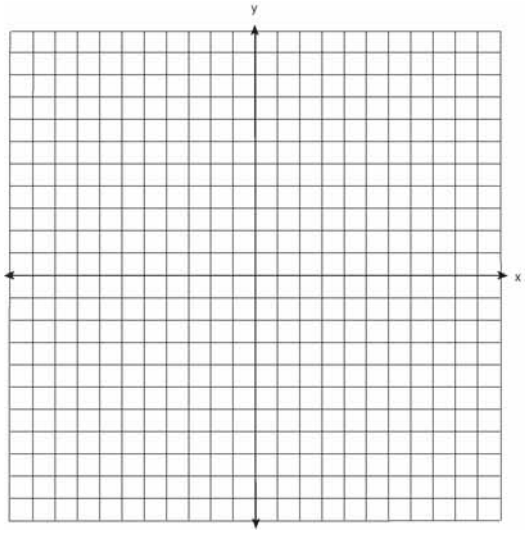
26. 060126b, P.I. A2.S.5

Professor Bartrich has 184 students in her mathematics class. The scores on the final examination are normally distributed and have a mean of 72.3 and a standard deviation of 8.9. How many students in the class can be expected to receive a score between 82 and 90?

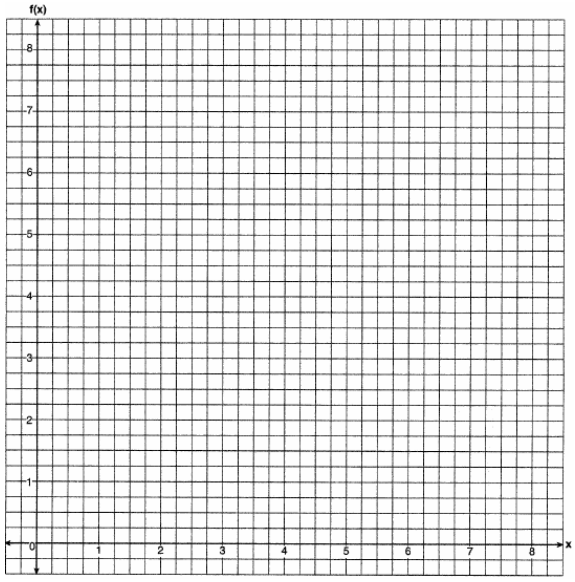
27. 060127b, P.I. A2.A.73
A wooden frame is to be constructed in the form of an isosceles trapezoid, with diagonals acting as braces to strengthen the frame. The sides of the frame each measure 5.30 feet, and the longer base measures 12.70 feet. If the angles between the sides and the longer base each measure 68.4°, find the length of one brace to the *nearest tenth of a foot.*

28. 060128b, P.I. A2.A.25
A homeowner wants to increase the size of a rectangular deck that now measures 15 feet by 20 feet, but building code laws state that a homeowner cannot have a deck larger than 900 square feet. If the length and the width are to be increased by the same amount, find, to the *nearest tenth,* the maximum number of feet that the length of the deck may be increased in size legally.

29. 060129b, P.I. G.G.61
Two parabolic arches are to be built. The equation of the first arch can be expressed as $y = -x^2 + 9,$ with a range of $0 \le y \le 9,$ and the second arch is created by the transformation $T_{7,0}$. On the accompanying set of axes, graph the equations of the two arches. Graph the line of symmetry formed by the parabola and its transformation and label it with the proper equation.



30. 060130b, P.I. A2.A.44
Draw $f(x) = 2x^2$ and $f^{-1}(x)$ in the interval $0 \le x \le 2$ on the accompanying set of axes. State the coordinates of the points of intersection.

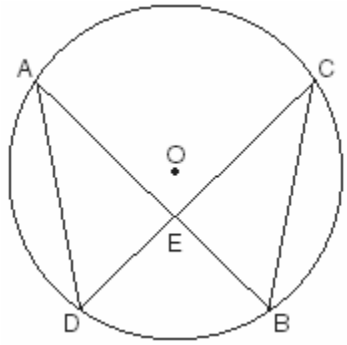


31. 060131b, P.I. A2.A.68
In the interval $0° \le A \le 360°,$ solve for all values of A in the equation $\cos 2A = -3\sin A - 1.$

32. 060132b, P.I. G.G.51
Point *P* lies outside circle *O*, which has a diameter of $\overline{AOC}$. The angle formed by tangent $\overline{PA}$ and secant $\overline{PBC}$ measures 30°. Sketch the conditions given above and find the number of degrees in the measure of minor arc *CB*.

33. 060133b, P.I. G.G.44

Given: chords $\overline{AB}$ and $\overline{CD}$ of circle *O* intersect at *E*, an interior point of circle O; chords $\overline{AD}$ and $\overline{CB}$ are drawn.



Prove: *(AE)(EB) = (CE)(ED)*

34. 060134b, P.I. A2.S.7

The 1999 win-loss statistics for the American League East baseball teams on a particular date is shown in the accompanying chart.

	W	L
New York	52	34
Boston	49	39
Toronto	47	43
Tampa Bay	39	49
Baltimore	36	51

Find the mean for the number of wins, $\overline{W}$, and the mean for the number of losses, $\overline{L}$, and determine if the point ($\overline{W}$, $\overline{L}$) is a point on the line of best fit. Justify your answer.

[1] A

[2] C

[3] C

[4] B

[5] A

[6] C

[7] C

[8] B

[9] A

[10] C

[11] B

[12] A

[13] B

[14] A

[15] C

[16] B

[17] A

[18] C

[19] B

[20] A

[21]

[2] 49.8, 65.1, and 65.1, and the appropriate use of the area formula is shown.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Only one or two angles are found correctly.
or [1] Cosine is used instead of sine, but appropriate work is shown.
or [1] The setup is appropriate, but incorrect work is shown, such as the sine of the angle but not the angle is found.
or [1] 49.8, 65.1, and 65.1, 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.

[22]

[2] 0.3 or an equivalent answer, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Appropriate work is shown, but no answer is found.
or [1] 0.3 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.

[23]

[2] $6.85, and appropriate work is shown.
[1] The correct rate for the first 5 minutes and the correct rate for each additional minute is shown, but the cost of a 30-minute call is not found.
or [1] Appropriate work is shown, but one computational error is made.
or [1] $6.85, but no work is shown.
[0] The student calculates either the rate for the first 5 minutes or the rate for each additional minute, but no further 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.

[2] $4(x - 2)$ or $4x - 8$, and appropriate work is shown.
[1] The problem is factored correctly but not reduced to simplest form.
or [1] Only two of the expressions are factored correctly, but an appropriate answer is found.
or [1] $4(x - 2)$ or $4x - 8$, but no work is shown.
[0] Only the formula for volume 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.

[24]

[2] 13.3, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] The correct value is substituted for n, and the equation is converted to exponential form, but it is not solved.
or [1] 13.3, 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.

[25]

[2] 25, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] The solution is incomplete, such as only the correct percent is shown.
or [1] 25, 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] 11.8, and an appropriate application of the Law of Cosines is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] The Law of Cosines is correctly applied, but the square root is not found.
[2] The Law of Cosines is applied correctly, and correct substitutions are shown, but no further work is shown.
or [2] Appropriate work is shown, but more than one computational error is made.
[1] The diagram is set up with the correct sides and angles, and the Law of Cosines is written, but substitution is not made.
or [1] The diagram is set up with the correct sides and angles, but no further work is shown.
or [1] 11.8, 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.

[27]

[4] 12.6, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] Appropriate work is shown, but the quadratic formula is incorrect.
[2] An appropriate equation is shown and put in standard form, but the quadratic formula is not used correctly.
or [2] An appropriate equation is shown and put in standard form, but no further work is shown.
or [2] Appropriate work is shown, but more than one computational error or one computational and one rounding error are made.
[1] An appropriate equation is shown, but all other work is missing or is incorrect.
or [1] 12.6, 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.

[28]

[4] Both parabolas are graphed correctly with the line of symmetry $x = 3.5$ drawn and labeled as $x = 3.5$.

[3] $y = -x^2 + 9$ is graphed incorrectly, but an appropriate translation is drawn, and an appropriate line of symmetry is drawn and labeled correctly.

or [3] $y = -x^2 + 9$ and its translation are graphed correctly, but no line of symmetry or an incorrect line of symmetry is drawn for the translation or no equation or an incorrect equation is shown for the line of symmetry.

[2] $y = -x^2 + 9$ is graphed correctly, but its translation is graphed incorrectly, but an appropriate line of symmetry is drawn and labeled correctly.

or [2] $y = -x^2 + 9$ is graphed incorrectly, but an appropriate translation is graphed, but an incorrect line of symmetry is drawn.

[1] $y = -x^2 + 9$ and its translation are graphed incorrectly, but an appropriate line of symmetry is drawn and labeled correctly.

or [1] $y = -x^2 + 9$ is graphed correctly, but an incorrect translation and line of symmetry are drawn.

[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] $(0,0)$ and $(\frac{1}{2},\frac{1}{2})$, and both graphs are drawn correctly.

[3] Both graphs are drawn correctly, but one or both points of intersection are stated incorrectly.

or [3] The graph of $y = 2x^2$ is incorrect, but the inverse is appropriate or correct, and the appropriate points of intersection are stated correctly.

[2] Both points of intersection are found correctly, using an algebraic solution.

or [2] The graph of $y = 2x^2$ is incorrect, but the inverse is appropriate or correct, but no further work is shown.

or [2] The graph of $y = 2x^2$ is correct, but the inverse is incorrect, but the appropriate points of intersection are stated.

or [2] The graph of $y = 2x^2$ is incorrect, but the inverse is correct, but the points of intersection are not stated or are incorrect.

[1] Both graphs are incorrect, but the points of intersection are appropriate, based on the incorrect graphs.

or [1] The graph of $y = 2x^2$ is correct, but the inverse is incorrect, and the points of intersection are labeled or stated incorrectly.

or [1] $(0,0)$ and $(\frac{1}{2},\frac{1}{2})$, but no work is shown.

[0] Straight lines are used as graphs of the functions.

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] 210° and 330°, and appropriate work is shown.
[3] Correct substitution and factoring are shown, with at least the reference angle of 30° found.
or [3] Correct substitution is shown, and the equation is put in standard form and factored correctly, but an incorrect reference angle is used to find appropriate answers.
or [3] An incorrect quadratic equation is solved correctly, and appropriate angles are determined.
[2] Correct substitution is shown, and the equation is put in standard form and factored correctly, but no angles are found.
[1] Correct substitution is shown, but the equation is not factored or is factored incorrectly.
or [1] 210° and 330°, but no work is shown.
[0] 210° or 330° or 30°, 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.

[31]

[4] 60°, and an appropriate sketch is drawn, and appropriate work is shown.
[3] A correct sketch is shown, and $m\overset{\frown}{AB}$ is correct.
or [3] A correct sketch is shown, but one computational error is made, leading to an incorrect $m\overset{\frown}{AB}$, but $m\overset{\frown}{CB}$ is appropriate, based on the incorrect $m\overset{\frown}{AB}$.
[2] A correct sketch is shown, but an incorrect procedure is used to find either the correct or incorrect $m\overset{\frown}{AB}$, but $m\overset{\frown}{CB}$ is appropriate, based on the incorrect $m\overset{\frown}{AB}$.
or [2] An incorrect sketch is shown, but an appropriate $m\overset{\frown}{CB}$ is found, based on the incorrect sketch.
[1] Only a correct sketch is shown.
or [1] 60°, 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 is shown, such as the example below:

Statements	Reasons
1 Chords $\overline{AB}$ and $\overline{CD}$ of circle O intersect at E, and chords $\overline{AB}$ and $\overline{CD}$ are drawn.	1 Given
2 $\angle A \cong \angle C$	2 Inscribed angles of a circle that intercept the same arc are congruent.
3 $\angle AED \cong \angle CEB$	3 Vertical angles are congruent.
4 $\triangle AED \sim \triangle CEB$	4 AA $\cong$ AA
5 $\frac{AE}{CE} = \frac{ED}{EB}$	5 Corresponding sides of similar triangles are in proportion.
6 $(AE)(EB) = (CE)(ED)$	6 In a proportion, the product of the means equals the product of the extremes.

[5] ΔAED and ΔCEB are correctly proved to be similar, and the appropriate proportion is written with justification.
or [5] A correct proof is shown, but one of the justifications is missing or is incorrect.
[4] ΔAED and ΔCEB are correctly proved to be similar, but no further work is shown.
[3] A correct proof is shown, but more than one justification is missing or is incorrect.
[2] The triangles are said to be similar, and the conclusion is written.
[1] Only one correct statement and justification are given.
[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] $\overline{W} = 44.6$ and $\overline{L} = 43.2$, the line of best-fit equation ($y = -1.007559x + 88.137149$) is shown, and an appropriate justification of point $(\overline{W}, \overline{L})$ fitting or not fitting, depending on the rounding of the equation, is given.
[5] $\overline{W}$ or $\overline{L}$ is incorrect, but the rest of the work is appropriate.
or [5] All conditions of the problem are met, except it is not stated whether $(\overline{W}, \overline{L})$ lies or does not lie on the line of best fit.
or [5] $\overline{W}$ and $\overline{L}$ and the equation of the line of best fit are correct, but one error results in an incorrect conclusion, such as the calculation or interchanging of $\overline{W}$ and $\overline{L}$.
[4] Both $\overline{W}$ and $\overline{L}$ are incorrect, but the rest of the work is appropriate.
or [4] $\overline{W}$ and $\overline{L}$ are correct, but the equation of the line of best fit is incorrect, but the justification is appropriate, based on the incorrect equation.
or [4] $\overline{W}$ and $\overline{L}$ are correct, a correct scatter plot is drawn, a correct line of best fit is drawn, $(\overline{W}, \overline{L})$ is plotted correctly, and a statement indicating that the point does or does not fit the line is given, with an appropriate explanation, but no equation is used.
or [4] All conditions of the problem are met, except for the justification of whether $(\overline{W}, \overline{L})$ lies on the line.
[3] $\overline{W}$ and $\overline{L}$ are correct, but the equation of the line of best fit is stated incorrectly, and no further work is shown.
[2] Only $\overline{W}$ and $\overline{L}$ are found correctly.
[1] Only one mean is found correctly.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[34]