1. 010401b, P.I. A2.A.76

   The expression $\cos 40° \cos 10° + \sin 40° \sin 10°$ is equivalent to

   [A] $\sin 30°$ [B] $\sin 50°$

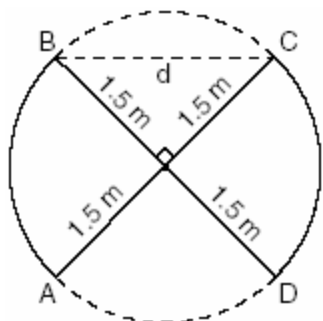   [C] $\cos 30°$ [D] $\cos 50°$

2. 010402b, P.I. A2.A.58

   The expression $\dfrac{\sec \theta}{\csc \theta}$ is equivalent to

   [A] $\sin \theta$ [B] $\dfrac{\cos \theta}{\sin \theta}$

   [C] $\cos \theta$ [D] $\dfrac{\sin \theta}{\cos \theta}$

3. 010403b, P.I. G.G.48

   An overhead view of a revolving door is shown in the accompanying diagram. Each panel is 1.5 meters wide.

   What is the approximate width of d, the opening from B to C?

   [A] 1.73 m   [B] 1.50 m

   [C] 2.12 m   [D] 3.00 m

4. 010404b, P.I. A2.A.27

   What is a positive value of x for which $9^{-\cos x} = \dfrac{1}{3}$?

   [A] 60°   [B] 90°   [C] 30°   [D] 45°

5. 010405b, P.I. A2.N.5

   The expression $\dfrac{7}{2 - \sqrt{3}}$ is equivalent to

   [A] $\dfrac{2 + \sqrt{3}}{7}$ [B] $\dfrac{14 + \sqrt{3}}{7}$

   [C] $14 + 7\sqrt{3}$ [D] $14 - 7\sqrt{3}$

6. 010406b, P.I. A2.S.4

   Jean's scores on five mathematics tests were 98, 97, 99, 98, and 96. Her scores on five English tests were 78, 84, 95, 72, and 79. Which statement is true about the standard deviations for the scores?

   [A] The standard deviations for both sets of scores are equal.

   [B] The standard deviation for the English scores is greater than the standard deviation for the math scores.

   [C] The standard deviation for the math scores is greater than the standard deviation for the English scores.

   [D] More information is needed to determine the relationship between the standard deviations.

7. 010407b, P.I. A2.A.73

   In $\triangle ABC$, $a = 19$, $c = 10$, and $m\angle A = 111$. Which statement can be used to find the value of $\angle C$?

   [A] $\sin C = \dfrac{19 \sin 69°}{10}$

   [B] $\sin C = \dfrac{10 \sin 21°}{19}$

   [C] $\sin C = \dfrac{10 \sin 69°}{19}$ [D] $\sin C = \dfrac{10}{19}$

8. 010408b, P.I. A2.A.42

If $f(x) = \dfrac{2}{x+3}$ and $g(x) = \dfrac{1}{x}$, then $(g \circ f)(x)$
is equal to

[A] $\dfrac{1+3x}{2x}$ [B] $\dfrac{x+3}{2x}$

[C] $\dfrac{2x}{1+3x}$ [D] $\dfrac{x+3}{2}$
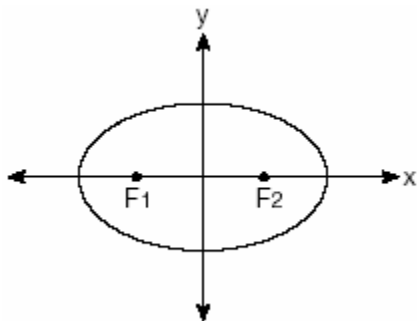
9. 010409b, P.I. A2.A.19

If $\log x = a$, $\log y = b$, and $\log z = c$, then
$\log \dfrac{x^2 y}{\sqrt{z}}$ is equivalent to

[A] $42a + b + \dfrac{1}{2}c$ [B] $2ab - \dfrac{1}{2}c$

[C] $2a + b - \dfrac{1}{2}c$ [D] $a^2 + b - \dfrac{1}{2}c$

10. 010410b

The accompanying diagram shows the elliptical orbit of a planet. The foci of the elliptical orbit are F_1 and F_2.

If a, b, and c are all positive and $a \neq b \neq c$, which equation could represent the path of the planet?

[A] $ax^2 + by^2 = c^2$ [B] $ax^2 - by^2 = c^2$

[C] $x^2 + y^2 = c^2$ [D] $y = ax^2 + c^2$

11. 010411b, P.I. A2.S.5

Battery lifetime is normally distributed for large samples. The mean lifetime is 500 days and the standard deviation is 61 days. Approximately what percent of batteries have lifetimes *longer than* 561 days?

[A] 84%   [B] 34%   [C] 16%   [D] 68%

12. 010412b

The expression $\log_3(8 - x)$ is defined for all values of x such that

[A] $x < 8$ [B] $x \leq 8$

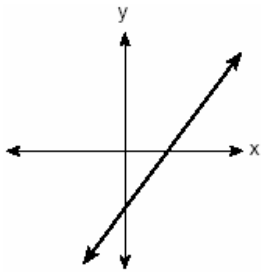[C] $x > 8$ [D] $x \geq 8$

13. 010413b, P.I. A2.A.10

The expression $b^{-\frac{3}{2}}, b > 0,$ is equivalent to

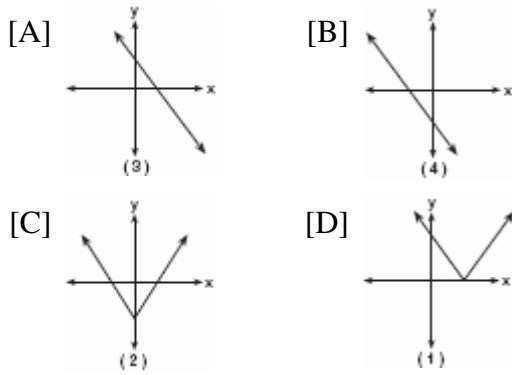[A] $-(\sqrt{b})^3$ [B] $(\sqrt[3]{b})^2$

[C] $\dfrac{1}{(\sqrt{b})^3}$ [D] $\dfrac{1}{(\sqrt[3]{b})^2}$

14. 010414b, P.I. A.G.4

The graph below represents $f(x)$.

Which graph best represents $|f(x)|$?

[A]

(3)

[B]

(4)

[C]

(2)

[D]

(1)

15. 010415b, P.I. A2.N.9

If $f(x) = x^3 - 2x^2$, then $f(i)$ is equivalent to

[A] $-2 - i$ [B] $-2 + i$ [C] $2 - i$ [D] $2 + i$

16. 010416b, P.I. A2.A.2

Which statement must be true if a parabola represented by the equation $y = ax^2 + bx + c$ does not intersect the x-axis?

[A] $b^2 - 4ac < 0$

[B] $b^2 - 4ac > 0$, and $b^2 - 4ac$ is not a perfect square.

[C] $b^2 - 4ac = 0$

[D] $b^2 - 4ac > 0$, and $b^2 - 4ac$ is a perfect square.

17. 010417b, P.I. A.G.1

A garden in the shape of an equilateral triangle has sides whose lengths are 10 meters. What is the area of the garden?

[A] $50\ m^2$ [B] $25\sqrt{3}\ m^2$

[C] $25\ m^2$ [D] $50\sqrt{3}\ m^2$

18. 010418b, P.I. A2.A.77

If x is an acute angle and $\sin x = \dfrac{12}{13}$, then $\cos 2x$ equals

[A] $\dfrac{119}{169}$ [B] $-\dfrac{25}{169}$

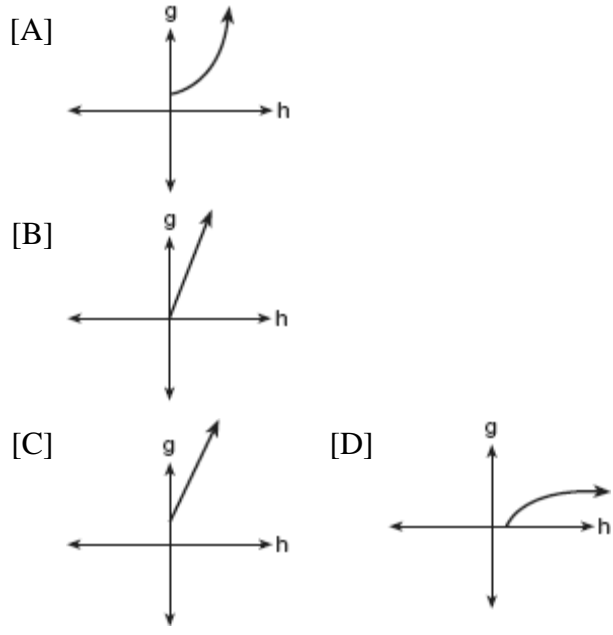[C] $-\dfrac{119}{169}$ [D] $\dfrac{25}{169}$

19. 010419b, P.I. A.A.41

What is the axis of symmetry of the graph of the equation $x = y^2$?

[A] y-axis   [B] line $y = -x$

[C] line $y = x$ [D] x-axis

20. 010420b

The cells of a particular organism increase logarithmically. If *g* represents cell growth and *h* represents time, in hours, which graph best represents the growth pattern of the cells of this organism?

[A]

[B]

[C]

[D]

21. 010421b

Kristine is riding in car 4 of the Ferris wheel represented in the accompanying diagram. The Ferris wheel is rotating in the direction indicated by the arrows. The eight cars are equally spaced around the circular wheel. Express, in radians, the measure of the *smallest* angle through which she will travel to reach the bottom of the Ferris wheel.
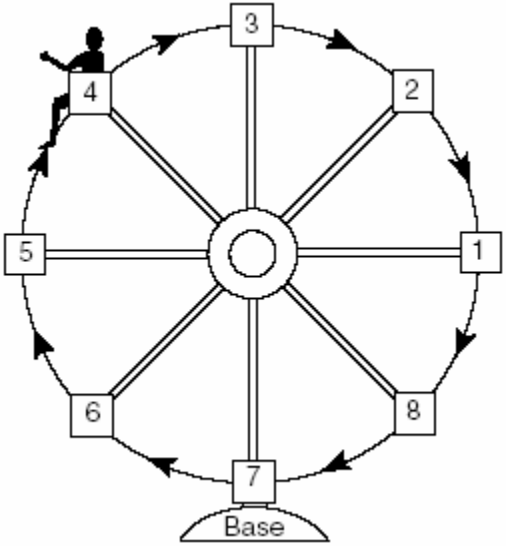
22. 010422b, P.I. A2.A.62

In the accompanying diagram, point $P(0.6,-0.8)$ is on unit circle O. What is the value of θ, to the *nearest degree*?
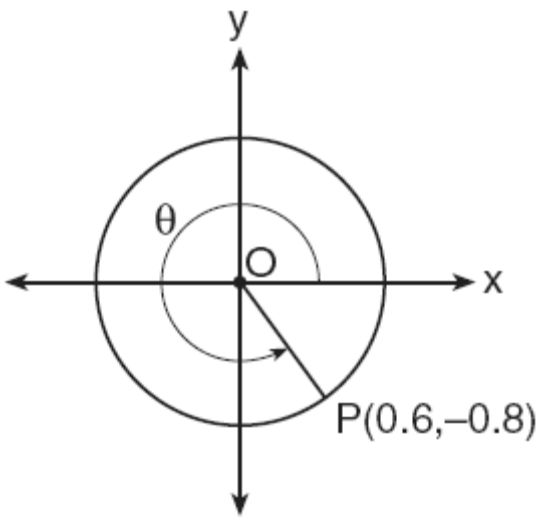
23. 010423b, P.I. A2.A.5
A pulley that has a diameter of 8 inches is belted to a pulley that has a diameter of 12 inches. The 8-inch-diameter pulley is running at 1,548 revolutions per minute. If the speeds of the pulleys vary inversely to their diameters, how many revolutions per minute does the larger pulley make?

24. 010424b, P.I. A.A.41
When a current, I, flows through a given electrical circuit, the power, W, of the circuit can be determined by the formula $W = 120I - 12I^2$. What amount of current, I, supplies the maximum power, W?

25. 010425b, P.I. A2.A.69
The brightness of the star MIRA over time is given by the equation $y = 2 \sin \dfrac{\pi}{4}x + 6$, where x represents time and y represents brightness. What is the period of this function, in radian measure?

26. 010426b, P.I. A2.A.75
A landscape designer is designing a triangular garden with two sides that are 4 feet and 6 feet, respectively. The angle opposite the 4-foot side is 30°. How many distinct triangular gardens can the designer make using these measurements?

27. 010427b, P.I. A2.A.22
Solve algebraically: $\sqrt{x+5}+1 = x$

28. 010428b, P.I. A2.S.15
A board game has a spinner on a circle that has five equal sectors, numbered 1, 2, 3, 4, and 5, respectively. If a player has four spins, find the probability that the player spins an even number *no more than* two times on those four spins.

29. 010429b, P.I. A2.A.27
The equation for radioactive decay is $p = (0.5)^{\frac{t}{H}}$, where p is the part of a substance with half-life H remaining radioactive after a period of time, t. A given substance has a half-life of 6,000 years. After t years, one-fifth of the original sample remains radioactive. Find t, to the *nearest thousand years*.

30. 010430b, P.I. A2.A.73
One force of 20 pounds and one force of 15 pounds act on a body at the same point so that the resultant force is 19 pounds. Find, to the *nearest degree*, the angle between the two original forces.

31. 010431b, P.I. A2.A.7

An acorn falls from the branch of a tree to the ground 25 feet below. The distance, S, the acorn is from the ground as it falls is represented by the equation

$S(t) = -16t^2 + 25$, where t represents time, in seconds. Sketch a graph of this situation on the accompanying grid. Calculate, to the *nearest hundredth of a second*, the time the acorn will take to reach the ground.
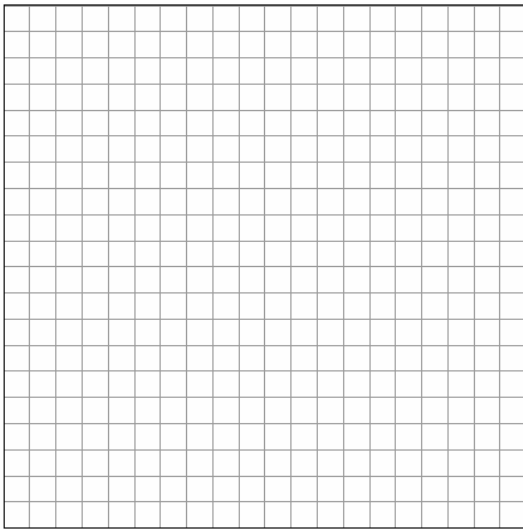
32. 010432b, P.I. G.G.27

In the accompanying diagram of circle O, $\overline{PA}$ is drawn tangent to the circle at A. Place B on $\overline{PA}$ anywhere between P and A and draw $\overline{OA}$, $\overline{OP}$, and $\overline{OB}$. Prove that $\overline{OB}$ is not perpendicular to $\overline{PA}$.
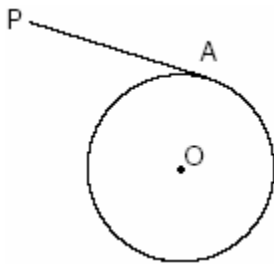
33. 010433b, P.I. A2.S.7

The accompanying table shows the average salary of baseball players since 1984. Using the data in the table, create a scatter plot on the grid and state the exponential regression equation with the coefficient and base rounded to the *nearest hundredth*. Using your written regression equation, estimate the salary of a baseball player in the year 2005, to the *nearest thousand dollars*.

Baseball Players' Salaries

Numbers of Years Since 1984	Average Salary (thousands of dollars)
0	290
1	320
2	400
3	495
4	600
5	700
6	820
7	1,000
8	1,250
9	1,580
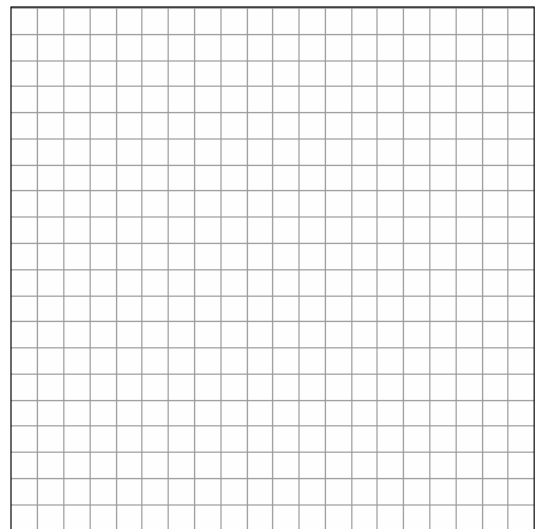
34. 010434b, P.I. A.A.18

Express in simplest form:

$$\frac{4x+8}{x+1} \bullet \frac{2-x}{3x-15} \div \frac{x^2-4}{2x^2-8x-10}$$

[1] C

[2] D

[3] C

[4] A

[5] C

[6] B

[7] C

[8] D

[9] C

[10] A

[11] C

[12] A

[13] C

[14] D

[15] C

[16] A

[17] B

[18] C

[19] D

[20] D

[2] $\frac{5\pi}{4}$ or an equivalent answer in radian measure, 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] 225 or 225°, but appropriate work is shown.
or [1] The measure of the angle in a counterclockwise rotation is found, resulting in an answer of $\frac{3\pi}{4}$.
or [1] $\frac{5\pi}{4}$ or an equivalent answer in radian measure, 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
[21] incorrect procedure.

[2] 307, 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 the value of the reference angle, but no further correct work is shown.
or [1] 307, 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] 1,032, 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] 1,032, but no work is shown.
[0] Direct variation is used instead of inverse variation.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[23] obviously incorrect procedure.

[2] 5, 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] 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
[24] incorrect procedure.

[2] 8, 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] 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
[25] incorrect procedure.

[2] Two, and appropriate work is shown or an appropriate diagram is drawn.
[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 one correct solution is found.
or [1] Two, 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] 4, and appropriate work is shown.
[3] Appropriate work is shown, but one computational error is made.
or [3] Appropriate work is shown, but $x = -1$ is not rejected.
[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] The correct quadratic equation is written in standard form, but no further correct work is shown.
or [2] A quadratic equation of equal difficulty is solved appropriately.
[1] Both sides of the equation are squared correctly, but no further correct work is shown.
or [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
[27] incorrect procedure.

[4] $\dfrac{513}{625}$ or 0.821 or an equivalent answer,

and appropriate work is shown, such as

$_4C_2(\dfrac{2}{5})^2(\dfrac{3}{5})^2+{}_4C_1(\dfrac{2}{5})^1(\dfrac{3}{5})^3+{}_4C_0(\dfrac{2}{5})^0(\dfrac{3}{5})^4.$

[3] Appropriate work is shown, but one computational error is made.
or [3] Appropriate work is shown, but a value

for at least two, $\dfrac{328}{625}$, is found.

[2] Appropriate work is shown, but two or more computational errors are made.
or [2] An appropriate answer is found, but one conceptual error is made, such as multiplying the probabilities or using five as the number of spins.
or [2] Appropriate work is shown, but a value

for less than two, $\dfrac{297}{625}$, is found.

[1] Appropriate work is shown, but a value

for exactly two, $\dfrac{216}{625}$, is found.

or [1] $\dfrac{513}{625}$ or 0.821 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
[28] incorrect procedure.

[4] 14,000, 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.
or [2] A correct equation such as

$\log\dfrac{1}{5}=(\dfrac{t}{6,000})\log 0.5$ is written, but no

further correct work is shown.
[1] The correct substitutions are made, but no further correct work is shown.
or [1] 14,000, 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] 116, 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 supplement of the correct answer, 64, is found.
[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] The correct substitutions are made into the Law of Cosines, but no further correct work is shown.
or [1] 116, 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] A correct graph is sketched and 1.25, and appropriate work is shown.
[3] A correct graph is sketched, but one computational or rounding error is made in determining the time.
or [3] Appropriate work is shown, but one error is made in sketching the graph, such as the axes are not labeled or are labeled incorrectly, but the time is determined correctly.
or [3] A correct graph is sketched and appropriate work is shown to calculate the time, but the negative root is not rejected.
[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] A correct graph is sketched, but no further correct work is shown.
or [2] Appropriate work is shown to calculate the time, but no graph or an incorrect graph is sketched.
[1] Appropriate work is shown to calculate the time, but one computational or rounding error is made, and no graph or an incorrect graph is sketched.
or [1] Appropriate work is shown to calculate the time, but the negative root is not rejected, and no graph or an incorrect graph is sketched.
or [1] 1.25, but no graph or an incorrect graph is sketched, 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
[31]　incorrect procedure.

[4] An appropriate diagram is drawn, and a correct proof is written in statement-reason or paragraph form, such as stating that ΔAOB cannot have two right angles or that two perpendiculars cannot be drawn to $\overline{PA}$ from point O.
[3] An appropriate diagram is drawn and an appropriate reason is written to show $\overline{OA} \perp \overline{PA}$, but one statement or one reason is incomplete or is incorrect, but an appropriate conclusion is drawn.
or [3] The diagram is not drawn, but a complete and correct proof is written.
[2] An appropriate diagram is drawn, and an appropriate reason is written to show $\overline{OA} \perp \overline{PA}$, but one statement and one reason are incomplete or are incorrect, but an appropriate conclusion is drawn.
[1] An appropriate diagram is drawn, but the proof contains circular reasoning.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[32]　incorrect procedure.

[6] An appropriate scatter plot is drawn, and either $y = 276.67(1.21)^x$ and \$15,151,000 or

$y = 276673.91(1.21)^x$ and \$15,152,000.

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

or [5] Appropriate work is shown, but one error is made in rounding the coefficients or by substituting an incorrect value of x for the year 2005.

or [5] Appropriate work is shown, but an incorrect nonlinear function for the regression equation is written, but an appropriate salary is found.

or [5] No scatter plot or an incorrect scatter plot is drawn, but the correct regression equation is written, and the correct salary is found.

[4] Appropriate work is shown, but two or more computational errors are made.

or [4] No scatter plot or an incorrect scatter plot is drawn, and one rounding error is made, but the correct regression equation is written, and an appropriate salary is found.

[3] Appropriate work is shown, but a linear function for the regression equation is written, but an appropriate salary is found.

or [3] An appropriate scatter plot is drawn, and the correct regression equation is written, but no further correct work is shown.

[2] An appropriate scatter plot is drawn, and the correct salary is found, but no work or regression equation is shown.

or [2] An appropriate scatter plot is drawn, but an incorrect regression equation is written, but an appropriate salary is found.

[1] No scatter plot or an incorrect scatter plot is drawn, and an incorrect regression equation is written, but an appropriate salary is found.

[1] An appropriate scatter plot is drawn, 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

[33] incorrect procedure.

[6] $-\dfrac{8}{3}$, and appropriate work is shown.

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

[4] Appropriate work is shown, but two or more computational errors are made.

[3] Appropriate work is shown, but one conceptual error is made, such as not factoring out -1 when canceling out 2 - x.

[2] Appropriate work is shown, but one conceptual error and one computational error are made.

[1] $-\dfrac{8}{3}$, 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

[34] incorrect procedure.