1. 060201b, P.I. A2.N.10
   What is the value of \( \sum_{m=2}^{5} (m^2 - 1)? \)

2. 060202b, P.I. A.A.16
   For all values of \( x \) for which the expression is defined, \( \frac{2x + x^2}{x^2 + 5x + 6} \) is equivalent to
   [A] \( \frac{1}{x + 2} \)  [B] \( \frac{x}{x + 2} \)
   [C] \( \frac{1}{x + 3} \)  [D] \( \frac{x}{x + 3} \)

3. 060203b, P.I. G.G.53
   In the accompanying diagram, the length of \( \overarc{ABC} \) is \( \frac{3\pi}{2} \) radians.
   (Not drawn to scale)

   What is \( m\angle ABC? \)

4. 060204b, P.I. G.G.28
   In the accompanying diagram of \( \triangle ABC \), \( \overline{AB} \cong \overline{AC} \), \( \overline{BD} = \frac{1}{3} \overline{BA} \), and \( \overline{CE} = \frac{1}{3} \overline{CA} \).

   Triangle \( EBC \) can be proved congruent to triangle \( DCB \) by
   [A] HL \( \cong \) HL  [B] SAS \( \cong \) SAS
   [C] ASA \( \cong \) ASA  [D] SSS \( \cong \) SSS

5. 060205b, P.I. A2.A.22
   The path of a rocket is represented by the equation \( y = \sqrt{25 - x^2} \). The path of a missile designed to intersect the path of the rocket is represented by the equation \( x = \frac{3}{2} \sqrt{y} \). The value of \( x \) at the point of intersection is 3. What is the corresponding value of \( y? \)

6. 060206b, P.I. A2.S.5
   On a standardized test, the distribution of scores is normal, the mean of the scores is 75, and the standard deviation is 5.8. If a student scored 83, the student's score ranks
   [A] between the 75th percentile and the 84th percentile
   [B] below the 75th percentile
   [C] between the 84th percentile and the 97th percentile
   [D] above the 97th percentile
7. 060207b
Which statement is true for all real number values of $x$?

[A] $|x - 1| > 0$  
[B] $\sqrt{x^2} = |x|$

[C] $\sqrt{x^2} = x$  
[D] $|x - 1| > (x - 1)$

8. 060208b, P.I. A2.A.10
If $x$ is a positive integer, $4x^\frac{1}{2}$ is equivalent to

[A] $2x$  
[B] $\frac{2}{x}$  
[C] $4\sqrt{x}$  
[D] $4\frac{1}{x}$

9. 060209b, P.I. A2.S.7
What is the equation of a parabola that goes through points $(0,1)$, $(-1,6)$, and $(2,3)$?

[A] $y = 2x^2 - 3x + 1$  
[B] $y = x^2 - 3x + 1$

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

10. 060210b, P.I. A2.A.42
If $f(x) = 2x^2 + 4$ and $g(x) = x - 3$, which number satisfies $f(x) = (f \circ g)(x)$?

[A] $\frac{3}{4}$  
[B] $5$  
[C] $\frac{3}{2}$  
[D] $4$

11. 060211b, P.I. A2.S.8
A linear regression equation of best fit between a student's attendance and the degree of success in school is $h = 0.5x + 68.5$. The correlation coefficient, $r$, for these data would be

[A] $0 < r < 1$  
[B] $r = -1$

[C] $-1 < r < 0$  
[D] $r = 0$

12. 060212b, P.I. A2.A.23
What is the solution set of the equation $\frac{x}{x-4} - \frac{1}{x+3} = \frac{28}{x^2 - x - 12}$?

[A] $\{\}$  
[B] $\{4\}$  
[C] $\{-6\}$  
[D] $\{4, -6\}$

13. 060213b, P.I. A2.A.38
Which equation represents a function?

[A] $x^2 + y^2 = 4$  
[B] $x = y^2 - 6x + 8$

[C] $y = x^2 - 3x - 4$  
[D] $4y^2 = 36 - 9x^2$

14. 060214b, P.I. A2.A.22
What is the solution set of the equation $x = 2\sqrt{2x - 3}$?

[A] $\{2\}$  
[B] $\{6\}$  
[C] $\{}$  
[D] $\{2, 6\}$

15. 060215b, P.I. A2.N.9
What is the sum of $\sqrt{-2}$ and $\sqrt{-18}$?

[A] $5i\sqrt{2}$  
[B] $4i\sqrt{2}$

[C] $2i\sqrt{5}$  
[D] $6i$
16. Which diagram represents a one-to-one function?

[A]

[B]

[C]

[D]

17. Point $P'$ is the image of point $P(-3,4)$ after a translation defined by $T_{(7,-1)}$. Which other transformation on $P$ would also produce $P'$?

[A] $R_{90^\circ}$ 
[B] $R_{-90^\circ}$ 
[C] $r_{y=-x}$ 
[D] $r_{y-axis}$

18. Which transformation does not preserve orientation?

[A] rotation 
[B] dilation 
[C] reflection in the $y$-axis 
[D] translation

19. The roots of the equation $2x^2 - x = 4$ are

[A] real, rational, and unequal 
[B] imaginary 
[C] real and irrational 
[D] real, rational, and equal

20. Which graph represents the inverse of $f(x) = \{(0,1),(1,4),(2,3)\}$?

[A]

[B]

[C]

[D]

21. On a nationwide examination, the Adams School had a mean score of 875 and a standard deviation of 12. The Boswell School had a mean score of 855 and a standard deviation of 20. In which school was there greater consistency in the scores? Explain how you arrived at your answer.
22. 060222b, P.I. A2.A.66
   Is \( \frac{1}{2} \sin 2x \) the same expression as \( \sin x \)?
   Justify your answer.

23. 060223b, P.I. A2.S.15
   After studying a couple's family history, a doctor determines that the probability of any child born to this couple having a gene for disease \( X \) is 1 out of 4. If the couple has three children, what is the probability that exactly two of the children have the gene for disease \( X \)?

24. 060224b, P.I. A2.A.27
   Growth of a certain strain of bacteria is modeled by the equation \( G = A(2.7)^{0.584t} \), where: \( G \) = final number of bacteria, \( A \) = initial number of bacteria, \( t \) = time (in hours).
   In approximately how many hours will 4 bacteria first increase to 2,500 bacteria? Round your answer to the nearest hour.

25. 060225b, P.I. A.A.41
   The equation \( W = 120I - 12I^2 \) represents the power (\( W \)), in watts, of a 120-volt circuit having a resistance of 12 ohms when a current \( (I) \) is flowing through the circuit. What is the maximum power, in watts, that can be delivered in this circuit?

26. 060226b, P.I. A.A.7
   Island Rent-a-Car charges a car rental fee of $40 plus $5 per hour or fraction of an hour. Wayne's Wheels charges a car rental fee of $25 plus $7.50 per hour or fraction of an hour. Under what conditions does it cost less to rent from Island Rent-a-Car? [The use of the accompanying grid is optional.]

27. 060227b, P.I. A2.S.4
   An electronics company produces a headphone set that can be adjusted to accommodate different-sized heads. Research into the distance between the top of people's heads and the top of their ears produced the following data, in inches: 4.5, 4.8, 6.2, 5.5, 5.6, 5.4, 5.8, 6.0, 5.8, 6.2, 4.6, 5.0, 5.4, 5.8.
   The company decides to design their headphones to accommodate three standard deviations from the mean. Find, to the nearest tenth, the mean, the standard deviation, and the range of distances that must be accommodated.
28. 060228b, P.I. A.A.11
A pelican flying in the air over water drops a crab from a height of 30 feet. The distance the crab is from the water as it falls can be represented by the function \( h(t) = -16t^2 + 30 \), where \( t \) is time, in seconds. To catch the crab as it falls, a gull flies along a path represented by the function \( g(t) = -8t + 15 \). Can the gull catch the crab before the crab hits the water? Justify your answer. [The use of the accompanying grid is optional.]

29. 060229b, P.I. G.G.27
Complete the partial proof below for the accompanying diagram by providing reasons for steps 3, 5, 6, and 9.

\[ \text{Given: } \Delta ABC \quad \text{DE} \perp \text{EF} \]
\[ \text{Prove: } \overline{AC} = \overline{FD} \]

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ( \triangle ABC )</td>
<td>1 Given</td>
</tr>
<tr>
<td>2 ( \triangle ABC \perp \text{DE} \perp \text{EF} )</td>
<td>2 Given</td>
</tr>
<tr>
<td>3 ( \angle B ) and ( \angle E ) are right angles.</td>
<td>3</td>
</tr>
<tr>
<td>4 ( \angle B = \angle E )</td>
<td>4 All right angles are congruent.</td>
</tr>
<tr>
<td>5 ( \text{DE} \parallel \text{EF} )</td>
<td>5 Given</td>
</tr>
<tr>
<td>6 ( \angle BCA \cong \angle EFD )</td>
<td>6</td>
</tr>
<tr>
<td>7 ( \overline{AC} \cong \overline{DE} )</td>
<td>7 Given</td>
</tr>
<tr>
<td>8 ( \triangle ABC \cong \triangle DEF )</td>
<td>8</td>
</tr>
<tr>
<td>9 ( \overline{AC} = \overline{FD} )</td>
<td>9</td>
</tr>
</tbody>
</table>

30. 060230b, P.I. A2.A.28
Solve for \( x \): \( \log_4 (x^2 + 3x) - \log_4 (x + 5) = 1 \)

31. 060231b, P.I. A2.A.73
A ship at sea heads directly toward a cliff on the shoreline. The accompanying diagram shows the top of the cliff, \( D \), sighted from two locations, \( A \) and \( B \), separated by distance \( S \). If \( m \angle DAC = 30 \), \( m \angle DBC = 45 \), and \( S = 30 \) feet, what is the height of the cliff, to the nearest foot?
32. Kieran is traveling from city A to city B. As the accompanying map indicates, Kieran could drive directly from A to B along County Route 21 at an average speed of 55 miles per hour or travel on the interstates, 45 miles along I-85 and 20 miles along I-64. The two interstates intersect at an angle of 150° at C and have a speed limit of 65 miles per hour. How much time will Kieran save by traveling along the interstates at an average speed of 65 miles per hour?

33. On a monitor, the graphs of two impulses are recorded on the same screen, where \(0^\circ \leq x < 360^\circ\). The impulses are given by the following equations:

\[
y = 2 \sin^2 x \\
y = 1 - \sin x
\]

Find all values of \(x\), in degrees, for which the two impulses meet in the interval \(0^\circ \leq x < 360^\circ\). [Only an algebraic solution will be accepted.]

34. The table below, created in 1996, shows a history of transit fares from 1955 to 1995. On the accompanying grid, construct a scatter plot where the independent variable is years. State the exponential regression equation with the coefficient and base rounded to the nearest thousandth. Using this equation, determine the prediction that should have been made for the year 1998, to the nearest cent.

<table>
<thead>
<tr>
<th>Year</th>
<th>Fare ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
<td>0.10</td>
</tr>
<tr>
<td>60</td>
<td>0.15</td>
</tr>
<tr>
<td>65</td>
<td>0.20</td>
</tr>
<tr>
<td>70</td>
<td>0.30</td>
</tr>
<tr>
<td>75</td>
<td>0.40</td>
</tr>
<tr>
<td>80</td>
<td>0.60</td>
</tr>
<tr>
<td>85</td>
<td>0.80</td>
</tr>
<tr>
<td>90</td>
<td>1.15</td>
</tr>
<tr>
<td>95</td>
<td>1.50</td>
</tr>
</tbody>
</table>
[2] The Adams School, and an appropriate explanation is given, such as the standard deviation is a measure of dispersion, which is how much the scores, on the average, differ from the mean. Therefore, the school with the smaller standard deviation would have the more consistent scores.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[21]

[2] No, and appropriate work is shown, such as setting the expressions equal to each other, with one trial showing that the two expressions are not always equal.

[1] No, but only one trial shows that the two expressions are not always equal.

[0] No or yes, and no work or incorrect 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] \( \frac{9}{64} \), and appropriate work is shown, such as \( 3 \binom{2}{1} \frac{1}{4} \left( \frac{3}{4} \right)^1 \).

[1] Only \( 3 \binom{2}{1} \frac{1}{4} \left( \frac{3}{4} \right)^1 \) is shown.

or [1] Appropriate work is shown, but one computational error is made.

or [1] \( \frac{9}{64} \), 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] 12, and appropriate work is shown, such as solving $2,500 = 4(2.7)^{0.584t}$.
[1] Appropriate work is shown, but the answer is not rounded or is rounded to 11.
or [1] Appropriate work is shown, but one computational error is made.
or [1] 12, 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] \[
\text{[2] } x = 55, \quad \sigma = 0.5, \quad \text{and the range is 4-7, and appropriate work is shown.}
\text{[3] } x = 55, \quad \sigma = 0.5, \quad \text{but one computational error is made when finding the range, but appropriate work is shown.}
\text{or [3] } x \text{ is correct, but } \sigma \text{ is incorrect, but the range is appropriate, based on the incorrect } \sigma. \\
\text{or [3] } x \text{ is incorrect, but } \sigma \text{ and the range are appropriate, based on the incorrect } x. \\
\text{[2] } x \text{ is incorrect and } \sigma \text{ is incorrect, but the range is appropriate, based on the incorrect } x \text{ and } \sigma. \\
\text{or [2] } x \text{ is correct and } \sigma \text{ is correct, but the range is not determined.}
\text{[1] } x = 55, \quad \sigma = 0.5, \quad \text{and the range is 4-7, but no work is shown.}
\text{[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.}
\]

[25] \[
\text{[2] } 300, \quad \text{and appropriate work is shown.}
\text{[1] Appropriate work is shown, but one computational error is made.}
\text{or [1] 300, but no work is shown.}
\text{[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.}
\]

[26] \[
\text{[2] } \text{More than 6 hours, and appropriate work is shown, using a graphic or algebraic solution.}
\text{[1] Appropriate work is shown, but one computational error or an error in analyzing the results is made.}
\text{or [1] More than 6 hours, but no work is shown.}
\text{[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.}
\]

[27] \[
\text{[4] } \text{Yes, and appropriate work is shown, and an appropriate justification is given.}
\text{[3] Appropriate work is shown, and an appropriate justification is given, but one computational error is made, or the negative value of } t \text{ is not rejected.}
\text{[2] An appropriate graph or equation is shown, such as } 16t^2 - 8t - 15 = 0.
\text{[1] An incorrect graph or equation of equal difficulty is used, but an appropriate solution is found.}
\text{[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.}
\]

[28] \[
\text{[4] } \text{Yes, and appropriate work is shown, and an appropriate justification is given.}
\text{[3] Appropriate work is shown, and an appropriate justification is given, but one computational error is made, or the negative value of } t \text{ is not rejected.}
\text{[2] An appropriate graph or equation is shown, such as } 16t^2 - 8t - 15 = 0.
\text{[1] An incorrect graph or equation of equal difficulty is used, but an appropriate solution is found.}
\text{[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.}
\]
[4] The reasons for all four steps are correct, such as:
Step 3: Perpendicular line segments form right angles.
Step 6: If two parallel lines are cut by a transversal, the alternate interior angles are congruent.
Step 8: $AAS \cong AAS$.
Step 9: Corresponding parts of congruent triangles are congruent.

[3] The reasons for only three steps are correct.

[2] The reasons for only two steps are correct.

[1] The reason for only one step is correct.

[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, and appropriate work is shown.

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

[2] One incorrect formula is used, but an appropriate answer is found.

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

[1] 41, 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.

[30]

[4] 5 and -4, and appropriate work is shown.

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

[2] The correct log equation, $\log_4 \frac{x^2 + 3x}{x + 5} = \log_4 4$, is shown, but no further work or incorrect work is shown.

[1] One correct logarithmic step is shown, such as $\log_4 \frac{x^2 + 3x}{x + 5}$.

or [1] 5 and -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.

[32]

[4] 0.15 hour or 9 minutes or an appropriately rounded answer, and appropriate work is shown, such as using the Law of Cosines.

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

[2] The correct distance along County Route 21 is found, but no further work or incorrect work is shown.

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

[1] The Pythagorean theorem is used to find the distance along County Route 21, and this distance is used to compare travel times.

or [1] 0.15 hour 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.
[6] 30, 150, and 270, and appropriate work is shown.
[5] Appropriate work is shown, but one computational error is made.
[4] The correct equation is shown, but only two correct solutions are found.
[3] The correct equation is shown, but only one correct solution is found.
[2] The correct equation is solved for \( x \), but no further work is shown.
[1] The correct equation is shown, but no further work is shown.

or [1] 30, 150, and 270, 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.

[33]

[6] A correct scatter plot, \( y = (0.002)(1.070)^x \), and $1.52 or an equivalent answer, and appropriate work is shown.
[5] Appropriate work is shown, but one computational or rounding error is made.
[4] A correct scatter plot is shown, but an incorrect equation of equal difficulty is used, but an appropriate fare for 1998 is determined, based on the incorrect equation.

or [4] A correct scatter plot with a function other than exponential is used, but an appropriate equation and fare derived from that equation are shown.
[3] A correct scatter plot is shown, and an appropriate fare based on the scatter plot is found, but no equation or work is shown.
[2] Only a correct scatter plot is shown.
[1] $1.52, 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.

[34]