1. Consider the function \( f(x) = 3(x - 7)^2 + 2 \). Select the correct statement.
   A. The range is \( y \in \mathbb{R} \).
   B. The vertex of \( f(x) \) is \((7, -2)\).
   C. The axis of symmetry for \( f(x) \) is \( x = 7 \).
   D. The domain is \( x > 7 \).

2. Which of the following equations has real roots? Select the correct answer.
   A. \( x^2 - 25 = 0 \)
   B. \(-\frac{1}{2}x^2 - 3 = 0\)
   C. \( 3x^2 + 4 = 2 \)
   D. \(-x^2 - 16 = 0\)

3. Consider the equation \( 3x^2 - 12x + 15 = 0 \). Select the correct statement.
   A. After using the quadratic formula, \( x = -2 \pm \sqrt{11} \).
   B. For any solution method, you can first rewrite the equation by dividing both sides by the GCF of the terms of the quadratic expression.
   C. If solving this equation using factoring, then \( (x - 5)(x + 1) = 0 \).
   D. To solve this by completing the square, \( \left( \frac{b}{2} \right)^2 = \left( \frac{-12}{2} \right)^2 = 36 \).

4. Consider the system of equations
   \[
   \begin{align*}
   y &= 2x^2 - 3x + 5 \\
   y - 3 &= x
   \end{align*}
   \] Select the correct statement.
   A. The only way to solve this equation is by elimination.
   B. Another way to write this system is \( x + 3 = 2x^2 - 3x + 5 \).
   C. The system has three solutions.
   D. The system has no solution.

5. Look at each focus and directrix. For which choice is the resulting parabola vertical? Select the correct answer.
   A. Focus \((0, 1)\), Directrix \( x = -2 \)
   B. Focus \((5, -1)\), Directrix \( x = \frac{1}{2} \)
   C. Focus \((6, -3)\), Directrix \( x = 2 \)
   D. Focus \((-4, -2)\), Directrix \( y = -3 \)
6. Marcia shoots an arrow that hits a bull’s–eye 80 feet away. Before hitting the bull’s–eye, the arrow reaches a maximum height of 16 feet at the midway point, 40 feet. If the bull’s–eye is considered to be at (80, 0), what function could represent the path of the arrow if \( x \) is the horizontal distance from Marcia and \( h(x) \) represents the height of the arrow in relation to the horizontal distance? (Lesson 3.2)
\[
h(x) = -\frac{1}{100}(x - 40)^2 + 16
\]

7. Consider the inequality \(-4x^2 + x \geq -2\). What method should be used to most easily solve the inequality if you have a choice between taking the square root, completing the square, or factoring? Explain your reasoning, and then solve the equation. (Lesson 4.4)
Completing the square. Because \( b \) is equal to 1 and not 0, taking the square root is not possible, and the quadratic expression \(-4x^2 + x + 2\) cannot be factored.
\[
x \geq \frac{1 \pm \sqrt{33}}{8}
\]

8. Keille is building a rectangular pen for a pet rabbit. She can buy wire fencing in a roll of 40 ft or a roll of 80 ft. The graph shows the areas of pens she can build with each type of roll.

A. Describe the function for an 80 ft roll of fencing as a transformation of the function for a 40 ft roll of fencing.
B. Is the largest pen Keille can build with an 80 ft roll of fencing twice as large as the largest pen she can build with a 40 ft roll of fencing? Explain.

A. translation 10 units right and 300 units up
B. No; the largest pen Keille can build with an 80 ft roll has an area of 400 ft², and the largest pen she can build with a 40 ft roll has an area of 100 ft². Therefore, a roll that is twice as long allows her to build a pen with 4 times the area.

PERFORMANCE TASKS
There are three different levels of performance tasks:

*Novice: These are short word problems that require students to apply the math they have learned in straightforward, real-world situations.

**Apprentice: These are more involved problems that guide students step-by-step through more complex tasks. These exercises include more complicated reasoning, writing, and open ended elements.

***Expert: These are open-ended, nonroutine problems that, instead of stepping the students through, ask them to choose their own methods for solving and justify their answers and reasoning.

SCORING GUIDES
Item 8 (2 points)
a. 1 point for correct transformation
b. 1 point for correct answer and explanation

Texas Essential Knowledge and Skills

<table>
<thead>
<tr>
<th>Items</th>
<th>Algebra 2 TEKS</th>
<th>Mathematical Processes TEKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>A2.4.B</td>
<td>A2.1.A</td>
</tr>
<tr>
<td>7</td>
<td>A2.4.H</td>
<td>A2.1.D</td>
</tr>
</tbody>
</table>

* Item integrates mixed review concepts from previous modules or a previous course.
9. Biology The spittlebug is the world’s highest jumping animal relative to its body length of about 6 millimeters. The height $h$ of a spittlebug’s jump in millimeters can be modeled by the function $h(t) = -4000t^2 + 3000t$, where $t$ is the time in seconds.

A. What is the maximum height that the spittlebug will reach?

B. What is the ratio of a spittlebug’s maximum jumping height to its body length? In the best human jumpers, this ratio is about 1.38. Compare the ratio for spittlebugs with the ratio for the best human jumpers.

A. 562.5 mm

B. 93.75 to 1; Possible answer: the ratio for spittlebugs is more than 67 times as great as the ratio for humans.

10. Safety The light produced by high-pressure sodium vapor streetlamps for different energy usages is shown in the table.

<table>
<thead>
<tr>
<th>Energy Use (watts)</th>
<th>35</th>
<th>50</th>
<th>70</th>
<th>100</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Output (lumens)</td>
<td>2250</td>
<td>4000</td>
<td>5800</td>
<td>9500</td>
<td>16,000</td>
</tr>
</tbody>
</table>

A. Find a quadratic model for the light output with respect to energy use.

B. Find a linear model for the light output with respect to energy use.

C. Apply each model to estimate the light output in lumens of a 200-watt bulb.

D. Which model gives the better estimate? Explain.

A. $y = 0.187x^2 + 84.3x - 863.6$

B. $y = 119x - 2159$

C. quadratic model output, about 23,476 lumens; linear model output, about 21,641 lumens

D. Possible answer: The quadratic model would probably give a better estimate of the light output for higher values of energy usage because the data points lie along a slight curve.
Toy Manufacturer A company is marketing a new toy. The function 
\[ s(p) = -50p^2 + 3000p \] models how the total sales \( s \) of the toy, in dollars, 
depends on the price \( p \) of the toy, in dollars.

a. Complete the square to write the function in vertex form.

b. Graph the function on the grid below.

c. What is the vertex of the graph? What does the vertex represent in this situation?

d. The model predicts that total sales will be $40,000 when the toy price is $20. At what 
other price does the model predict that the total sales will be $40,000? Use the symmetry 
of the graph to support your answer.

e. According to the model, at what nonzero price should the manufacturer expect to sell no 
toys? How can you determine this price using the graph?

**Solution**

a. \[ s(p) = -50(p - 30)^2 + 45,000 \]

b. [Graph of the function showing the vertex at (30, 45,000)].

c. (30, 45,000); the toy price ($30) that is predicted to result in the greatest 
total sales ($45,000).

d. $40; The point (20, 40,000) is 10 units to the left of the vertex. Based 
on the symmetry of the graph, there will also be a point 10 units to 
the right of the vertex with a \( y \)-coordinate of 40,000. This point is 
(40, 40,000).

e. $60; This corresponds to the point (60, 0), which means that the total 
sales is zero when the price is $60.