Name ___________________________ Quadratics Review

Formula for vertical motion:

1. A projectile is launched from a height of 1 foot with an initial upward velocity of 60 ft/s.

Write the function that models the path of this projectile:

Formula:

2. When will the projectile reach its maximum height?

3. What is its maximum height?

4. Where is this on the graph?

5. How long is the projectile in the air? (When will it hit the ground?)

6. Where is this on the graph?

7. Will the projectile reach 55 feet? 65 feet? Prove your answer with the discriminant!

Formula:
Solve using the quadratic formula. For #8-10 leave answers in simplest radical form. For #11-12 round to the nearest tenth.

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<tr>
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<tr>
<td>8.</td>
<td>$4x^2 - 12x + 9 = 0$</td>
</tr>
<tr>
<td>9.</td>
<td>$3x^2 + 10x = -6$</td>
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<td>11.</td>
<td>$3x^2 = 11x + 2$</td>
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12. A soccer ball is kicked with an initial upward velocity of 50 ft/s from a starting height of 3.5 feet.
   A. Write the vertical motion formula:
   B. How long is the ball in the air?
Find the number and the nature of the roots for each function:

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<td>13. $49x^2 + 28x + 4 = 0$</td>
<td>14. $6x^2 = 5x - 10$</td>
</tr>
<tr>
<td>15. $x^2 + 8 = 4x$</td>
<td>16. $8x^2 - 2x - 4 = 0$</td>
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17. A soccer ball is kicked and follows the path: $h = -16t^2 + 50t + 2$. Will the ball reach 40 feet? 50 feet?

18. An apartment’s rental agency uses the formula $I = 5400 + 300n - 50n^2$ to find its monthly income $I$ based on renting $n$ apartments. Will the agency’s monthly income ever be $7000$?
Name __________________________ Quadratics Review

Formula for vertical motion:

\[ h = -16t^2 + vt + C \]

1. A projectile is launched from a height of 1 foot with an initial upward velocity of 60 ft/s.

Write the function that models the path of this projectile:

\[ h = -16t^2 + 60t + 1 \]

2. **When** will the projectile reach its **maximum height**? **1.875 sec**

3. **What** is its **maximum height**? **57.25 feet**

4. Where is this on the graph? **vertex**

5. How long is the projectile in the air? (When will it hit the ground?) **3.77 sec**

6. Where is this on the graph? **x-int**

\[ t = \frac{-b}{2a} = \frac{-60}{2(-16)} = \frac{15}{4} = 3.75 \]

\[ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]

\[ x = \frac{-60 \pm \sqrt{60^2 - 4(-16)(1)}}{2(-16)} \]

\[ x = \frac{-60 \pm \sqrt{3600 - 64}}{-32} \]

\[ x = \frac{-60 \pm 6 \sqrt{5}}{-32} \]

\[ x = \frac{30 + 6 \sqrt{5}}{16} \]

7. Will the projectile reach 55 feet? 65 feet? **Prove your answer with the discriminant!**

55:

\[ -16t^2 + 60t + 1 = 55 \]

0 = -16t^2 + 60t - 54

\[ (160)^2 - 4(-16)(-54) = 144 \text{ yes} \]

65:

\[ -16t^2 + 60t + 1 = 65 \]

0 = -16t^2 + 60t - 64

\[ (160)^2 - 4(-16)(-64) = -4910 \text{ no} \]

\[
<table>
<thead>
<tr>
<th>t</th>
<th>h</th>
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<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>145</td>
</tr>
<tr>
<td>2</td>
<td>57</td>
</tr>
<tr>
<td>3</td>
<td>37</td>
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<td>4</td>
<td>15</td>
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\]
Solve using the quadratic formula. For #8-10 leave answers in simplest radical form. For #11-12 round to the nearest tenth.

8. \(4x^2 - 12x + 9 = 0\)
\[
\begin{align*}
x &= \frac{-(-12) \pm \sqrt{(-12)^2 - 4(4)(9)}}{2(4)} \\
x &= \frac{12 \pm \sqrt{0}}{8} \\
x &= \frac{12}{8} = \frac{3}{2}
\end{align*}
\]

9. \(3x^2 + 10x = -6\)
\[
\begin{align*}
3x^2 + 10x + 6 &= 0 \\
x &= \frac{-10 \pm \sqrt{10^2 - 4(3)(6)}}{2(3)} \\
x &= \frac{-10 \pm \sqrt{16}}{6} \\
x &= \frac{-10 \pm 4}{6} \\
x &= \frac{-5 \pm 2\sqrt{3}}{3}
\end{align*}
\]

10. \(3x^2 - 4x + 7 = 0\)
\[
\begin{align*}
x &= \frac{4 \pm \sqrt{(-4)^2 - 4(3)(7)}}{2(3)} \\
x &= \frac{4 \pm \sqrt{-40}}{6} \\
x &= \frac{4 \pm 2i\sqrt{10}}{6} = \frac{2 \pm i\sqrt{10}}{3}
\end{align*}
\]

11. \(3x^2 = 11x + 2\)
\[
\begin{align*}
3x^2 - 11x - 2 &= 0 \\
x &= \frac{11 \pm \sqrt{(11)^2 - 4(3)(-2)}}{2(3)} \\
x &= \frac{11 \pm \sqrt{145}}{6} \\
x &= \frac{11 \pm 12.04}{6} \\
x &= \frac{23 \pm 12.04}{6} \\
x &= \frac{35.04}{6} = 5.84 \\
x &= \frac{21.04}{6} = 3.51
\end{align*}
\]

12. A soccer ball is kicked with an initial upward velocity of 50 ft/s from a starting height of 3.5 feet.
   A. Write the vertical motion formula:
   \[h = -16t^2 + 50t + 3.5\]
   B. How long is the ball in the air?
\[
\begin{align*}
x &= \frac{-50 \pm \sqrt{(50)^2 - 4(-16)(3.5)}}{2(-16)} \\
x &= \frac{-50 \pm \sqrt{2704}}{-32} \\
x &= \frac{-50 \pm 52.19}{-32} \\
x &= \frac{-50 + 52.19}{-32} = 0.668 \\
x &= \frac{-50 - 52.19}{-32} = 3.19 \\
x &= \frac{3.19}{-32} = 3.2
\end{align*}
\]
Find the number and the nature of the roots for each function:

13. \(49x^2 + 28x + 4 = 0\)
   \[
   (28)^2 - 4(49)(4) = 0
   \]
   1 Real Root

14. \(6x^2 - 5x + 10 = 0\)
   \[
   (-5)^2 - 4(6)(10) = -215
   \]
   0 real, 2 imaginary

15. \(x^2 + 8 = 4x\)
   \[
   x^2 - 4x + 8 = 0
   \]
   \[
   (-4)^2 - 4(1)(8) = -16
   \]
   0 real, 2 imaginary

16. \(8x^2 - 2x - 4 = 0\)
   \[
   (-2)^2 - 4(8)(-4) = 132
   \]
   2 real

17. A soccer ball is kicked and follows the path: \(h = -16t^2 + 50t + 2\). Will the ball reach 40 feet? 50 feet?
   \[
   40 = -16t^2 + 50t + 2
   \]
   \[
   0 = -16t^2 + 50t - 38
   \]
   \[
   (50)^2 - 4(-16)(-38) = 68 \rightarrow \text{yes}
   \]
   \[
   50 = -16t^2 + 50t + 2
   \]
   \[
   0 = -16t^2 + 50t - 48
   \]
   \[
   (50)^2 - 4(-16)(-48) = -572 \rightarrow \text{no}
   \]

18. An apartment's rental agency uses the formula \(I = 5400 + 300n - 50n^2\) to find its monthly income \(I\) based on renting \(n\) apartments. Will the agency's monthly income ever be $7000?
   \[
   7000 = 5400 + 300n - 50n^2
   \]
   \[
   -50n^2 - 300n + 1600 = 0
   \]
   \[
   (-300)^2 - 4(-50)(1600) = -230000
   \]
   \[
   50n^2 - 300n + 1600 = 0
   \]