Use the graph to answer questions 1 – 6.

1.) Does the graph represent a function? How do you know? 
Yes, passes the Vertical Line Test.
2.) For what value of \( x \) is \( f(x) \) at its maximum? \( x = 0 \)
3.) Using interval notation, identify the increasing intervals.
\((-3, 0) \cup (3, 5)\)
4.) Using interval notation, identify the decreasing intervals.
\((-\infty, -3) \cup (0, 3)\)
5.) Find \( f(2) \).
\( f(2) = -1 \)
6.) Find \( x \) if \( f(x) = -3 \) \( x = 3 \)

7.) Is the graph of \( f(x) = \frac{1}{2} (x - 1)^2 + 2 \) wider, narrower, or the same width as the parent graph of \( y = x^2 \)?
Wider
8.) Is the graph of \( f(x) = 3(x - 1)(x + 4) \) wider, narrower, or the same width as the parent graph of \( y = x^2 \)?
Narrower
9.) Give the domain and range of the function \( f(x) = x^2 + 5 \).
\( D: (-\infty, \infty) \) \( R: [5, \infty) \)
10.) Give the domain and range of the function \( f(x) = -x^2 - 2 \).
\( D: (-\infty, \infty) \) \( R: (-\infty, -2) \)

Write the equation of each absolute value graph shown.

11.) \( y = a|x - h| + k \)
\( a = \frac{1}{2} \)
Vertex: \((2, 1)\)
12.) \( y = -|x + 2| + 3 \)

Simplify each expression.

13.) \( (6x^2y^2 - 2xy^2 + 7xy^2) + (-3x^2y^2 + 4y^2 - 2xy^2) \)
\( 3x^2y^2 + 2y^2 + 5xy^2 \)

14.) \( (4x^2 + 7x^3y^2) - (6x^2 \leq 7x^3y^2) \)
\( 4x^2 + 7x^3y^2 + 6x^2 + 7x^3y^2 \)
\( 10x^2 + 14x^3y^2 \)
Answer questions 15 and 16 using the following situation.

A baseball is hit so that its height above ground is given by the equation \( h = -16t^2 + 96t + 4 \), where \( h \) is the height in feet and \( t \) is the time in seconds after it is hit.

15.) What is the \( y \)-intercept of the graph of this function? What does its value mean in this example?

Let \( t = 0 \), \( y = 4 \) \( (0,4) \); The ball was hit at a height of 4 ft.

16.) When will the ball hit the ground?

Let \( x = 0 \) \(-16t^2 + 96t + 4 = 0 \)

\[ \chi = \frac{-96 \pm \sqrt{(96)^2 - 4(-16)(4)}}{2(-16)} \]
\[ \chi = \frac{-96 \pm \sqrt{9408}}{-32} \]
\[ \chi = \frac{-96 \pm 97.28}{-32} \]
\[ \chi = 0.04 \approx 0.04 \text{ seconds} \]

Use the following equation to answer questions 17 and 18.

Use quad. formula.

17.) Find the values of \( x \) that satisfy the equation. (solutions) Use any method.

Factor by grouping

\[ 3.5 = 15 \]
\[ 3x^2 + 5x - 3x - 5 = 0 \]

Signs \( (+) (-) \)
\[ (x+1)(3x+5) = 0 \]
\[ x = 1, -\frac{5}{3} \]

or Quadratic formula

\[ x = \frac{-2 \pm \sqrt{4 - 4(3)(-5)}}{6} \]
\[ x = \frac{-2 \pm \sqrt{56}}{6} \]
\[ x = \frac{-2 \pm 8}{6} \]
\[ x = 1, \frac{-5}{3} \]

18.) If \( x > 0 \), what is \( x + 4 \)?

Only 1 is greater than 0 so \( x = 1 \)

19.) How many solutions does the system of non-linear equations shown to the right have?

4: The graphs touch each other in 4 places

Solve each system of equations.

20.) \( x^2 + y = 1 \)
\[ 2x + y = 2 \]

\[ y = -2x + 2 \]

\[ x^2 + (-2x + 2) = 1 \]
\[ x^2 - 2x + 1 = 0 \]
\[ (x-1)(x-1) = 0 \]
\[ x = 1 \]

(1,0)

(or use quad. form.

or comp. the square)

21.) \(-3x^2 + y^2 = 9 \)
\[-2x + y = 0 \]
\[ y = 2x \]

\[-3x^2 + (2x)^2 = 9 \]
\[-3x^2 + 4x^2 = 9 \]
\[ x^2 = 9 \]
\[ x = \pm 3 \]

\[ y = 2(3) = 6 \]
\[ y = 2(-3) = -6 \]

(3, 6)

(-3, -6)
Write each expression in standard form. (Use complex conjugate.)

22.) \( \frac{-2 - 4i}{7i} \cdot \frac{-7i}{-7i} \)

\[
\frac{14i + 28i^2}{-49i^2} = \frac{14i - 28}{49} = \frac{-28 + 14i}{49} \cdot \frac{49}{49i} = \frac{-4 + 2i}{7} \cdot \frac{7}{7i} \]

23.) \( \frac{8 + 7i}{3 - 4i} \cdot \frac{3 + 4i}{3 + 4i} = \frac{24 + 32i + 21i + 28i^2}{9 + 12i - 12i - 16i^2} = \frac{24 + 53i - 2}{9 + 16} \)

\[
= \frac{-4 + 53i}{25} \cdot \frac{25}{25i} = \frac{-53 - 4i}{25} \cdot \frac{25}{25i} \]

24.) Let \( f(x) = 2x + k. \) If \( k \) is a constant and \( f(10) = 23, \) find \( f(-1). \)

\[
\begin{align*}
23 &= 2(10) + k \\
23 &= 20 + k \\
k &= 3
\end{align*}
\]

\[
\begin{align*}
f(-1) &= 2(-1) + 3 \\
f(-1) &= -2 + 3 \\
f(-1) &= 1
\end{align*}
\]

Complete the following using linear programming.

25.) Your club plans to raise money by selling two sizes of fruit baskets. The plan is buy small baskets for $10 and sell them for $16 and to buy large baskets for $15 and sell them for $25. The club president estimates that you will not sell more than 100 baskets. Your club can afford to spend up to $1200 to buy the baskets. Find the number of small and large fruit baskets you should buy in order to maximize profit.

Objective function (max/min):

\[
P = 16x + 25y - \text{NO}!!
\]

Constraints (inequalities):

\[
\begin{align*}
x + y &\leq 100 \\
10x + 5y &\leq 1200 \\
x &\geq 0 \\
y &\geq 0
\end{align*}
\]

Corner Points (vertices of common shaded area):

\[
(0, 0) \quad (0, 100) \quad (100, 0) \quad (0, 80) \quad (120, 0)
\]

Solution (show work – substitute points into objective function):

\[
\begin{align*}
P &= 16(0) + 25(0) = 0 \\
P &= 16(80) + 25(0) = 12800 \\
P &= 16(0) + 25(40) = 1000
\end{align*}
\]

\[
\boxed{P = 12800, 000} \quad \boxed{P = 16(100) + 25(0) = 1600, 000} \]

\[
\text{only purchase 80 large baskets to max. profit}
\]
Write an equation for each parabola shown.

26.)

\[ h: 4 \]
\[ k: 1 \]
\[ p: 2 \]

\[ x = \frac{1}{4p} (y-k)^2 + h \]

27.)

\[ h: -4 \]
\[ k: 0 \]
\[ p: -4 \]

\[ x = \frac{1}{4p} (y-k)^2 + h \]

Determine if each set of data is linear, quadratic or exponential. If linear or quadratic, write the equation represented by the data.

28.)

<table>
<thead>
<tr>
<th>x</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>0</td>
<td>0.5</td>
<td>1</td>
<td>1.5</td>
<td>2</td>
</tr>
</tbody>
</table>

Linear \( m = \frac{1}{2} \)
\( b = 1 \)

\[ y = \frac{1}{2}x + 1 \]

29.)

<table>
<thead>
<tr>
<th>x</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>0.2</td>
<td>1</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>x^5</td>
<td>x^5</td>
<td>x^5</td>
<td>x^5</td>
</tr>
</tbody>
</table>

Exponential

30.)

<table>
<thead>
<tr>
<th>x</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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</thead>
<tbody>
<tr>
<td>y</td>
<td>2</td>
<td>6</td>
<td>18</td>
<td>54</td>
<td>162</td>
</tr>
<tr>
<td></td>
<td>x^2</td>
<td>x^3</td>
<td>x^3</td>
<td>x^3</td>
<td>x^3</td>
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</table>

Exponential

31.)

<table>
<thead>
<tr>
<th>x</th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>2</td>
<td>4.5</td>
<td>8</td>
<td>12.5</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>+0.5</td>
<td>+3.5</td>
<td>+4.5</td>
<td>+5.5</td>
<td>+1</td>
</tr>
</tbody>
</table>

Quadratic (see extra paper for work)
\[ y = \frac{1}{2}x^2 + 5x + 12.5 \]

32.)

<table>
<thead>
<tr>
<th>x</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>4</td>
<td>1</td>
<td>-2</td>
<td>-5</td>
<td>-8</td>
</tr>
<tr>
<td></td>
<td>-3</td>
<td>-3</td>
<td>-3</td>
<td>-3</td>
<td>-3</td>
</tr>
</tbody>
</table>

Linear \( m = -3 \)
\( b = -2 \)

\[ y = -3x - 2 \]

33.)

<table>
<thead>
<tr>
<th>x</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>2.5</td>
<td>5</td>
<td>10</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>x^2</td>
<td>x^2</td>
<td>x^2</td>
<td>x^2</td>
<td>x^2</td>
</tr>
</tbody>
</table>

Exponential
\[
\begin{align*}
2 &= a(-3)^2 + b(-3) + c \\
2 &= 9a - 3b + c \\
8 &= a(-1)^2 + b(-1) + c \\
8 &= a - b + c \\
-10.5 &= 9a - 3b \\
13.5 &= -3a + 3b \\
3 &= 6a \\
a &= \frac{3}{6} \\
a &= \frac{1}{2} \\
-4.5 &= 5 - b \\
-5 &= -b \\
b &= 5
\end{align*}
\]

\[y = \frac{1}{2}x^2 + 5x + 12.5\]
\[ 2 = a(-3)^2 + b(-3) + c \]
\[ 2 = 9a - 3b + c \]
\[ 8 = a(-1)^2 + b(-1) + c \]
\[ 8 = a - b + c \]
\[ 18 = a(1)^2 + b(1) + c \]
\[ 18 = a + b + c \]

\[ 2 = 9a - 3b + c \]
\[ (18 = a + b + c) - 1 \Rightarrow 8 = a - b + c \]
\[ -18 = -a - b - c \]
\[ -16 = 8a - 4b \]
\[ -16 = 8a - 4c(5) \]
\[ -16 = 8a - 20 \]
\[ 4 = 8a \]
\[ a = \frac{1}{2} \]

\[ -10 = -2b \]
\[ -2 \]
\[ 5 = b \]

\[ 8 = \frac{1}{2} - 5 + c \]
\[ 8 = 4.5 + c \]
\[ c = 12.5 \]

\[ a = \frac{1}{2} \]
\[ b = 5 \]
\[ y = \frac{1}{2}x^2 + 5x + 12.5 \]
\[ c = 12.5 \]