Unit 2 Assessment so far...

Factoring

Solving Quadratic Equation
1) by Factoring
2) Square Root property \( u^2 = k \)
3) Quadratic Formula
   - Discriminant
4) Completing the square

**Discriminant**

If \( b^2 - 4ac > 0 \) you have two real solutions
* perfect square - two rational solutions
* not a perfect square - two irrational solutions

If \( b^2 - 4ac = 0 \) one rational solution.
If \( b^2 - 4ac < 0 \) two imaginary solutions.

One real solution
\[ 6x^2 - 6x - h = 0 \]
\[ a = 6 \quad b = -6 \quad c = -h \]
\[ b^2 - 4ac = 0 \]
\[ (-6)^2 - 4(6)(-h) = 0 \]
\[ 36 + 24h = 0 \]
\[ 3h = -36 \]
\[ h = -3/2 \]
Graphing parabolas \( f(x) = a(x-h)^2 + k \)

1) if \( a > 0 \), the parabola opens upward
   
   if \( a < 0 \), the parabola opens downward

2) if \( |a| > 1 \), the parabola is narrower than the \( x^2 \) graph.
   
   if \( 0 < |a| < 1 \), the parabola is wider than the \( x^2 \) graph.

3) the vertex is \((h, k)\).
   
   axis of symmetry \( x = h \)

4) domain all real \#'s.

Graph

\[
y = (x+4)^2 - 1
\]

1) opens upward
   
   same shape as \( x^2 \).

2) vertex \((-4, -1)\).

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>3</td>
</tr>
<tr>
<td>-3</td>
<td>0</td>
</tr>
<tr>
<td>-4</td>
<td>-1</td>
</tr>
<tr>
<td>-5</td>
<td>0</td>
</tr>
<tr>
<td>-6</td>
<td>3</td>
</tr>
</tbody>
</table>

\( x \)-intercepts

\[
0 = (x+4)^2 - 1
+1
+1
\]

\[
\sqrt{(x+4)^2} = \sqrt{1}
\]

\[
x + 4 = \pm 1
\]

\[
x = -4 \pm 1
\]

\[
x = -4 + 1 = -3
\]

on, \( x = -4 - 1 = -5 \)

\( y \)-intercepts

let, \( x = 0 \)

\[
y = (0+4)^2 - 1
= 4^2 - 1
= 16 - 1
= 15 \]
Graph

\[ y = 2x^2 - 8x + 6 \]

Factor a out of the x-terms

\[ y = 2(x^2 - 4x + \square) + 6 - 8 \]

\[ y = 2(x-2)^2 - 2 \]

1) Opens upward
narrower than \( x^2 \)

2) Vertex \((2, -2)\)

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-2</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

Another way to find vertex

For \( f(x) = ax^2 + bx + c \)

Vertex \( x = \frac{-b}{2a} \)

\( \left( \frac{-b}{2a}, f\left( \frac{-b}{2a} \right) \right) \)

To graph \( f(x) = ax^2 + bx + c \)
either complete the square first
and then do \( f(x) = a(x-h)^2 + k \)
\[
y = -\frac{3}{2} x^2 - 15x - \frac{75}{2}
\]

\[
y = -\frac{3}{2} (x^2 + 10x + 25) - \frac{75}{2} + \frac{75}{2}
\]

\[
y = -\frac{3}{2} (x + 5)^2 + 0
\]

opens downward

vertex: (-5, 0)

\[
\begin{array}{c|c}
 x & y \\
-3 & -6 \\
-4 & -3/2 \\
-5 & 0 \\
-6 & -3/2 \\
-7 & -6 \\
\end{array}
\]

\[
f(x) = a(x-h)^2 + k
\]

\[
f(x) = -(x^2 + 8x + 16) - 17 + 16
\]

\[
f(x) = -(x + 4)^2 - 1
\]

opens: downward

vertex: (-4, -1)

Maximum y = -1

x = -4

\[
-15 \left(-\frac{9}{2}\right) = -15 \left(-\frac{2}{3}\right)
\]

Magic #

\[
\left(\frac{10}{2}\right)^2 = (5)^2 = 25
\]

\[
a = -1, \ b = -8
\]

\[
x = \frac{-b}{2a}
\]

\[
x = \frac{-(-8)}{2(-1)} = \frac{8}{-2} = -4
\]

\[
\text{vertex: } (-4, -1)
\]

Maximum y = -1

x = -4
**Exponent Rules**

\[ b^m \cdot b^n = b^{m+n} \]

\[ b^m = b \cdot b \cdot b \ldots \cdot b \]

\[ \frac{b^m}{b^n} = b^{m-n} \quad \text{if } b \neq 0 \]

\[ w^3 \cdot w^5 = w^8 \]

\[ \frac{w^3}{w^5} = \frac{1}{w^2} \]

\[ x^4 \cdot x^4 \cdot x \cdot x^3 = x^{12} \]

\[ -4u^5(-u^5) = 4u^{10} \]

\[ 2u \cdot 4u^3 \cdot w^5 \cdot 6w^9 = 48u^4w^{14} \]

**Quotient Rule**

\[ \frac{b^m}{b^n} = b^{m-n} \quad \text{if } b \neq 0 \]

**Zero Exponent Rule**

\[ b^0 = 1 \quad \text{if } b \neq 0 \]

\[ 2000^0 = 1 \]

\[ -2000^0 = -1 \]

\[ (-2000)^0 = 1 \]
Negative Exponent Rule:

\[ b^{-n} = \frac{1}{b^n} \]

\[ W^{-5} = \frac{1}{W^5} \]

\[ (2W)^{-5} = \frac{1}{(2W)^5} = \frac{1}{2^5W^5} = \frac{1}{32W^5} \]

\[ 2W^{-5} = \frac{2}{W^5} \]