Mat 011 Agenda Day 20       June 20, 2006

Return Quiz
Quadratic Equations, PowerPoint 30
Graphing a Parabola, PowerPoint 31
Quiz on Factoring ???

Homework: Topic 32
\[
\begin{align*}
  h &= -16t^2 + 526t + 148 \\
  &= -16(9) + 526(3) + 148 \\
  &= -144 + 1578 + 148 \\
  h &= 1582 \text{ feet}
\end{align*}
\]
\[ R = -1.7x^2 + 8.2x \]
\[ C = 1.3x^2 - 135x + 157 \]
\[ P = R - C \]
\[ = (-1.7x^2 + 8.2x) - (1.3x^2 - 135x + 157) \]
\[ = -1.7x^2 + 8.2x - 1.3x^2 + 135x - 157 \]
\[ P = -3x^2 + 217x - 157 \]
\[(x - 6)(x + 1)\]

\[x^2 + x - 6\]

\[x^2 - 5x - 6\]
\[ x^2 - 5x - 4 = 0 \]

\[
\begin{align*}
    x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\
    a &= 1 \\
    b &= -5 \\
    c &= -4
\end{align*}
\]
You drop a rock from the top of the 1600 feet tall Rears Tower. The height (in feet) of the rock from the ground is given by the equation:

\[ h = -16t^2 + 1600 \]

\( h \) is in feet and \( t \) is in seconds. How long until the rock hits the ground?

\[ 0 = -16 \cdot t^2 + 1600 \]

\[ 0 = -16 \left( t^2 - 100 \right) \]

\[ 0 = -16 \left( t+10 \right) \left( t-10 \right) \]

\[ t+10 = 0 \text{ or } t-10 = 0 \]

\[ t = -10 \text{ sec} \text{ or } t = 10 \text{ sec} \]
You drop a rock from the top of the 1600 feet tall Rears Tower. The height (in feet) of the rock from the ground is given by the equation:

\[ h = -16t^2 + 1600 \]

\( h \) is in feet and \( t \) is in seconds. How long until the rock hits the ground?

\[ t = 10 \text{ or } t = -10 \]

\[ 0 = -16t^2 + 1600 \]

\[ 0 = -16(t^2 - 100) \]

\[ 0 = -16(t - 10)(t + 10) \]

\( (t - 10) = 0 \text{ or } (t + 10) = 0 \)
You drop a rock from the top of the 1600 feet tall Rears Tower. The height (in feet) of the rock from the ground is given by the equation:

\[ h = -16t^2 + 1600 \]

\( h \) is in feet and \( t \) is in seconds. How long until the rock hits the ground?

\[ h = -16t^2 + 1600 \]
\[ 0 = -16t^2 + 1600 \]
\[ 0 = -16(t^2 - 100) \]
\[ 0 = -16(t - 10)(t + 10) \]

\( t = 10 \) or \( t = -10 \)

\( t = 10 \) is the only reasonable answer.
The equation for profit is,

\[ \text{Profit} = \text{Revenue} - \text{Cost} \]

Revenue:
\[ R = 280x - .4x^2 \]

Cost:
\[ C = 5000 + .6x^2 \]

\[
P = (280x - .4x^2) - (5000 + .6x^2) \]
\[
P = 280x - .4x^2 - 5000 - .6x^2 \]
\[
= -1x^2 + 280x - 5000 \]
The equation for profit is,

\[ \text{Profit} = \text{Revenue} - \text{Cost} \]

Revenue:
\[ R = 280x - 0.4x^2 \]

Cost:
\[ C = 5000 + 0.6x^2 \]

\[ P = (280x - 0.4x^2) - (5000 + 0.6x^2) \]

\[ P = 280x - 0.4x^2 - 5000 - 0.6x^2 \]

\[ P = -1x^2 + 280x - 5000 \]
How many items must be made and sold to generate a $439 profit.

\[ P = -1x^2 + 280x - 5000 \]

\[ a = -1 \]
\[ b = 280 \]
\[ c = -5439 \]

\[ \Delta = b^2 - 4ac \]
\[ \Delta = 280^2 - 4(-1)(-5439) \]
\[ \Delta = 78400 - 4(-5439) \]
\[ \Delta = 78400 - 21756 \]
\[ \Delta = 56644 \]

\[ x = \frac{-b \pm \sqrt{\Delta}}{2a} \]
\[ x = \frac{-280 \pm \sqrt{56644}}{-2} \]
\[ x = -140 \pm 238 \]
\[ x = -518, 259 \]
How many items must be made and sold to generate a $439 profit.

\[ P = -1x^2 + 280x - 5000 \]

\[ 439 = -1x^2 + 280x - 5000 \] Subtract 439 from both sides

\[ 0 = -1x^2 + 280x - 5439 \]
Use the Quadratic Formula to solve:

\[ 0 = -1x^2 + 280x - 5439 \]

\[ 0 = ax^2 + bx + c \]

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

\[ a = -1 \quad b = 280 \quad c = -5439 \]

\[ x = \frac{-280 \pm \sqrt{280^2 - 4(-1)(-5439)}}{2(-1)} \]

\[ x = \frac{-280 \pm \sqrt{78400 - 21756}}{-2} \]
Use the Quadratic Formula to solve:

\[ 0 = -1x^2 + 280x - 5439 \]

\[ 0 = ax^2 + bx + c \]

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

\[ x = \frac{-280 \pm \sqrt{280^2 - 4(-1)(-5439)}}{2(-1)} \]

\[ x = \frac{-280 \pm \sqrt{78400 - 21756}}{-2} \]

\[ x = \frac{-280 \pm \sqrt{56644}}{-2} \]
Use of the calculator to evaluate a square root.

To find the square root of a number, use $\sqrt{}$ key in row 6 column 1.

$\sqrt{56644}$ is keyed in as

2nd, $\sqrt{}$ , 56644, ENTER
Use the Quadratic Formula to solve:

\[0 = -1x^2 + 280x - 5439\]

\[0 = ax^2 + bx + c\]

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

\[x = \frac{-280 \pm \sqrt{280^2 - 4(-1)(-5439)}}{2(-1)}\]

\[x = \frac{-280 \pm \sqrt{78400 - 21756}}{-2}\]

\[x = \frac{-280 \pm \sqrt{56644}}{-2}\]

\[x = \frac{-280 \pm 238}{-2}\]
Use the Quadratic Formula to solve:

\[ 0 = -1x^2 + 280x - 5439 \]

\[ x = \frac{-280 \pm 238}{-2} \]

\[ x = \frac{-280 + 238}{-2} = \frac{-42}{-2} = 21 \]

\[ x = \frac{-280 - 238}{-2} = \frac{-518}{-2} = 259 \]
Use the Quadratic Formula to solve:

\[0 = -1x^2 + 280x - 5439\]

\[x = \frac{-280 \pm 238}{-2}\]

\[x = \frac{-280 \pm 238}{-2}\]

\[\frac{-280 + 238}{-2} = \frac{-42}{-2} = 21\]

\[\frac{-280 - 238}{-2} = \frac{-518}{-2} = 259\]

Two solutions to make P = $439:

\[x = 21\] and \[x = 259\] items
Wanna skip stones?

That's a stupid idea.

Yeah... I guess you're right.
LET'S SOLVE QUADRATIC EQUATIONS IN THE SAND!
WANNA SKIP STONES?
THAT'S A STUPID IDEA.

Yeah... I guess you're right.

LET'S SOLVE QUADRATIC EQUATIONS IN THE SAND!
Graph $y = ax^2 + bx + c$.

Graph of a quadratic in the form $y = ax^2 + bx + c$ is a parabola.

Graph of $y = 1x^2 - 6x + 8$ is a parabola which opens upward because $a$ is positive coefficient.

Graph of $y = -1x^2 + 2x + 8$ is a parabola which opens downward because $a$ is negative coefficient.
Graph \( y = ax^2 + bx + c \).

Graph of a quadratic in the form \( y = ax^2 + bx + c \) is a parabola.

Graph of \( y = 1x^2 - 6x + 8 \) is a parabola which opens upward because \( a \) is positive coefficient. Think of a happy face!

Graph of \( y = -1x^2 + 2x + 8 \) is a parabola which opens downward because \( a \) is negative coefficient. Think of an unhappy face!
\(0 = -1x^2 + 2x + 8\)
\(0 = -1(x - 4)(x + 2)\)

1. Opens down
2. Vertex: \(x = \frac{-b}{2a}\)
   \((-1, 9)\)
3. \(x\)-intercepts
   \((4, 0), (-2, 0)\)
4. \(y\)-intercept \((0, 8)\)

\(a = -1\), \(b = 2\), \(c = 8\)
\[ y = -1x^2 + 2x + 8 \]

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

\[ x = \frac{-2 \pm \sqrt{4 + 32}}{-2} \]

\[ = \frac{-2 \pm \sqrt{36}}{-2} = \frac{-2 \pm 6}{-2} \]

\[ \frac{-2 + 6}{-2} = \frac{4}{-2} = -2 \]

\[ \frac{-2 - 6}{-2} = \frac{-8}{-2} = 4 \]
\[ y = x^2 - 6x + 8 \]

1. \textit{Open up}

2. \textit{Vertex} \((3, -1)\)
   
   \[
   x = -\frac{-b}{2a} = \frac{6}{2(1)} = 3
   \]
   
   \[
   y = x^2 - 6x + 8
   \]
   
   \[
   y = 9 - 6(3) + 8 = -1
   \]

3. \textit{X-intercepts}:
   
   \(0 = x^2 - 6x + 8\)
   
   \(0 = (x - 4)(x - 2)\)
   
   \(x - 4 = 0 \quad x - 2 = 0\)
   
   \(x = 4 \quad x = 2\)

4. \textit{Y-intercept}:
   
   \((0, 8)\)
   
   \[y = x^2 - 6x + 8\]
   
   \[y = 0 - 6(0) + 8\]
   
   \(y = 0 + 8\)

\[ a = 1 \quad b = -6 \quad c = 8 \]
$y = x^2 - 6x + 8$

$(x-2)(x-4) = 0$

$x = 2, \ x = 4$

Vertex:

$(0, 8)$

$y$-intercept:

$(3, -1)$

$(6, 8)$

Factoring:

1. $f(x) = x^2 - 6x + 8$

2. $(x-2)(x-4)$

3. $x = 2, \ x = 4$
open up? down?

1. Vertex
2. x-intercept
3. y-intercept
Enclose a rectangle with a 40 inch string and use a wall of the room for one side of the rectangle. Make a table and find the formula for the area of the rectangle.

<table>
<thead>
<tr>
<th>Width</th>
<th>Length</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40 - 2(1) = 38</td>
<td>38 sq inches</td>
</tr>
<tr>
<td>5</td>
<td>40 - 2(5) = 30</td>
<td>150 sq in</td>
</tr>
<tr>
<td>10</td>
<td>40 - 2(10) = 20</td>
<td>200 sq in</td>
</tr>
<tr>
<td>15</td>
<td>40 - 2(15) = 10</td>
<td>150 sq in</td>
</tr>
</tbody>
</table>

\[ A = -2x + 40x \]

\[ A = -2x(10 - x) \]

\[ x = 0 \quad x = 20 \]

\[ x = \frac{-40}{2(-2)} = 10 \]
Enclose a rectangle with a 40 inch string and use a wall of the room for one side of the rectangle. Make a table and find the formula for the area of the rectangle.

<table>
<thead>
<tr>
<th>Width</th>
<th>Length</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>40-2(5)=30</td>
<td>5(30)=150</td>
</tr>
<tr>
<td>10</td>
<td>40-2(10)=20</td>
<td>10(20)=200</td>
</tr>
<tr>
<td>15</td>
<td>40-2(15)=10</td>
<td>15(10)=150</td>
</tr>
<tr>
<td>X</td>
<td>40-2(X)</td>
<td>X(40-2X)=40X-2X²</td>
</tr>
</tbody>
</table>
Enclose a rectangle with a 40 inch string and use a wall of the room for one side of the rectangle. Find the dimensions of the rectangle if the area is 65 square inches.

\[
A = 40x - 2x^2
\]

\[
65 = -2x^2 + 40x
\]
Enclose a rectangle with a 40 inch string and use a wall of the room for one side of the rectangle. Find the dimensions of the rectangle if the area is 65 square inches.

\[ A = 40x - 2x^2 \]

\[ 65 = -2x^2 + 40x \]

\[ 0 = -2x^2 + 40x - 65 \]

Subtract 65 from both sides.
Use the Quadratic Formula to solve:
\[ 0 = -2x^2 + 40x - 65 \]
Use the Quadratic Formula to solve:

\[ 0 = -2x^2 + 40x - 65 \]

\[ 0 = ax^2 + bx + c \quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]

\[ a = -2 \quad b = 40 \quad c = -65 \]

\[ x = \frac{-40 \pm \sqrt{40^2 - 4(-2)(-65)}}{2(-2)} \]

\[ x = \frac{-40 \pm \sqrt{1600 - 520}}{-4} \]
Use the Quadratic Formula to solve:

$$0 = -2x^2 + 40x - 65$$

$$x = \frac{-280 \pm 238}{-2}$$

$$x = \frac{-40 \pm 32.86}{-4}$$

$$\begin{align*}
\text{Two solutions to make } A = 65 \text{ sq in:} \\
x &= 1.8 \text{ and } x = 18.2 \text{ inches}
\end{align*}$$
A 10 cm stick is broken into two pieces. One is placed at a right angle to form an upside down “T” shape. By attaching wires from the ends of the base to the end of the upright piece, a framework for a sail will be formed.

<table>
<thead>
<tr>
<th>Base</th>
<th>Height</th>
<th>Area (A=0.5bh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A 10 cm stick is broken into two pieces. One is placed at a right angle to form an upside down “T” shape. By attaching wires from the ends of the base to the end of the upright piece, a framework for a sail will be formed.

<table>
<thead>
<tr>
<th>Base</th>
<th>Height</th>
<th>Area (A=.5bh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10-(0)=10</td>
<td>(.5)(0)(10)=0 sq cm</td>
</tr>
<tr>
<td>2</td>
<td>10-(2)=8</td>
<td>(.5)(2)(8)= 8 sq cm</td>
</tr>
<tr>
<td>4</td>
<td>10-(4)=6</td>
<td>(.5)(4)(6)=12 sq cm</td>
</tr>
<tr>
<td>6</td>
<td>10-(6)=4</td>
<td>(.5)(6)(4)=12 sq cm</td>
</tr>
<tr>
<td>8</td>
<td>10-(8)=2</td>
<td>(.5)(8)(2)=8 sq cm</td>
</tr>
<tr>
<td>10</td>
<td>10-(10)=0</td>
<td>(.5)(10)(0)=0 sq cm</td>
</tr>
<tr>
<td>b</td>
<td>10-(b)</td>
<td>(.5)(b)(10-b)= 5b-.5b^2</td>
</tr>
</tbody>
</table>
What should the base of the sail be if the area must be 10 sq cm?

\[ A = 5b - 0.5b^2 \]

\[ 10 = 5b - 0.5b^2 \]
What should the base of the sail be if the area must be 10 sq cm?

\[ A = 5b - 0.5b^2 \]

\[ 10 = 5b - 0.5b^2 \quad \text{Subtract 10 from both sides} \]

\[ 0 = -0.5b^2 + 5b - 10 \]
Use the Quadratic Formula to solve:

\[ 0 = -0.5b^2 + 5b - 10 \]

\[ 0 = ax^2 + bx + c \quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]

\[ a = -0.5 \quad b = 5 \quad c = -10 \]

\[ x = \frac{-5 \pm \sqrt{5^2 - 4(-0.5)(-10)}}{2(-0.5)} \]

\[ x = \frac{-5 \pm \sqrt{25 - 20}}{-1} \]
Use the Quadratic Formula to solve:

\[ 0 = -0.5x^2 + 5x - 10 \]

\[ x = \frac{-5 \pm 2.24}{-1} \]

\[ x = \frac{-5 + 2.24}{-1} = \frac{-2.76}{-1} = 2.8 \]

\[ x = \frac{-5 - 2.24}{-1} = \frac{-7.24}{-1} = 7.2 \]

Two solutions to make \( A = 10 \) sq in:
\( x = 2.8 \) and \( x = 7.2 \) inches