Mat 011 Agenda Day 20 June 21, 2005

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

Homework: Topic 32
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?
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?

\[ \begin{align*}
  h &= -16t^2 + 1600 \\
  0 &= -16t^2 + 1600 \\
  0 &= -16(t^2 - 100) \\
  0 &= -16(t - 10)(t + 10) \\
  (t - 10) &= 0 \text{ or } (t + 10) = 0
\end{align*} \]

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

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

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

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

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

\( t = 10 \) is the only reasonable answer.
The equation for profit is,
\[ \text{Profit} = \text{Revenue} - \text{Cost} \]
Revenue: \[ R = 280x - 0.4x^2 \]
Cost: \[ C = 5000 + 0.6x^2 \]

\[ P = R - C \]
\[ = (280x - 0.4x^2) - (5000 + 0.6x^2) \]
\[ = 280x - 0.4x^2 - 5000 - 0.6x^2 \]
\[ P = -1x^2 + 280x - 5000 \]
The equation for profit is,

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

Revenue: \[ R = 280x - .4x^2 \]
Cost: \[ C = 5000 + .6x^2 \]

\[ P = (280x - .4x^2) - (5000 + .6x^2) \]
\[ P = 280x - .4x^2 - 5000 - .6x^2 \]
\[ P = -1x^2 + 280x - 5000 \]
How many items must be made and sold to generate a $439 profit.

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

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

439 \[ = -1x^2 + 280x - 5000 \]

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

\[ x = \frac{-280 \pm \sqrt{78400 - 4(-1)(-5439)}}{2(-1)} \]

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

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

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

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

\[ \frac{-280 - 238}{-2} = 259 \]
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 = \[ -1x^2 + 280x - 5439 \]
inflection
Use the Quadratic Formula to solve:

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

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

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

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

\[ x = \frac{-280 \pm \sqrt{78400 - 21756}}{-2} \]
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 $\sqrt{\text{ key in row 6 column 1.}}$

$$\sqrt{56644}$$

is keyed in as

2nd, $\sqrt{\text{, 56644, ENTER}}$
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:

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

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

\[
x = \frac{-280 \pm 238}{-2} \quad \text{and} \quad \frac{-280 + 238}{-2} = \frac{-42}{-2} = 21
\]

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

Two solutions to make \( P = $439 \):
\[ x = 21 \text{ and } x = 259 \text{ items} \]
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 \textit{upward} because \( a \) is positive coefficient.

Graph of \( y = -1x^2 + 2x + 8 \) is a parabola which opens \textit{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!
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>38</td>
<td>38</td>
</tr>
<tr>
<td>2</td>
<td>40 - 2x2 = 36</td>
<td>72</td>
</tr>
<tr>
<td>5</td>
<td>40 - 2x5 = 30</td>
<td>150</td>
</tr>
<tr>
<td>10</td>
<td>40 - 2x10 = 20</td>
<td>200</td>
</tr>
<tr>
<td>15</td>
<td>40 - 2x15 = 10</td>
<td>150</td>
</tr>
</tbody>
</table>

Formula:

\[
A = x(40 - 2x)
\]

\[
A = 40x - 2x^2
\]
\[ A = 40x - 2x^2 \]
\[ = -2x^2 + 40x \]
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)=</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40X-2X²</td>
</tr>
</tbody>
</table>

Lecture 31
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.

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

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

\[ 0 = -2x^2 + 40x - 65 \]
\[ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]

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

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

\[ x = \frac{-40 \pm \sqrt{1600 - 4(-2)(-65)}}{2(-2)} \]

\[ = \frac{-40 \pm \sqrt{1600 - 520}}{-4} \]

\[ = \frac{-40 \pm \sqrt{1080}}{-4} \]

\[ = \frac{-40 \pm 32.9}{-4} \]

\[ \frac{-40 + 32.9}{-4} = \frac{-7.1}{-4} = 1.8 \]

\[ \frac{-40 - 32.9}{-4} = \frac{-72.9}{-4} = 18.2 \]
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:

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

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

\[
X = \frac{-40 \pm 32.86}{-4} \]

\[
\frac{-40 + 32.86}{-4} = \frac{-7.14}{-4} = 1.8
\]

\[
\frac{-40 - 32.86}{-4} = \frac{-72.86}{-4} = 18.2
\]

Two solutions to make A = 65 sq in:
\[ x = 1.8 \] and \[ x = 18.2 \] inches
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=\frac{1}{2}bh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>(10-2=8)</td>
<td>(\frac{1}{2}(2)(8)=8)</td>
</tr>
<tr>
<td>4</td>
<td>(10-4=6)</td>
<td>(\frac{1}{2}(4)(6)=12)</td>
</tr>
<tr>
<td>6</td>
<td>(10-6=4)</td>
<td>(\frac{1}{2}(4)(4)=12)</td>
</tr>
<tr>
<td>8</td>
<td>(10-8=2)</td>
<td>(\frac{1}{2}(8)(2)=8)</td>
</tr>
<tr>
<td>10</td>
<td>(10-0=10)</td>
<td>(\frac{1}{2}(10)(0)=0)</td>
</tr>
</tbody>
</table>

\[
A = \frac{1}{2} b (10 - b) \\
A = \frac{1}{2} (10 b - b^2)
\]
\[ x^2 + 7x + 12 = (x + 3)(x + 4) \]
\[ x^2 + 13x + 12 = (x + 12)(x + 1) \]
\[ x^2 - 8x + 12 = (x - 2)(x - 6) \]
\[ x^2 - 7x + 12 = (x - 3)(x - 4) \]
\[x^2 + 4x - 12 = (x + 6)(x - 2)\]

\[x^2 - 4x - 12 = (x + 2)(x - 6)\]

\[x^2 + x - 12 = (x + 4)(x - 3)\]

\[x^2 - x - 12 = (x + 3)(x - 4)\]
\[ x^2 - 25y^2 = (x + 5y)(x - 5y) \]

\[ x^2 + 8x + 16 = (x + 4)(x + 4) = (x + 4)^2 \]

\[ x^2 + 8x - 12 = \text{nonfactorable over reals} \]

\[ \frac{x^2}{x - 16} = (x + 4)(x - 4) \]

\[ x^2 - 4x + 4x - 16 \]

\[ x^2 - 16x = x(x - 16) \]
$x^2 + 25 = \text{nonfactorable over reals}$
\[ C = 8x + 500 \quad R = 35x - x^2 \]

\[ P = R - C \]
\[ = (35x - x^2) - (8x + 500) \]

\[ P = 35x - x^2 - 8x - 500 \]
\[ a = -1 \quad b = 27 \quad c = -1700 \]

\[ Q = -\frac{1}{2}x^2 + 27x - 500 \]
\[ O = -\frac{1}{2}x^2 + 27x - 1700 \]
\[ C = 0.1x^2 - 20x + 180 \]
\[ R = -0.9x^2 + 60x \]

\[ P = (0.9x^2 + 60x) - (0.1x^2 - 20x + 180) \]
\[ P = -0.9x^2 + 60x - 0.1x^2 + 20x - 180 \]
\[ a = -1 \]
\[ b = 80 \]
\[ c = -1180 \]
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-.5b²</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?

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

10 = 5b - .5b^2  Subtract 10 from both sides

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:

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

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

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

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

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

Two solutions to make A = 10 sq in: 
\[ x = 2.8 \text{ and } x = 7.2 \text{ inches} \]