Mat 011 Agenda    Day 38: 04/25/03
• Review Quadratics, Sailboat
• Quiz 11
Homework: Topic 34, S267
GRAPHS OF THE FORM $Y = ax^2 + bx + c$

$Y = 1 \cdot x^2 + 8 \cdot x + -20$

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Y Intercept</th>
</tr>
</thead>
<tbody>
<tr>
<td>-4</td>
<td>-36</td>
<td>(0, # #)</td>
</tr>
</tbody>
</table>

**Vertex:**
- X: -4
- Y: -36

**Y Intercept:**
- (0, # #)

**X Intercepts:**
- 2
- -10

**Equation Components:**
- $a$
- $b$
- $c$
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.
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></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>
<tr>
<td>b</td>
<td>h</td>
<td>Area ( A = \frac{1}{2}bh )</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>-----------------</td>
</tr>
<tr>
<td>1</td>
<td>10 - 1 = 9</td>
<td>4.5 ( \frac{1}{2} \times 9 \times 1 )</td>
</tr>
<tr>
<td>2</td>
<td>10 - 2 = 8</td>
<td>8 ( \frac{1}{2} \times 8 \times 2 )</td>
</tr>
<tr>
<td>3</td>
<td>10 - 3 = 7</td>
<td>10.5 ( \frac{1}{2} \times 7 \times 3 )</td>
</tr>
<tr>
<td>4</td>
<td>10 - 4 = 6</td>
<td>12 ( \frac{1}{2} \times 6 \times 4 )</td>
</tr>
<tr>
<td>5</td>
<td>10 - 5 = 5</td>
<td>12.5 ( \frac{1}{2} \times 5 \times 5 )</td>
</tr>
<tr>
<td>6</td>
<td>10 - 6 = 4</td>
<td>12 ( \frac{1}{2} \times 4 \times 6 )</td>
</tr>
<tr>
<td>7</td>
<td>10 - 7 = 3</td>
<td>10.5 ( \frac{1}{2} \times 3 \times 7 )</td>
</tr>
<tr>
<td>x</td>
<td>10 - x</td>
<td>( 0.5 \times (10 - x) \times x )</td>
</tr>
</tbody>
</table>
\[ a = -5 \]
\[ b = 5 \]
\[ c = 0 \]

\[ A = \frac{5}{2} \times (10 - x) = 5x - \frac{5}{2}x^2 \]
\[ A = -\frac{5}{2}x^2 + 5x \]

1. \[ -\frac{5}{2} (25) + 5(5) = -12.5 + 25 = 12.5 \]

2. Vertex: \[ x = -\frac{b}{2a} = \frac{-5}{2(-5)} = 5 \]
   \[ (5, 12.5) \]

3. \[ 0 = -\frac{5}{2}x^2 + 5x \]
   \[ x = 0 \text{ or } x = 10 \]

4. \( (0, 0) \)
\[-0.5x(10-x) = 0\]

\[
\begin{align*}
-0.5x &= 0 \\
\frac{-0.5x}{-0.5} &= \frac{0}{-0.5} \\
10 - x &= 0 \\
10 &= x
\end{align*}
\]

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

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

\[ \begin{array}{c|c}
\hline
x & A \\
\hline
5 & 12.5 \\
0 & 0 \\
10 & 0 \\
\hline
\end{array} \]

Area

\[ 2 \quad 4 \quad 6 \quad 8 \quad 10 \quad \text{base} \]
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>10 - (0)=10</td>
<td>(0.5)(0)(10)=0 sq cm</td>
</tr>
<tr>
<td>2</td>
<td>10 - (2)=8</td>
<td>(0.5)(2)(8)=8 sq cm</td>
</tr>
<tr>
<td>4</td>
<td>10 - (4)=6</td>
<td>(0.5)(4)(6)=12 sq cm</td>
</tr>
<tr>
<td>6</td>
<td>10 - (6)=4</td>
<td>(0.5)(6)(4)=12 sq cm</td>
</tr>
<tr>
<td>8</td>
<td>10 - (8)=2</td>
<td>(0.5)(8)(2)=8 sq cm</td>
</tr>
<tr>
<td>10</td>
<td>10 - (10)=0</td>
<td>(0.5)(10)(0)=0 sq cm</td>
</tr>
<tr>
<td>b</td>
<td>10 - (b)</td>
<td>(0.5)(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?

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

$$0 = -.5b^2 + 5b - 10$$
Use the Quadratic Formula to solve:

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

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

Two solutions to make \( A = 10 \) sq in:
\[ x = 2.8 \text{ and } x = 7.2 \text{ inches} \]
An angry student stands on the top of a 250 foot cliff and throws his book upward with a velocity of 46 feet per second. The height of the book from the ground is given by the equation: \( h = -16t^2 + 46t + 250 \). \( h \) is in feet and \( t \) is in seconds. Graph the equation.
Graph: \[ h = -16t^2 + 46t + 250 \]

Vertex:

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

\[ t = \frac{-46}{2(-16)} = \frac{-46}{-32} = 1.4 \]

\[ h = -16(1.4)^2 + 46(1.4) + 250 = 283 \]
Graph: \[ h = -16t^2 + 46t + 250 \]

Vertex:

\[ x = \frac{-b}{2a} \]
\[ t = \frac{-46}{2(-16)} = \frac{-46}{-32} = 1.4 \]

\[ h = -16(1.4)^2 + 46(1.4) + 250 = 283 \]

Vertex: \((1.4, 283)\)

\[ x = 1.4 \text{ sec}, \ h = 283 \text{ feet} \]
Graph: \( h = -16t^2 + 46t + 250 \)

t-Intercepts: when \( h = 0 \), what is \( t \)?
Graph: \[ h = -16t^2 + 46t + 250 \]

**t-Intercepts:** when \( h = 0 \), what is \( t? \)

\[ h = -16t^2 + 46t + 250 \]

\[ 0 = -16t^2 + 46t + 250 \]

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

\[
t = \frac{-46 \pm \sqrt{46^2 - 4(-16)(250)}}{2(-16)}
\]
Graph: \[ h = -16t^2 + 46t + 250 \]

**t-Intercepts:** when \( P = 0 \), what is \( t \)?

\[
t = \frac{-46 \pm \sqrt{46^2 - 4(-16)(250)}}{2(-16)}
\]

\[
t = \frac{-46 \pm \sqrt{2116 + 16000}}{-32}
\]

\[
t = \frac{-46 \pm \sqrt{18116}}{-32}
\]

\[
t = \frac{-46 \pm 134.6}{-32}
\]
Use the Quadratic Formula to solve:

\[ 0 = -16t^2 + 46t + 250 \]

\[
t = \frac{-46 \pm \sqrt{134.6}}{-32}
\]

\[
t = \frac{-46 - 134.6}{-32} = \frac{-180.6}{-32} = 5.6
\]

\[
t = \frac{-46 + 134.6}{-32} = \frac{88.6}{-32} = -2.8
\]
Use the Quadratic Formula to solve:

\[ 0 = -16t^2 + 46t + 250 \]

\[
t = \frac{-46 \pm 134.6}{-32}
\]

\[
t = \frac{-46 \pm 134.6}{-32}
\]

\[
\frac{-46 + 134.6}{-32} = \frac{88.6}{-32} = -2.8
\]

\[
\frac{-46 - 134.6}{-32} = \frac{-180.6}{-32} = 5.6
\]

Two solutions to make \( h = 0 \):

\[ t = -2.8 \] and \[ t = 5.6 \] seconds

\[ t = -2.8 \] does not make sense
Graph: \[ h = -16t^2 + 46t + 250 \]

**h-Intercept:** when \( t = 0 \), what is \( h \)?
\[ C = 8x + 500 \quad R = 35x - 1x^2 \]

\[ P = R - C \]

\[ = 35x - 1x^2 - 8x - 500 \]

\[ P = -1x^2 + 27x - 500 \]
Graph: \[ h = -16t^2 + 46t + 250 \]

h-Intercept: when \( t = 0 \), what is \( h \)?

\[
h = -16(0)^2 + 46(0) + 250
\]

\[
h = 250 \text{ feet}
\]
Graph:

\[ h = -16t^2 + 46t + 250 \]

1. Because \( a = -16 \), parabola opens down
2. Vertex: \((1.4, 283)\)
3. \(t\)-Intercept: \((5.6, 0)\)
4. \(h\)-Intercept: \((0, 250)\)
Graph: \[ h = -16t^2 + 46t + 250 \]