MTH 112 Review for Exam 2
Prof. Townsend Fall 2014

Chapter 6 – use of the LCD
1) Use to combine fractions into a single fraction.
2) Use to solve equations for x with fractions – multiply by the LCD to clear the denominators.

The LCD (lowest common denominator) is a set of factors that includes all denominators. If there is a term without a denominator, its denominator is 1.

Chapter 7- quadratic equations and parabolas
\[ ax^2 + bx + c = 0 \]
Example 1: \( y = x^2 - 6x + 3 \)
Example 2: \( y = x^2 - 6x + 9 \)
Example 3: \( y = x^2 - 6x + 12 \)

1) Solve for x using the quadratic formula
\[
x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
\]
The discriminant, \( D = b^2 - 4ac \), tells you how many solutions there are

<table>
<thead>
<tr>
<th>( x = \frac{-b \pm \sqrt{D}}{2a} )</th>
<th>( D &gt; 0 )</th>
<th>2 roots</th>
</tr>
</thead>
<tbody>
<tr>
<td>( D = 0 )</td>
<td>1 root</td>
<td></td>
</tr>
<tr>
<td>( D &lt; 0 )</td>
<td>No real roots</td>
<td></td>
</tr>
</tbody>
</table>

Examples:

| \( D = (-6)^2 - 4(1)(3) = 24 \) | \( D > 0 \) | 2 roots | \( x = 3 \mp 6 \)
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>( x = 0.5501,5.449 )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( D = (-6)^2 - 4(1)(9) = 0 )</td>
<td>( D = 0 )</td>
<td>1 root</td>
<td>( x = 3 )</td>
</tr>
<tr>
<td>( D = (-6)^2 - 4(1)(12) = -12 )</td>
<td>( D &lt; 0 )</td>
<td>No real roots</td>
<td>( x = 3 \mp \sqrt{-3} )</td>
</tr>
</tbody>
</table>
2) Parabolas

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

a) Graph it.

Using algebra:

<table>
<thead>
<tr>
<th>( y = x^2 - 6x + 3 )</th>
<th>( y = x^2 - 6x + 9 )</th>
<th>( y = x^2 - 6x + 12 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )-Intercept</td>
<td>( y = 3 )</td>
<td>( y = 9 )</td>
</tr>
<tr>
<td>( y )-Intercept=( c )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertex</td>
<td>( x_{vertex} = \frac{-b}{2a} )</td>
<td>( x_{vertex} = \frac{-6}{2(1)} = 3 )</td>
</tr>
<tr>
<td></td>
<td>( y_{vertex} = 3^2 - 6 \cdot 3 + 3 = -6 )</td>
<td>( y_{vertex} = 3^2 - 6 \cdot 3 + 9 = 0 )</td>
</tr>
<tr>
<td>Roots</td>
<td>( x = 0.5501 )</td>
<td>( x = 5.449 )</td>
</tr>
<tr>
<td></td>
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</table>

b) Find the \( y \)-intercept (where \( x=0 \)) using F5/Value with \( x=0 \)

The formula: \( y_{\text{intercept}}=c \)

c) Find the roots using F5/Zeros. You should get the same answers as you did using the quadratic equation. On the TI-89, the lower bound is just to the left of the root on the \( x \)-axis and the upper bound is just to the right of the root on the \( x \)-axis. You will have to perform this calculation twice – once for each root.

d) The vertex is the location of the maximum or minimum of the parabola. Use F5/max or min to find it. Again, the lower bound is just to the left of the \( x \) value of the vertex and the upper bound is just to the right of the vertex \( x \) value.

Formula

\[
\begin{align*}
x_{vertex} &= \frac{-b}{2a} \\
y_{vertex} &= ax_{vertex}^2 + bx_{vertex} + c
\end{align*}
\]

To find the \( y_{vertex} \) value on the command line use

\[ ax^2 + bx + c \bigg| x = x_{vertex} \]
or, since you graphed \( y = ax^2 + bx + c \), assuming it was entered in y1=, you can use
\[ y1(x_{\text{vertex}}) \]

Note that the values of \( y_{\text{intercept}} \), the location of the vertex in x and y, and the zeros should agree whether you use the formulas or the graph tools.

**Chapter 4 – Trig in quadrant I.**

a) SOHCAHTOA

Two representations of the same information.

![Triangle and Circle Diagram](image)

**Trig function definitions:**

<table>
<thead>
<tr>
<th>( \cos \theta )</th>
<th>( \sin \theta )</th>
<th>( \tan \theta )</th>
<th>( \sec \theta )</th>
<th>( \csc \theta )</th>
<th>( \tan \theta )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{\text{adj}}{\text{hyp}} = \frac{x}{r} )</td>
<td>( \frac{\text{opp}}{\text{hyp}} = \frac{y}{r} )</td>
<td>( \frac{\text{opp}}{\text{adj}} = \frac{y}{x} )</td>
<td>( \frac{1}{\cos \theta} = \frac{\text{hyp}}{\text{adj}} = \frac{r}{x} )</td>
<td>( \frac{1}{\sin \theta} = \frac{\text{hyp}}{\text{opp}} = \frac{r}{y} )</td>
<td>( \frac{1}{\tan \theta} = \frac{\text{adj}}{\text{opp}} = \frac{x}{y} = \frac{\cos \theta}{\sin \theta} )</td>
</tr>
</tbody>
</table>

Other useful formulas:

\[ A + B + C = 180' \]

The Pythagorean theorem.
\[ c^2 = a^2 + b^2 \quad \text{or} \quad r^2 = x^2 + y^2 \]

Be careful with minus signs. Be sure to take the square root when finding a side.
There are three sides (a, b, c) across from three angles (A,B,C).

You must be given three (at least one piece must be the length of a side) of the six pieces of information to solve the triangle, i.e. find the other three pieces of information.

You know

\[ A + B + C = 180^\circ \]

The trig definitions.

The Pythagorean theorem. \[ c^2 = a^2 + b^2 \]

Solving right triangles \( C = 90^\circ \):

i) given one side and one angle.
   a) Find the third angle from \( A + B = 90^\circ \)
   b) Find another side using the side you know, A or B, and an appropriate trig definition (SOHCAHTOA)
   c) Check you work by using the two numbers you just calculated and one of the given numbers. Do not use a formula you used to solve for the two missing numbers.

ii) given two sides
   a) Find one of the angles using inverse trig functions based on SOHCAHTOA.
   b) Find the third angle from \( A + B = 90^\circ \)
   c) Check you work by using the two numbers you just calculated and one of the given numbers. Do not use a formula you used to solve for the two missing numbers.