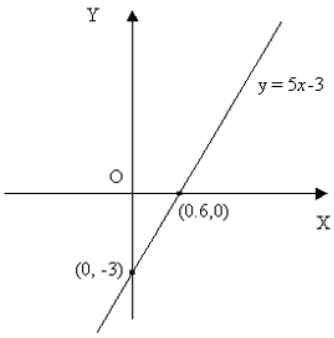
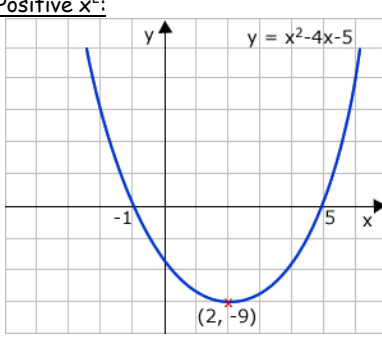
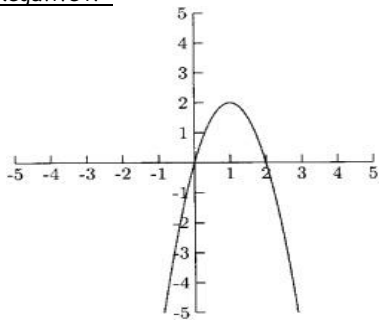


## Topic 5: Functions/Graphs

### 1) The Basics:

<p><b>a) Terminology:</b></p> <ul style="list-style-type: none"> <li><b>Domain</b> = the values that are put <b>into</b> a function.</li> <li><b>Range</b> = the values that come <b>out</b> of a function.</li> <li><b>Codomain</b> = the values that <b>could come out</b> of a function.</li> </ul>	<p><b>c) Evaluating Functions:</b></p> <p><b>Example:</b> If <math>f(x) = 2x^2 + 3</math>, find <math>f(3)</math> and <math>f(-1)</math>.</p> $f(3) = 2(3)^2 + 3 = 21$ $f(-1) = 2(-1)^2 + 3 = 5$
<p><b>b) Notation:</b></p> <p>The different ways functions are written are:</p> <ul style="list-style-type: none"> <li><math>f(x) = x^2 + 3x</math></li> <li><math>f:x \rightarrow x^2 + 3x</math></li> <li><math>y = x^2 + 3x</math></li> </ul>	<p><b>d) Finding Inputs of Functions:</b></p> <p><b>Example:</b> If <math>f(x) = 5x - 3</math>, find the value of <math>x</math> for which <math>f(x) = 12</math>.</p> $f(x) = 12$ $\Rightarrow 5x - 3 = 12$ $\Rightarrow 5x = 15$ $\Rightarrow x = 3$

### 2) Types of Graphs:

<p><b>a) Linear: <math>y = ax + b</math></b></p>  <p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>Graph above is for function of the form <math>y = ax + b</math></li> <li>If 'a' is positive, the line increases from left to right but if 'a' is negative, the line decreases from left to right</li> <li>Function of the form <math>y = ax</math> would be a line through the origin 'O'</li> <li>The root is where the graph crosses the x-axis....in the graph above, the root is 0.6.</li> </ul>	<p><b>b) Quadratic: <math>y = ax^2 + bx + c</math></b></p> <div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p><b>Positive <math>x^2</math>:</b></p>  <p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>Graph above is for function of the form <math>y = ax^2 + bx + c</math>, where 'a' is a positive number</li> <li>Roots are where the graph crosses the x-axis....in the graph above, the roots are -1 and 5</li> <li>The minimum point is the lowest point on the graph....in the graph above the minimum point is (2, -9).</li> </ul> </div> <div style="width: 48%;"> <p><b>Negative <math>x^2</math>:</b></p>  <p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>Graph above is for function of the form <math>y = ax^2 + bx + c</math>, where 'a' is a negative number</li> <li>Roots are where the graph crosses the x-axis....in the graph above, the roots are 0 and 2</li> <li>The maximum point is the highest point on the graph....in the graph above the maximum point is (1, 2)</li> </ul> </div> </div>
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### 3) Drawing/Interpreting Graphs:

<p><b>a) Drawing Graphs:</b></p> <ul style="list-style-type: none"> <li>Just fill in the values from the domain and use calculator.</li> </ul> <p><b>Example:</b> Draw the graph of <math>x^2 - 3x - 4</math>, in the domain <math>-2 \leq x \leq 1</math></p> $f(x) = x^2 - 3x - 4$ <table style="border: none;"> <tr> <td><math>f(-2) = (-2)^2 - 3(-2) - 4 = 6</math></td> <td><math>(-2, 6)</math></td> </tr> <tr> <td><math>f(-1) = (-1)^2 - 3(-1) - 4 = 0</math></td> <td><math>(-1, 0)</math></td> </tr> <tr> <td><math>f(0) = (0)^2 - 3(0) - 4 = -4</math></td> <td><math>(0, -4)</math></td> </tr> <tr> <td><math>f(1) = (1)^2 - 3(1) - 4 = -6</math></td> <td><math>(1, -6)</math></td> </tr> <tr> <td><math>f(2) = (2)^2 - 3(2) - 4 = -6</math></td> <td><math>(2, -6)</math></td> </tr> <tr> <td><math>f(3) = (3)^2 - 3(3) - 4 = -4</math></td> <td><math>(3, -4)</math></td> </tr> </table> <div style="border: 1px solid black; padding: 5px; margin-top: 10px; width: fit-content;"> <p>Can plot these on graph paper. Should know shape of graph from Section 2.</p> </div>	$f(-2) = (-2)^2 - 3(-2) - 4 = 6$	$(-2, 6)$	$f(-1) = (-1)^2 - 3(-1) - 4 = 0$	$(-1, 0)$	$f(0) = (0)^2 - 3(0) - 4 = -4$	$(0, -4)$	$f(1) = (1)^2 - 3(1) - 4 = -6$	$(1, -6)$	$f(2) = (2)^2 - 3(2) - 4 = -6$	$(2, -6)$	$f(3) = (3)^2 - 3(3) - 4 = -4$	$(3, -4)$	<p><b>b) Interpreting Graphs:</b></p> <p><b>Tip:</b></p> <p>Use ruler and dotted lines when working out values from a graph</p> <ul style="list-style-type: none"> <li>To find <math>f(2)</math> or <math>f(-1)</math> from graph, for example: come up from <math>x = 2</math> or <math>x = -1</math> until you hit the graph and then go across to y value</li> <li>To find <math>f(x) = 3</math> or <math>f(x) = -2</math> from graph: draw a line through <math>y = 3</math> or <math>y = -2</math>, and then come up/down to x-axis from the point(s) where the line crosses the graph</li> <li>Roots are where graph crosses x-axis i.e. <math>f(x) = 0</math></li> </ul> <p>Axis of symmetry is the line that cuts the graph into 2. Only arises in U or <math>\cap</math> shape.</p>
$f(-2) = (-2)^2 - 3(-2) - 4 = 6$	$(-2, 6)$												
$f(-1) = (-1)^2 - 3(-1) - 4 = 0$	$(-1, 0)$												
$f(0) = (0)^2 - 3(0) - 4 = -4$	$(0, -4)$												
$f(1) = (1)^2 - 3(1) - 4 = -6$	$(1, -6)$												
$f(2) = (2)^2 - 3(2) - 4 = -6$	$(2, -6)$												
$f(3) = (3)^2 - 3(3) - 4 = -4$	$(3, -4)$												