Graphs of quadratics

$f(x) = ax^2 + bx + c$ (Parabolas)

$(a \neq 0)$

Ex 1 $f(x) = 2x^2 - 7x + 5$

y-int: when $x = 0$

$f(0) = 2(0)^2 - 7(0) + 5$

$f(0) = 5$

x-int: when $y = 0$

$f(x) = 0 = 2x^2 - 7x + 5$ — Factor

$0 = (x-1)(2x-5)$

If 0, then the whole thing is zero

$x - 1 = 0 \Rightarrow x = 1$

$2x - 5 = 0 \Rightarrow 2x = 5$

$x = \frac{5}{2} = 2.5$

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Aside: If our quadratic is a perfect square

ex $f(x) = (x-4)^2$; $\overset{x\text{-int}}{x=4}$ only

If we can't factor our quadratic

ex $f(x) = x^2 + 2x + 6$; No x-int

Vertex: Lowest or highest point

$a>0$

$a<0$

Notice: if we draw a vertical line through the vertex, the parabola is symmetric (mirror image). So, the vertex must be in the middle of the two x-intercepts (x_1 and x_2)

To find middle: $\frac{x_1 + x_2}{2}$

In our example: $\frac{1 + 2.5}{2} = \frac{3.5}{2} = 1.75$

x-value at vertex $= 1.75$

vertical line

and we say: $x = 1.75$ is called the axis of symmetry

Domain/Range:

Domain: allowed x-values

Range: allowed y-values

All x-values are allowed for parabolas

Domain: $x \in \mathbb{R}$ (Any real number)

All y-values are allowed that are equal to the vertex or greater than the vertex $(a > 0)$ / smaller than the vertex $(a < 0)$

y-value at vertex: $f(1.75) = 2(1.75)^2 - 7(1.75) + 5$

$= -1.125$

Range: $y \geq -1.125$