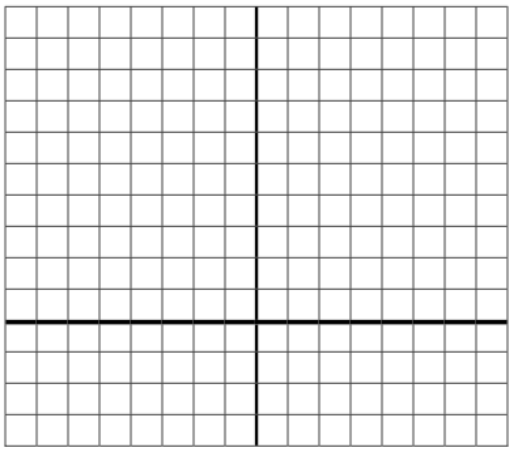
MCF3M Unit 1, Lesson 9

Working with Vertex Form

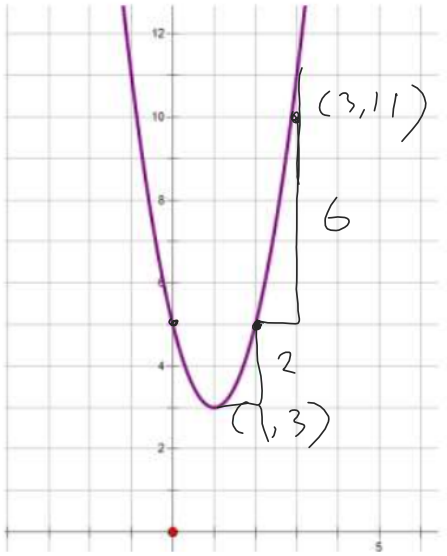
Warm-up

Complete the following table. Then graph each of the parabolas from the table.

Equation	Vertex	Direction of Opening	Step Pattern	Equation of Axis of Symmetry	RANGE
$f(x) = (x-1)^2 - 4$	(1,-4)	up	1,3,5...	$x=1$	$\{y \in R \mid y \geq -4\}$
$g(x) = -0.5(x+3)^2 + 4$	(-3,4)	down	0.5, 1.5, 2.5 ...	$x=-3$	$\{g(x) \in R \mid g(x) \leq 4\}$
$h(x) = -x^2 + 6$	(0,6)	down	1,3,5,7 ...	$x=0$	$\{h(x) \in R \mid h(x) \leq 6\}$



Find the equation of the parabola shown to the right.



$y = 2(x-1)^2 + 3$

Test a point to see if the equation works!

$x = 3$

$y = 2(3-1)^2 + 3$

$y = 2(2)^2 + 3$

$y = 11$ ✓

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Sometimes the step pattern may not be obvious. In this case, find the equation algebraically.

$y = a(x+2)^2 + 3$

sub. in (0,0)

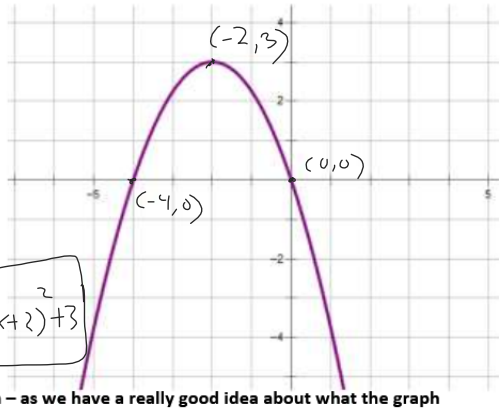
$0 = a(0+2)^2 + 3$

$0 = 4a + 3$

$-3 = 4a$

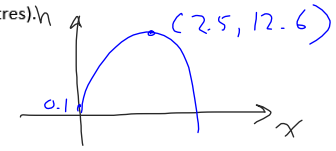
$a = -3/4$

$y = -\frac{3}{4}(x+2)^2 + 3$



A quadratic equation in vertex form is also easy to work with – as we have a really good idea about what the graph looks like.

1. The path of a volleyball hit is given by the equation $h(x) = -2(x - 2.5)^2 + 12.6$ where *h(x)* is the height of the volleyball (in metres) and *x* is the horizontal distance travelled (in metres).



   a) What is the initial height of the volleyball?

$h(0) = -2(0-2.5)^2 + 12.6$

$h(0) = 0.1\text{m}$

   b) Draw a rough sketch of this graph. What is the maximum height the volleyball reaches?

12.6m

2. The graph below shows the height of football, *h(t),* t seconds after it is thrown. Estimate the equation for this graph.

$h(t) = a(t-2)^2 + 64$

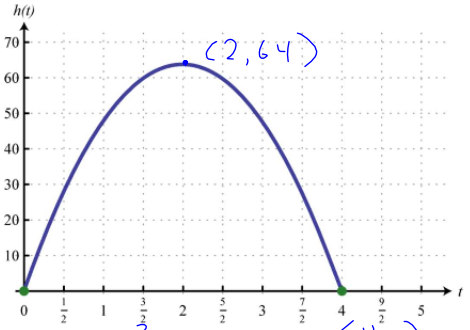
sub. in (4,0)

$0 = a(4-2)^2 + 64$

$0 = 4a + 64$

$-4a = 64$

$a = -16$



$h(t) = -16(t-2)^2 + 64$ ← vertex form

simplify

$h(t) = -16(t-2)(t-2) + 64$

$h(t) = -16(t^2 - 4t + 4) + 64$

$h(t) = -16t^2 + 64t - 64 + 64$

$h(t) = -16t^2 + 64t$ standard form

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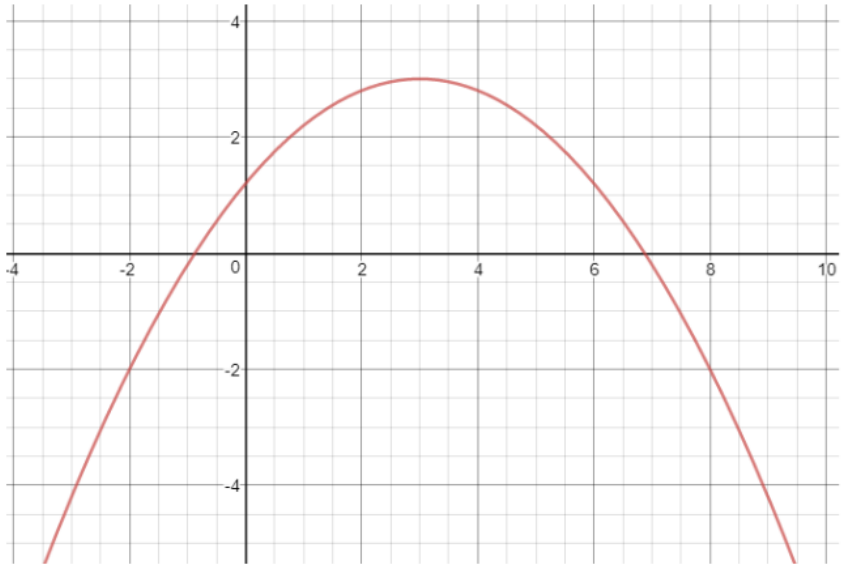
Working with Vertex Form – Problem Set

1. A parabola is shown below.

a) Find the equation of the parabola shown below.

b) Find the domain and range of the parabola.



2. A batter in baseball hits a pop fly into the air. The height of this ball is given by the equation $h(t) = -5(t-2)^2 + 21$, where *h* is the height of the ball, in metres, *t* seconds after it has been hit.

a) What is the maximum height of this ball and when does it occur?
b) What is the initial height?
c) Evaluate *h(1)* and interpret its meaning.
d) What is the range of this function?

3. **Text page 51 #8abce**
4. **page 57 #10 - 13**
5. **page 62 #2, 3 (also find the equation of each graph shown)**

ANSWERS

1. a) $y = -0.2(x-3)^2 + 3$ b) D: $\{x \epsilon R\}$ R: $\{y \epsilon R | y \leq 3\}$
2. a) 21 m after 2 seconds. b) 1 m c) h(1)=16 (height of ball after 1 second) d) $\{h(t) \epsilon R | 0 \leq h(t) \leq 21\}$

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