Agenda:

- Hand out "Writing Project" - Due Mon. 12/8 (in 2 weeks)
- Wrap up 8.4 - Functions, Domain, Range
- Start 8.5 - Quadratic Functions

8.5 HW #1-8 all,. 9 - 47 (e.o.o.), 49, 53

y is a function of x if for each independent variable there exists a unique dependent variable.

Ordered Pairs

EXAMPLES	NON-EXAMPLES
{(1,3), (2,5), (3,6), (4,3), (-2,1)}.	{(1,4), (2,7), (1,6) (-2,5), (-3,7)}

Domain? {1, 2, 3, 4, -2}

Range? {3, 5, 6, 1}

y is a function of x if for each x there exists only one y.

Equation

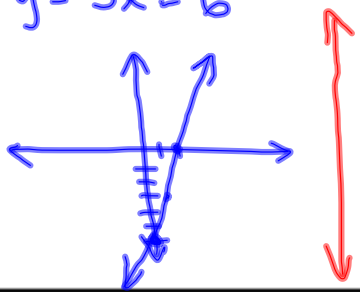
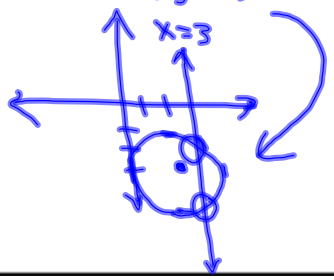
EXAMPLES	NON-EXAMPLES
$y = 2x$ $\frac{x+2}{3} = y$ $x - 2y = 0$ $y^3 = x$	$y^2 = x$ (16, 4) (16, −4) $\lvert y \rvert = x$ $x^2 + y^2 = 1$

Domain?

Range?

Vertical Line Test: If a vertical line intersects the graph of the relation in more than one point then the relation is **not** a function.

Graph

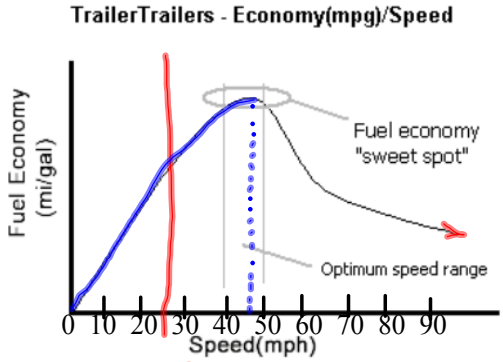
EXAMPLES	NON-EXAMPLES
$y = 3x - 6$ 	$(x-2)^2 + (y+3)^2 = 4$ 

Domain?

$x = 3$ has 2 different y-values.

Range?

The graph below shows the (hypothetical) relationship between fuel economy and speed.



a) What is the dependent variable? fuel economy
The independent variable? speed

b) What is the domain? $[0, ?)$

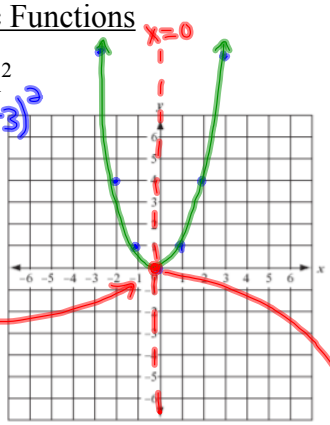
c) Is this relation a function? yes

d) Where is the fuel economy rising? $(0, 47)$
...falling?

Quadratic Functions

$f(x) = x^2$ $f(-3) = (-3)^2$

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9



Domain: all reals (line)
Axis of symmetry: $x=0$
x-intercept(s): (0,0)

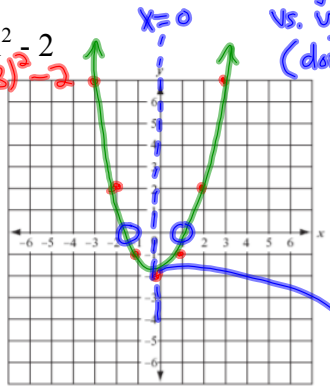
Range: $[0, \infty)$
Vertex: (0,0)
y-intercept: (0,0)

Quadratic Functions

$f(x) = x^2 - 2$

x	y
-3	7
-2	2
-1	-1
0	-2
1	-1
2	2
3	7

$f(-3) = (-3)^2 - 2$



$y = x^2$ vs. $y = x^2 - 2$ (downward shift of 2 units)

Domain: all reals

Range: $[-2, \infty)$

Axis of symmetry: $x = 0$

Vertex: $(0, -2)$

x-intercept(s):

$0 = x^2 - 2$

$2 = x^2$

$\pm\sqrt{2} = x \rightarrow (-\sqrt{2}, 0)$ and $(+\sqrt{2}, 0)$

y-intercept: $(0, -2)$

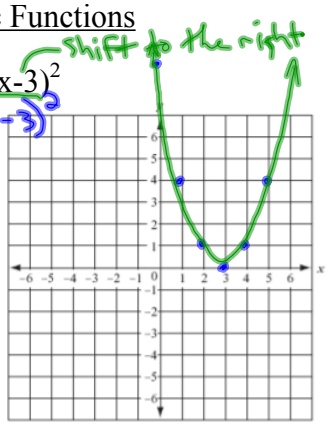
Quadratic Functions

$f(x) = (x-3)^2$

shift to the right

$f(-3) = (-3-3)^2$

x	y
-3	36
-2	25
-1	16
0	9
1	4
2	1
3	0
4	1
5	4



HW

Domain:

Range:

Axis of symmetry:

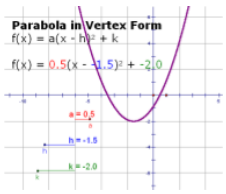
Vertex:

x-intercept(s):

y-intercept:

Quadratics: Vertex Form

$f(x) = a(x - h)^2 + k$



Example: $2(x-1)^2 - 8$ = f(x)

down 8

right 1

Opens: upwards

Axis of Symmetry: x = 1 (right 1 unit)

Vertex: (1, −8)

x-intercept(s): put y = 0:

Domain: all reals

y-intercept: (put in x = 0: $2(-1)^2 - 8 = -6$; (0, −6))

Range: $[-8, \infty)$

$0 = 2(x-1)^2 - 8$

$\frac{8}{2} = \frac{2}{2}(x-1)^2$

$4 = (x-1)^2$

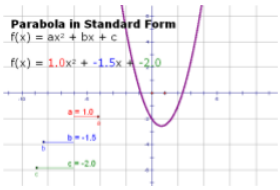
$\pm 2 = x - 1$

$1 \pm 2 = x \Rightarrow x = 3, -1$

x-intercepts are (3, 0), (−1, 0)

Quadratics: Standard Form

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



Example: $2(x-1)^2 - 8 = 2(x^2 - 2x + 1) - 8$

$f(x) = 2x^2 - 4x - 6$

Opens:

Axis of Symmetry:
(in general: x = -b/(2a) --> why?)

$x = \frac{-b}{2a}$

Vertex:

x-intercept(s):

start here

Domain:

y-intercept:

Range:

Two. (Complete the Square)

Deepening Understanding:

1. What is the relationship between the x-intercepts and the solutions to the quadratic equation

$$0 = a(x-h)^2 + k$$

2. What would you conjecture about the number and type of x-intercepts for a perfect square trinomial?

Deepening Understanding:

A quadratic function has a vertex at (-2, 1) and passes through the point (2, -7).

What other (easy-to-find) point is on the graph of the quadratic function?

What is the vertex form of this quadratic function?

Deepening Understanding:

The quadratic formula was used to find that, for a certain quadratic function:

$$x = \frac{-7 \pm \sqrt{81}}{2(-2)}$$

1. What is the axis of symmetry for this quadratic function?

2. What are the x-intercepts?

3. What is the equation of the quadratic function?

Deepening Understanding:

Find the equation of the parabola plotted here.