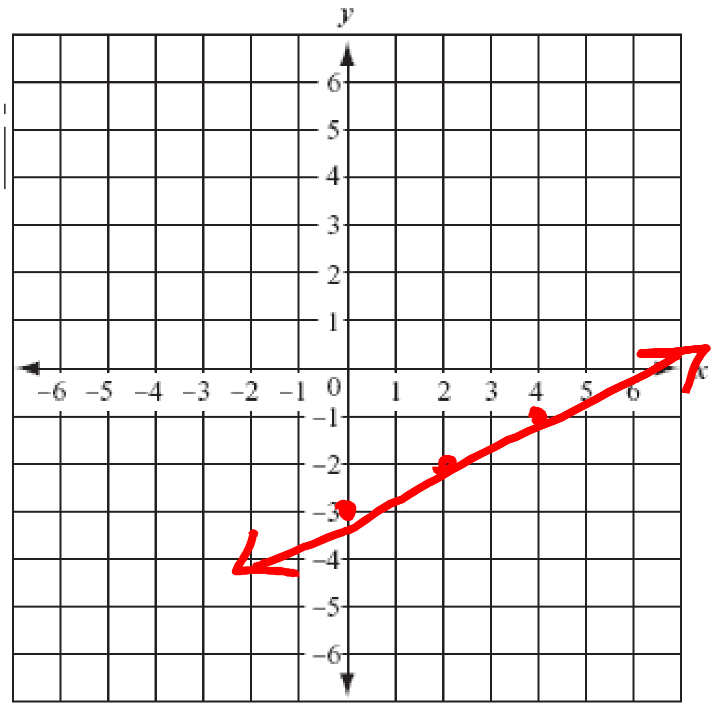
Ch 11

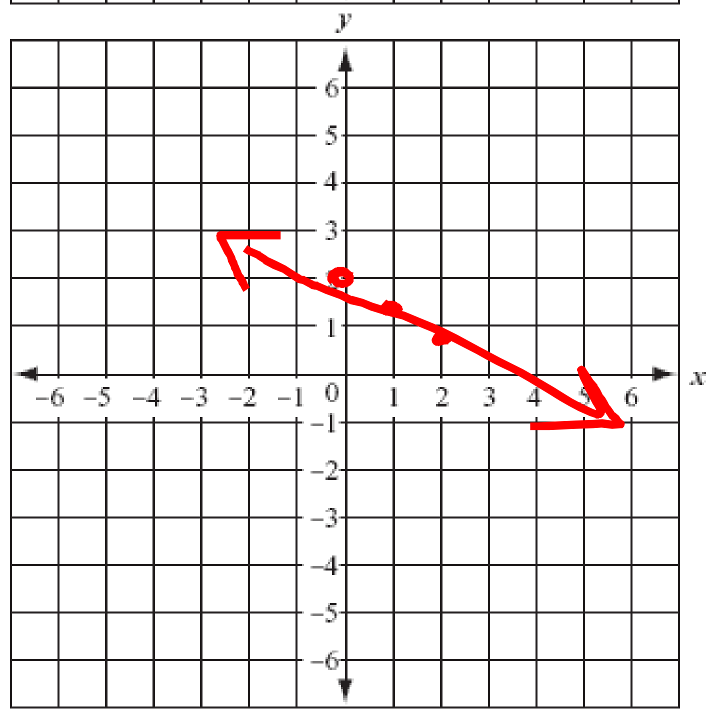
Quadratic and Exponential Functions

Quick Revi

- Graphing Equations:
  - $y = \frac{1}{2}x - 3$
  - $2x + 3y = 6$

x	y
0	2
1	$1\frac{1}{3}$
2	$\frac{2}{3}$





Quick Review

- Evaluate Expressions
  - Order of Operations!

P – grouping symbols
E – exponents
M/D – mult/Div left to right
A/S – add/sub – left to right

- Factor
  - 1st – GCF
  - 2nd – trinomials into two binomials

11.1

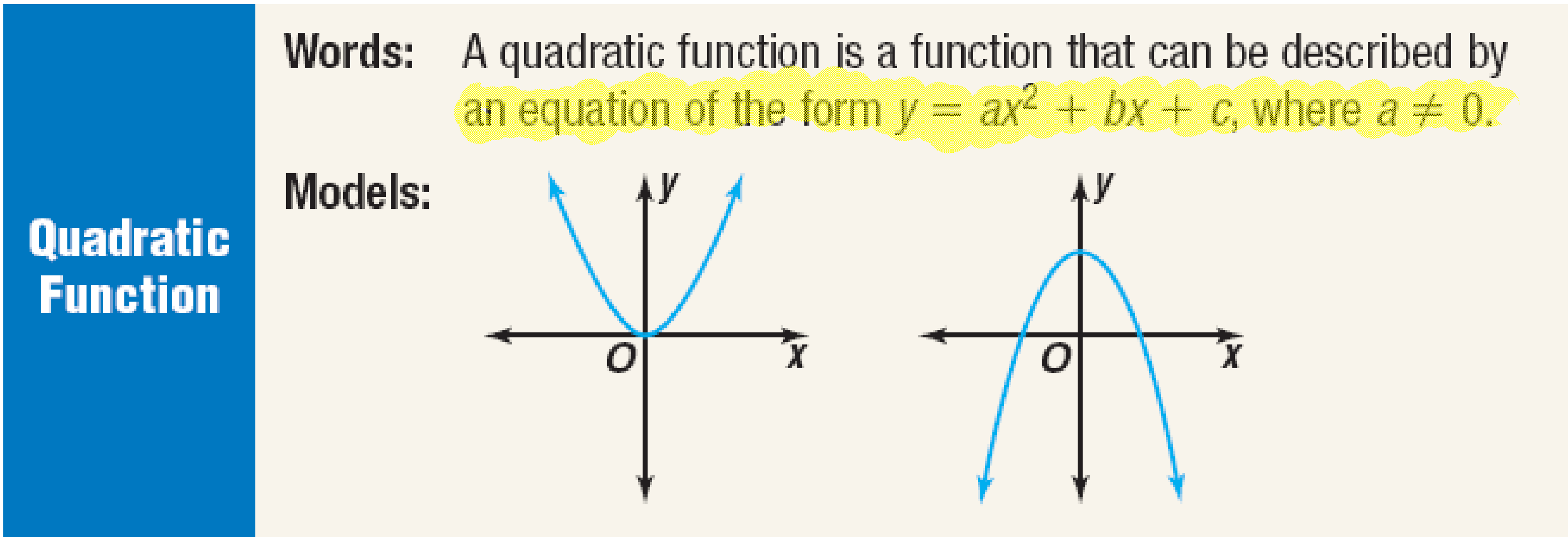
Graphing Quadratic Functions

Vocab

- Parabola –
  - The graph of a quadratic function

- Quadratic Function –
  - A function described by an equation of the form $f(x) = ax^2 + bx + c$, where $a \neq 0$
  - A second degree polynomial
- Function –
  - A relation in which exactly one x-value is paired with exactly one y-value

Quadratic Function



- This shape is a parabola
- Graphs of all quadratic functions have the shape of a parabola

Exploration of Parabolas

- Sketch pictures of the following situations

$y = 3x^2$ $\quad y = 2x^2$ $\quad y = x^2$ $\quad y = \frac{1}{2}x^2$ $\quad y = \frac{1}{4}x^2$ $\quad y = \frac{1}{8}x^2$

$y = -2x^2$ $\quad y = -1x^2$ $\quad y = 1x^2$ $\quad y = 2x^2$

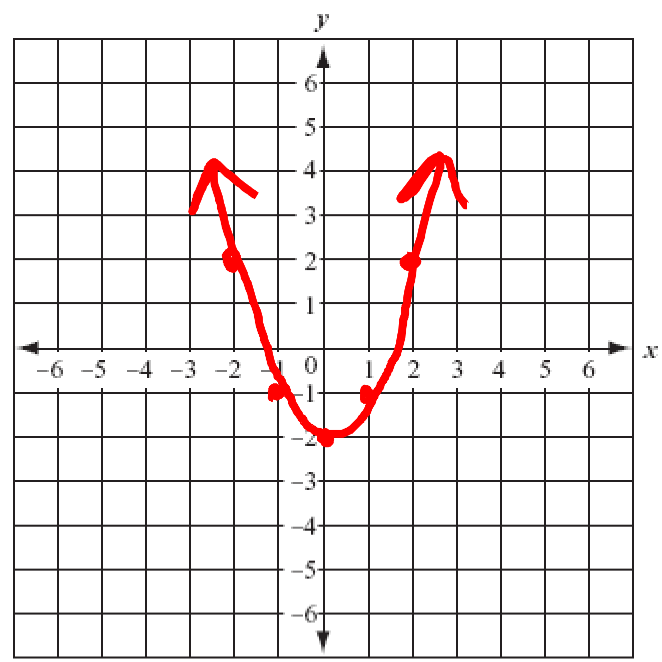
$y = x^2 - 3$ $\quad y = x^2 - 1$ $\quad y = x^2 + 1$ $\quad y = x^2 + 4$

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

Example

- Graph the quadratic equation by making a table of values. $y = x^2 - 2$

x	y
-2	2
-1	-1
0	-2
1	-1
2	2



Example

$-\frac{1}{2}(1)^2+4$

$-\frac{1}{2}(1)+4$

$-\frac{1}{2}+4$

$3\frac{1}{2}$

$-\frac{1}{2}(-2)^2+4$

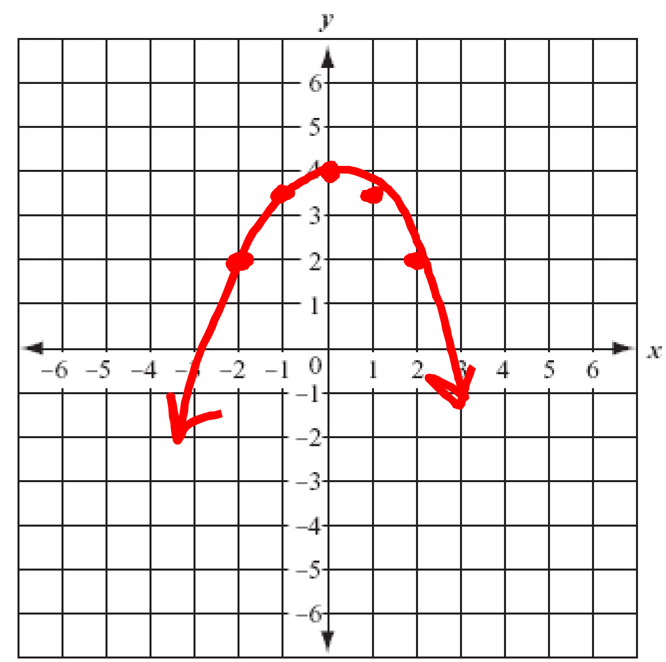
$-\frac{1}{2}(4)+4$

$-2+4$

2

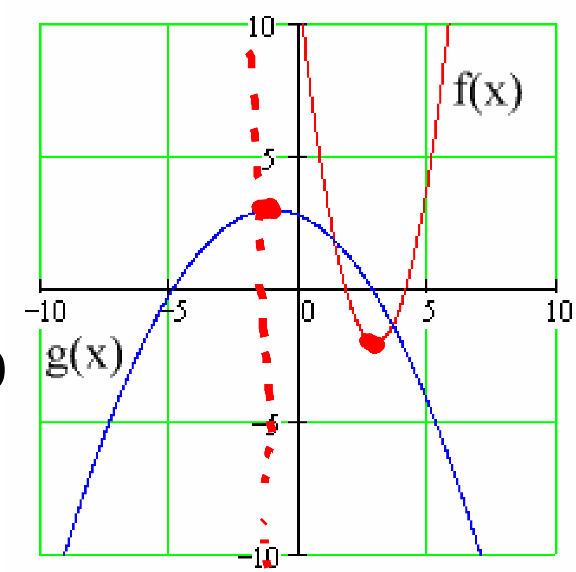
- Graph the quadratic equation by making a table of values. $y = -\frac{1}{2}x^2 + 4$

x	y
0	4
1	$3\frac{1}{2}$
2	2
-1	$3\frac{1}{2}$
-2	2



Parts of a Parabola → $ax^2 + bx + c$

- + a opens up
  - Lowest point called: minimum
- - a opens down
  - Highest point called: maximum
- Parabolas continue to extend as they o



- Domain (x-values): all real numbers
- Range (y-values):
  - Opens up - #s greater than or equal to minimum value
  - Opens down - #s less than or equal to the maximum value

$y \geq -2$

$y \leq 3$

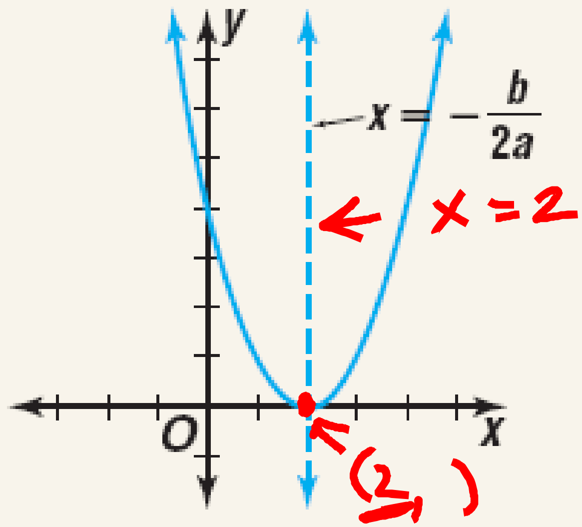
- Vertex – minimum or maximum value
- Axis of Symmetry: vertical line through vertex

Axis of Symmetry

Equation of the Axis of Symmetry

Words: The equation of the axis of symmetry for the graph of $y = ax^2 + bx + c$, where $a \neq 0$, is $x = -\frac{b}{2a}$.

Model:



Example

- Use characteristics of quadratic functions to graph $y = -x^2 + 2x + 1$

$a = -1$

$b = 2$

$c = 1$

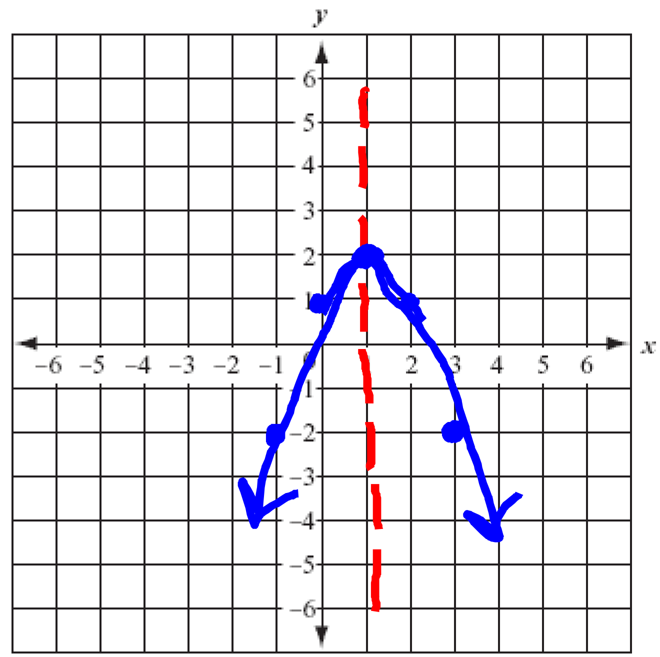
$ax^2 + bx + c$

$x = \frac{-b}{2a} = \frac{-2}{2(-1)} = \frac{-2}{-2}$

$x = 1$

  - Find the equation of the axis of symmetry.
  - Find the coordinates of the vertex of the parabola.
  - Graph the function.

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



Example

- Use characteristics of quadratic functions to graph

$$y = x^2 + x$$

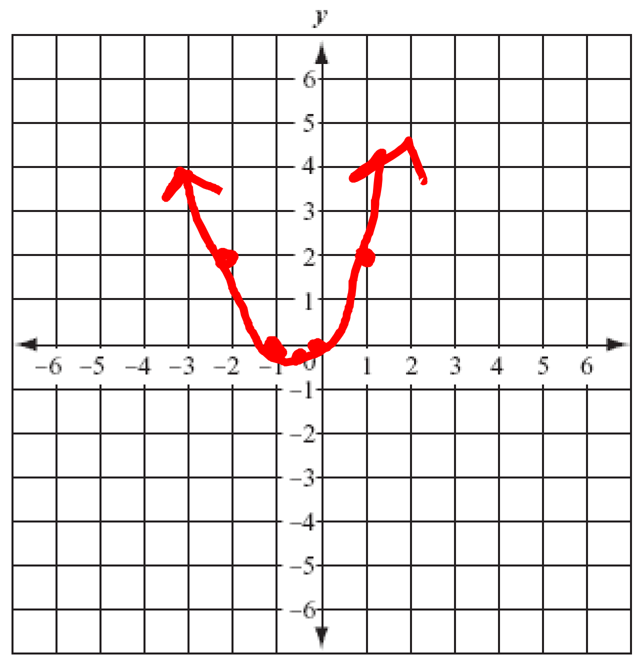
$a = 1$

$b = 1$

$c = 0$

  - Find the equation of the axis of symmetry. $x = \frac{-b}{2a} = \frac{-1}{2(1)} = -\frac{1}{2}$
  - Find the coordinates of the vertex of the parabola. $x = -\frac{1}{2}$
  - Graph the function.

x	y
$-1/2$	$-1/4$
-1	0
-2	2
0	0
1	2



Example

- A football player throws a short pass. The height y of the ball is given by the equation $y = -16x^2 + 8x + 5$, where x is the number of seconds after the ball was thrown. What is the maximum height reached by the ball?

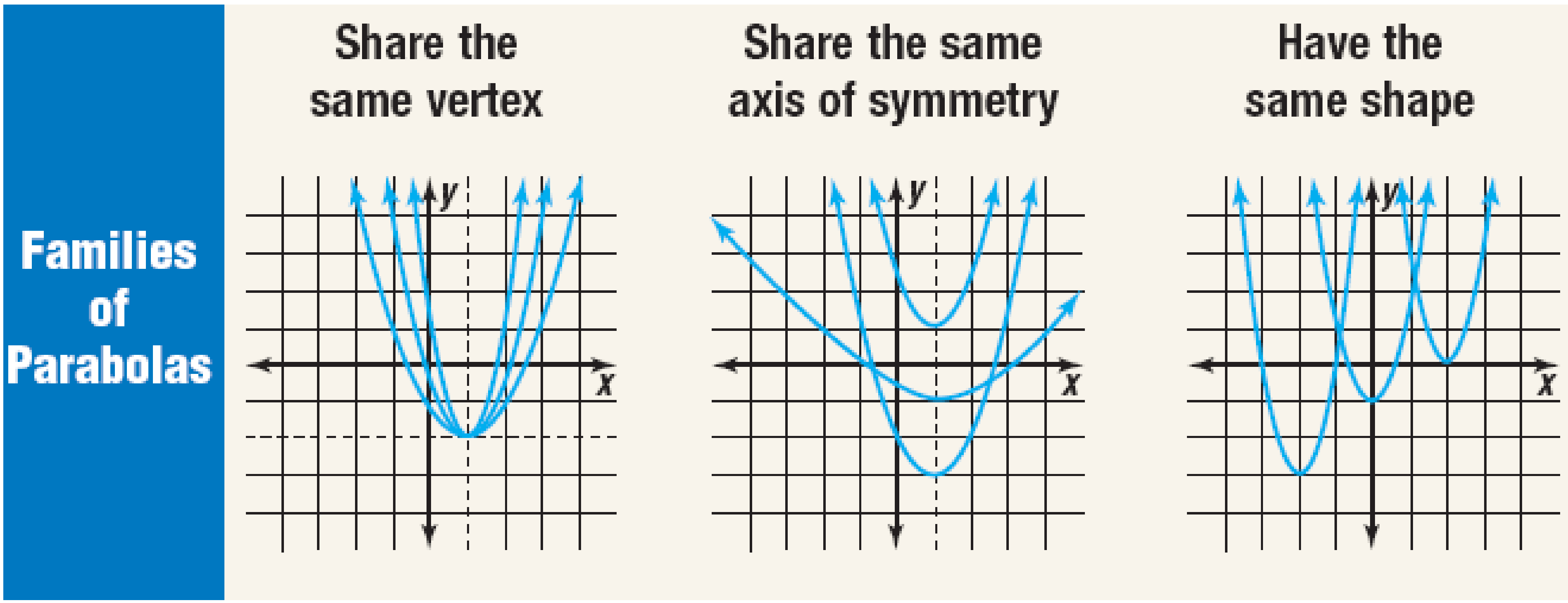
Assignments

- #1 – due today
  - P461: 11 – 15
- #2 – due next time
  - P462: 28 – 40, 45 – 47, 49

11-2

Families of Quadratic Functions

Families of Quadratic Functions



Compare: same vertex + axis of sym

Example

Contrast: different sizes

- Graph the group of equations on the same graph. Compare and contrast the graphs. What conclusions can be drawn?

$$y = x^2$$

x	y
0	0
1	1
-1	1
2	4
-2	4

$$y = \frac{1}{2}x^2$$

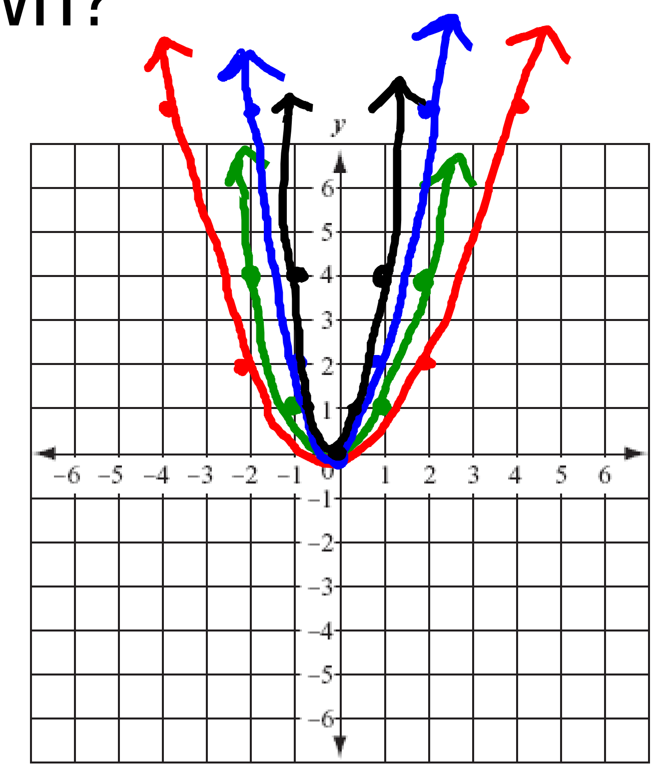
x	y
0	0
2	2
-2	2
4	8
-4	8

$$y = 2x^2$$

x	y
0	0
1	2
-1	2
2	8
-2	8

$$y = 4x^2$$

x	y
0	0
1	4
-1	4
1/2	1
-1/2	1



Summary

Addition to $y = x^2$ equation	Changes to graph
as 'a'	
as 'a'	

Compare: same axis of sym. + shape

Example

all open down

contrast: different vertex

- Graph the group of equations on the same graph. Compare and contrast the graphs. What conclusions can be drawn?

$y = -x^2$

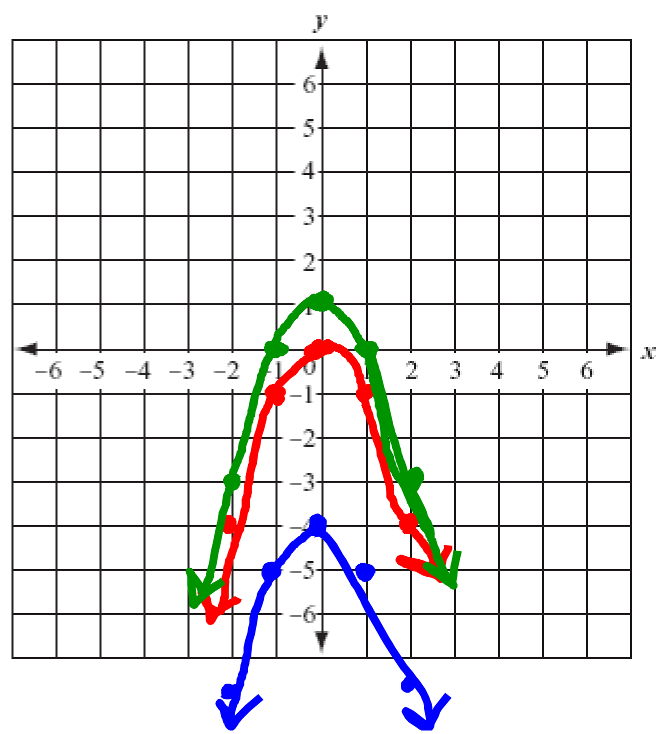
$y = -x^2 + 1$

$y = -x^2 - 4$

x	y
0	0
1	-1
-1	-1
2	-4
-2	-4

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

x	y
0	-4
1	-5
-1	-5
2	-8
-2	-8



Summary

Addition to $y = x^2$ equation	Changes to graph
Coefficient on x^2 becomes greater	Parabola narrows
Coefficient on x^2 becomes smaller	Parabola widens
$+c$	
$-c$	

compare: same shape

Example

contrast: different vertex + axis of sym

- Graph the group of equations on the same graph. Compare and contrast the graphs. What conclusions can be drawn?

$$y = x^2$$

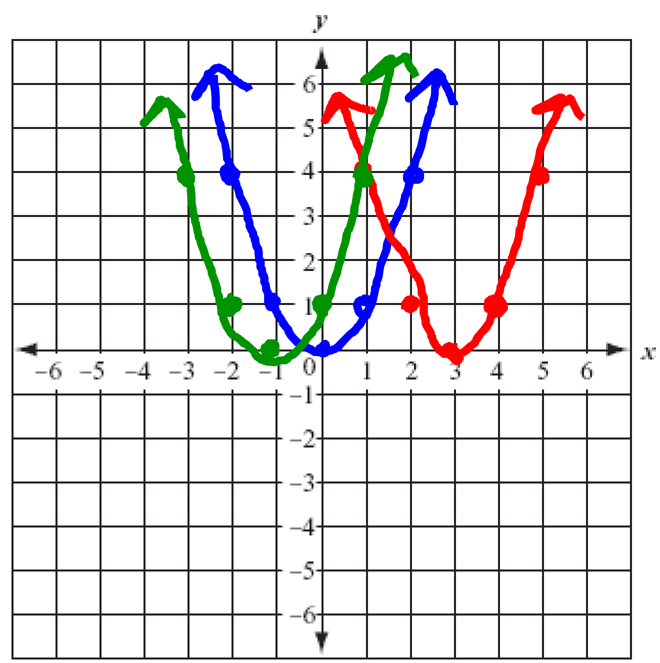
x	y
0	0
-1	1
1	1
2	4
-2	4

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

x	y
3	0
4	1
2	1
1	4
5	4

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

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



Summary

Addition to $y = x^2$ equation	Changes to graph
Coefficient on x^2 becomes greater	Parabola narrows
Coefficient on x^2 becomes smaller	Parabola widens
Constant is greater than zero	Shifts parabola upwards
Constant is less than zero	Shifts parabola downwards
I $(x + \_\_)^2$	
N $(x - \_\_)^2$	

Example

- Describe how each graph would change from the parent graph of y = x^2. Then name the vertex.

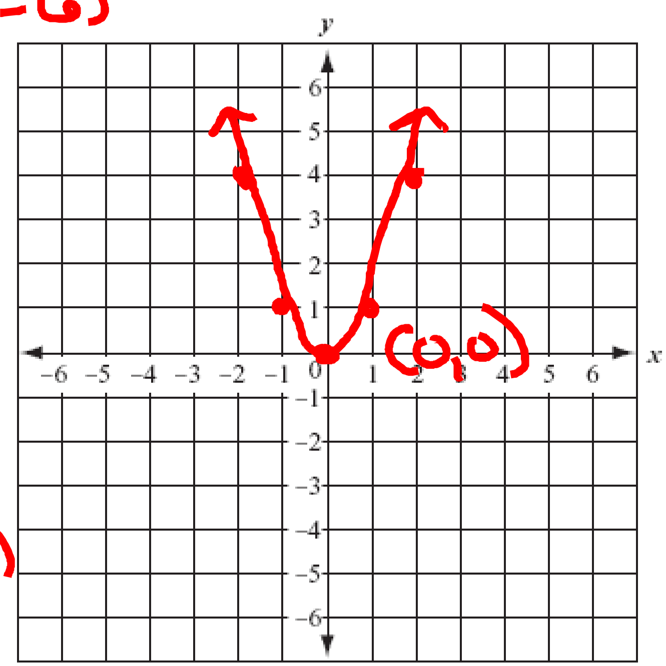
$y = -2x^2$ opens down, narrows (0,0)

$y = x^2 - 6$ shifts down 6 (0,-6)

$y = (x+2)^2$ shift left 2 (-2,0)

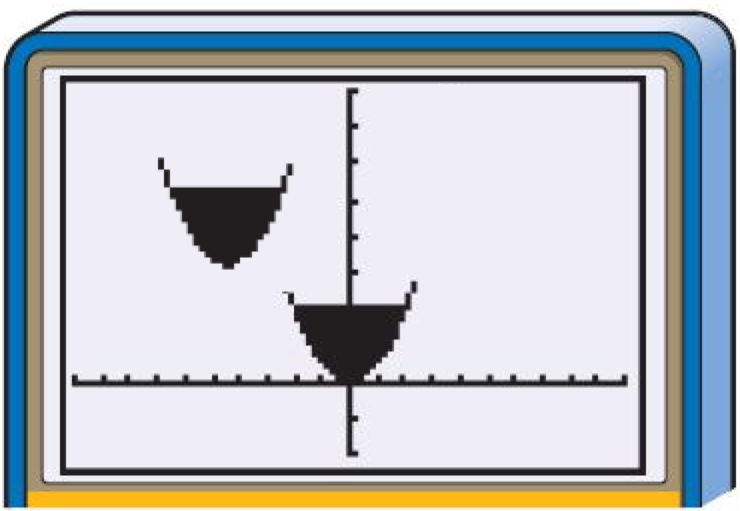
$y = (x-7)^2 + 2$ shifts right 7 shifts up 2 (7,2)

$y = (x+2)^2 - 1$ shifts left 2 shifts down 1 (-2,-1)



Example

- In a computer game, a player dodges space shuttles that are shaped like parabolas. Suppose the vertex of one shuttle is at the origin. The space shuttle begins with original equation $y=-2x^2$. The shuttle moves until its vertex is at (-2, 3). Find an equation to model the shape and position of the shuttle at its final location.



$(4, -6)$

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

Assignments

- #1 – due today
  - P466: 3, 4, 5, 7, 9, 11, 13, 15, 17
- #2 – due next time
  - P466: 6 – 24 even, 25 – 27, 30 – 35

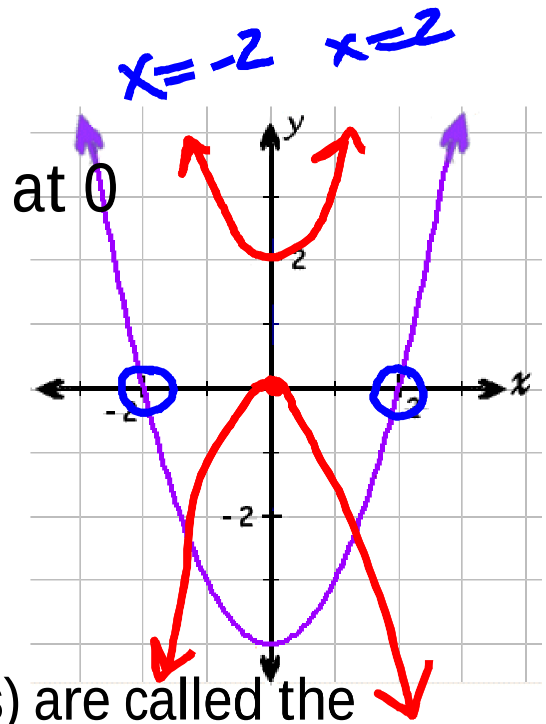
11-3

Solving Quadratic Equations by Graphing

Quadratic Equations

- Quadratic Equations –
  - Value of the related quadratic function at 0
  - What does that mean?

$$y = ax^2 + bx + c$$

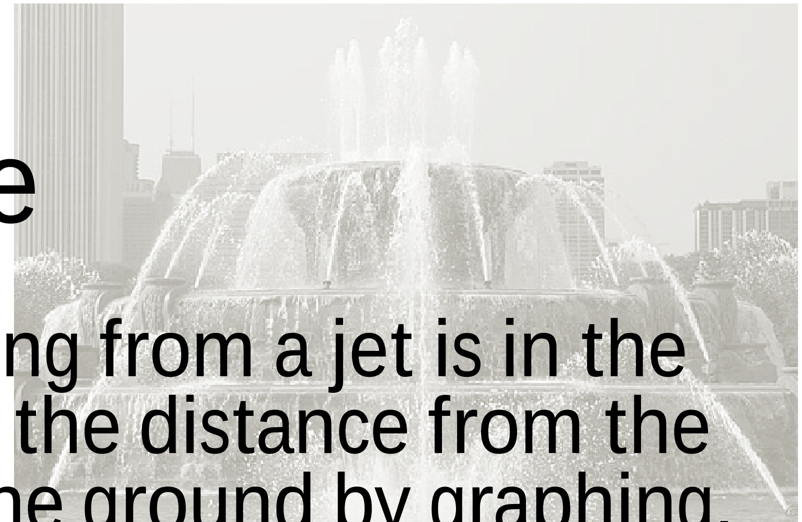


- At 0 means that y = 0

$$0 = ax^2 + bx + c$$

- The solutions (the two things that x equals) are called the <u>roots</u>
  - The roots are the solutions to quadratic equations
- The roots can be found by finding the x-intercepts or <u>zeros</u>

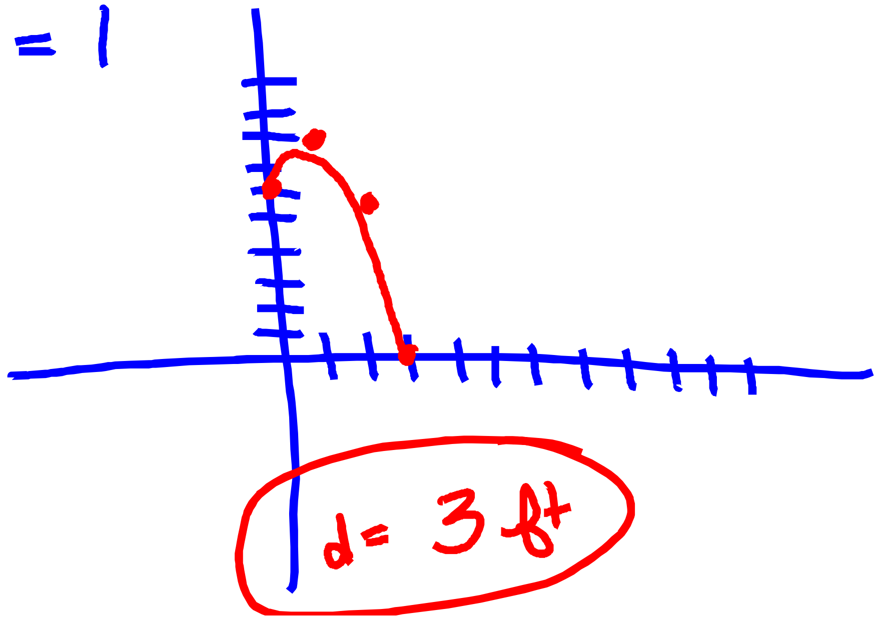
Example



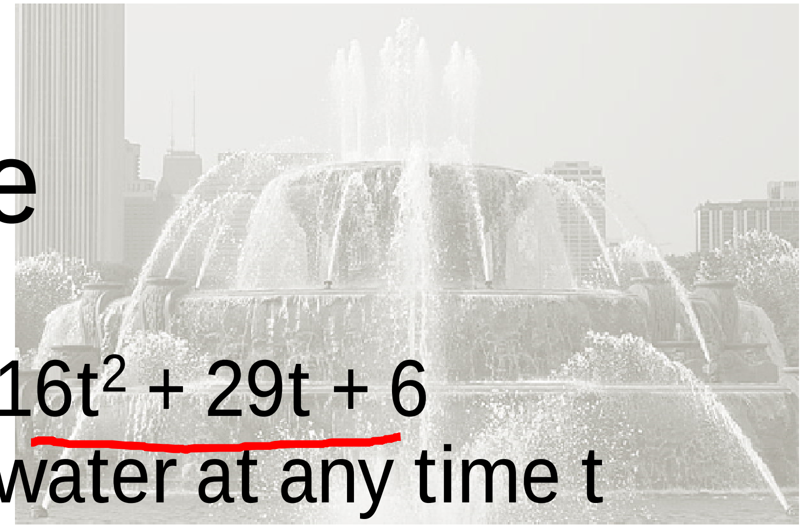
- The path of water streaming from a jet is in the shape of a parabola. Find the distance from the jet where the water hits the ground by graphing. Use the function $h(d) = -2d^2 + 4d + 6$, where $h(d)$ represents the height of a stream of water at any distance d from the jet in feet.

$$x = \frac{-b}{2a} = \frac{-4}{2(-2)} = \frac{-4}{-4} = 1$$

x	y
1	8
0	6
2	6
3	0



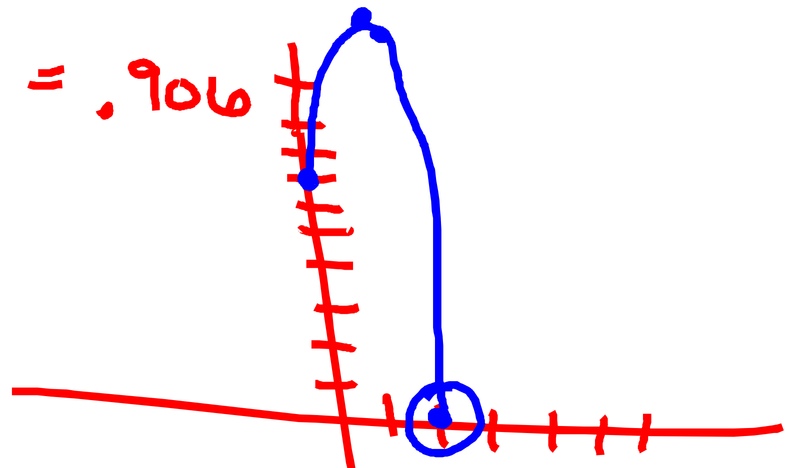
Example



- Suppose the function $h(t) = -16t^2 + 29t + 6$ represents the height of the water at any time t seconds after it has left its jet. Find the number of seconds it takes the water to hit the ground by graphing.

$$x = \frac{-b}{2a} = \frac{-29}{2(-16)} = \frac{-29}{-32} = .906$$

x	y
.906	19.14
0	6
1	19
2	0



2s

Example

- Find the roots of $x^2 + 2x – 15 = 0$ by graphing the related function.

$a=1$

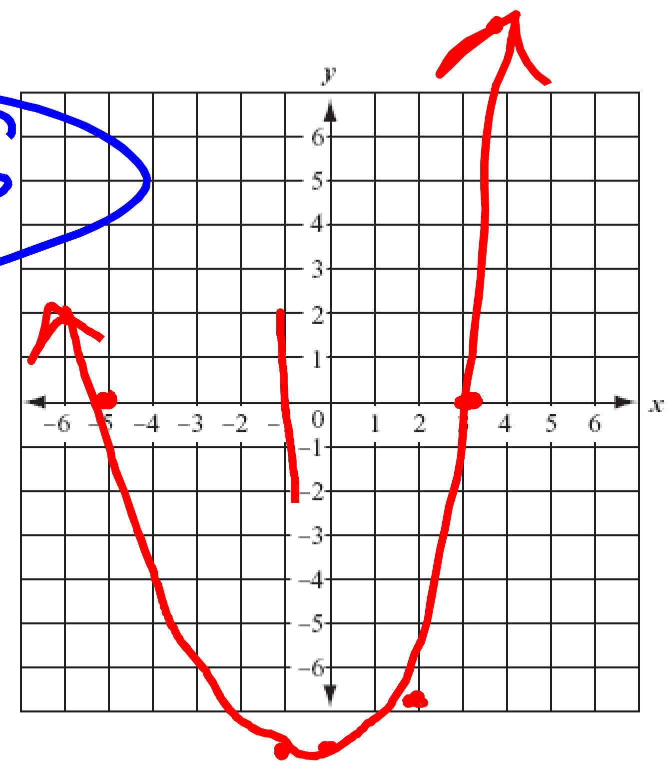
$x = \frac{-b}{2a} = \frac{-2}{2(1)} = -1$

$b=2$

$c=-15$

$x = -5, 3$

x	y
-1	-16
0	-15
5	20
2	-7
4	9
3	0
-5	0



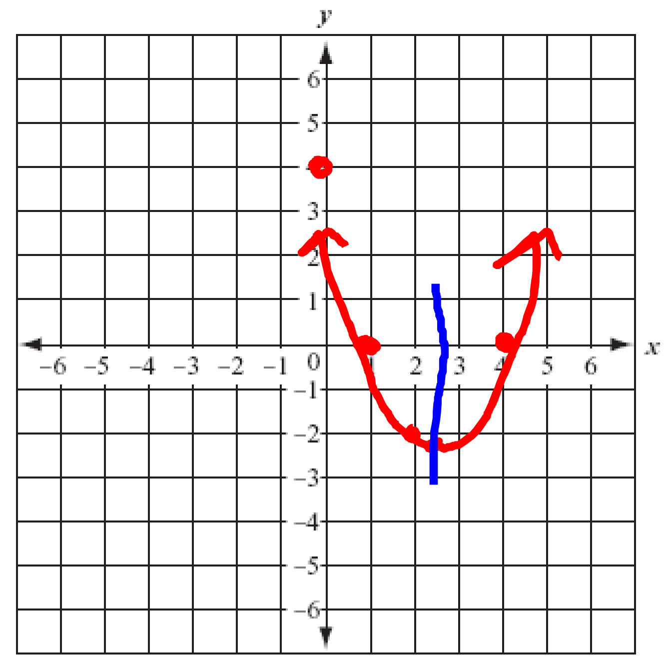
Example

- Find the roots of $0 = x^2 - 5x + 4$ by graphing the related function.

$$x = \frac{-b}{2a} = \frac{5}{2(1)} = 2.5$$

$x = 1, 4$

x	y
2.5	-2.25
2	-2
0	4
1	0
4	0



Example

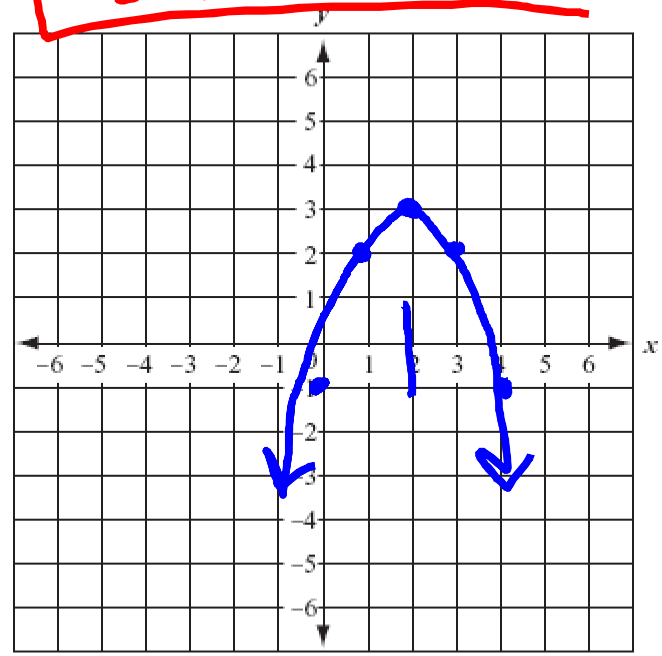
- Estimate the roots of $-x^2 + 4x - 1 = 0$.

$$x = \frac{-b}{2a} = \frac{-4}{2(-1)} = \frac{-4}{-2} = 2$$

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

Between 3 + 4

Between 0 + 1



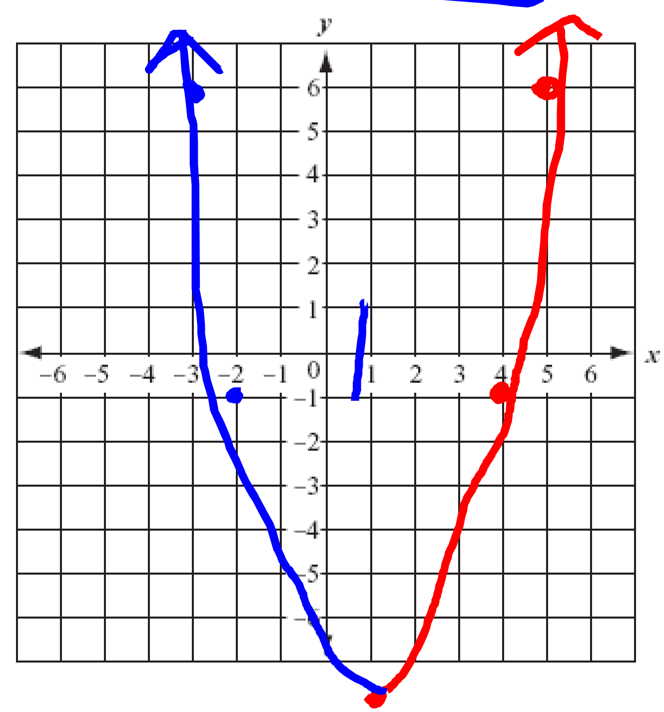
Example

- Estimate the roots of $y = x^2 - 2x - 9$.

$$x = \frac{-b}{2a} = \frac{2}{2(1)} = 1$$

x	y
1	-10
5	6
4	-1
-2	-1
-3	6

Between 4 + 5
Between -3, -2



Example

- Find two numbers whose sum is 10 and whose product is -24.

$$x(10-x) = -24$$

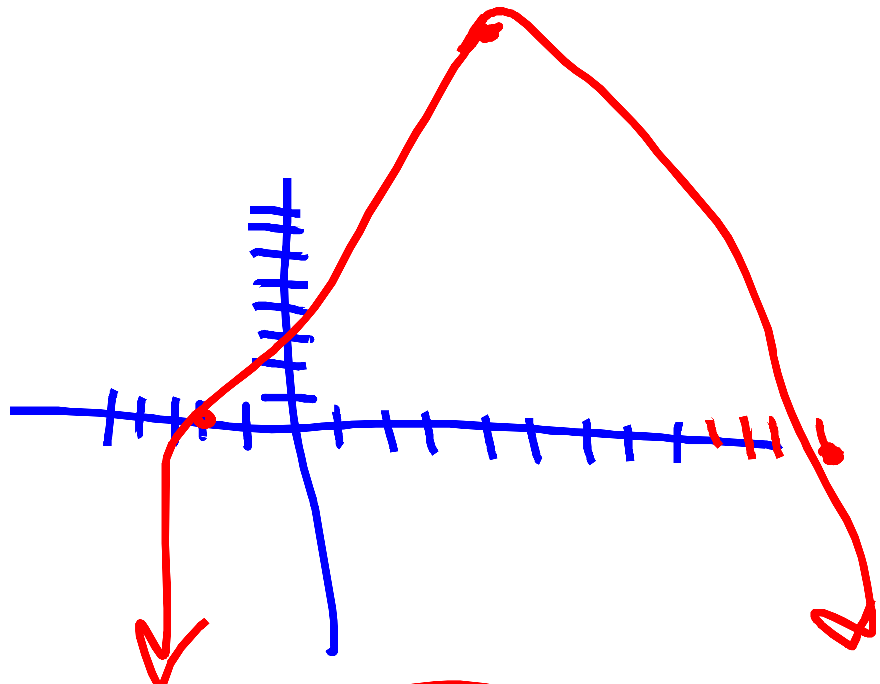
$$10x - x^2 = \cancel{-24}$$

$$+24 \qquad \cancel{+24}$$

$$-x^2+10x+24 = 0$$

$$x = \frac{-b}{2a} = \frac{-10}{2(-1)} = 5$$

x	y
5	49
12	0
-2	0



12, -2

Example

- Find two numbers whose sum is 4 and whose product is 5.

$$x(4-x)=5$$

$$4x-x^2=5$$

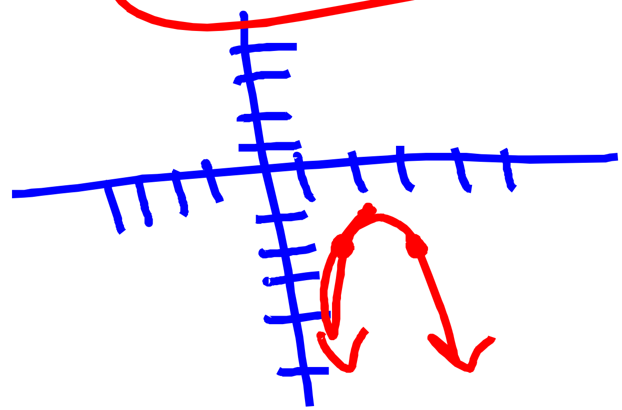
$$-5 \qquad -5$$

$$-x^2+4x-5=0$$

$$x=\frac{-b}{2a}=\frac{-4}{2(-1)}=\frac{-4}{-2}=2$$

x	y
2	-1
1	-2
3	-2

no real solutions



Assignments

- #1 – due today
  - P471: 1, 2, 3, 5, 7, 11, 13, 21, 23
- #2 – due next time
  - P471: 4 – 24 even, 28 – 32

11-4

Solving Quadratic Equations by Factoring

Factoring to Solve a Quadratic Equ

$$y = 3x^2 - 3x$$

- In the last chapter, we set the quadratic equation equal to what number?

$$0 = 3x^2 - 3x$$

$$0 = \underbrace{3x}_{a}\underbrace{(x-1)}_{b}$$

$$3x = 0 \qquad x - 1 = 0$$

$$\frac{3x}{3} = \frac{0}{3} \qquad \begin{array}{r} x - 1 = 0 \\ +1 \quad +1 \\ \hline x = 1 \end{array}$$

$$x = 0 \qquad x = 1$$

Zero Product Property	For all numbers a and b, if $ab = 0$, then $a = 0$, $b = 0$ or both a and b equal 0.

Example

- Solve -2x(x + 5) = 0. Check your solution.

$$-2x = 0 \qquad\qquad x + 5 = 0$$
$$\frac{-2x}{-2} = \frac{0}{-2} \qquad\qquad \underline{-5\quad -5}$$
$$x = 0 \qquad\qquad x = -5$$

checks

$$-2(0)(0+5) = 0 \qquad\qquad -2(-5)(-5+5) = 0$$
$$-2(0)(5) = 0 \qquad\qquad -2(-5)(0) = 0$$
$$0 = 0 \checkmark \qquad\qquad 0 = 0 \checkmark$$

Example

- Solve z(z – 8) = 0. Check your solution.

$z = 0$

$$\begin{aligned} z - 8 &= 0 \\ +8 \quad & \quad +8 \\ \hline z &= 8 \end{aligned}$$

Check

$0(0-8) = 0$

$0(-8) = 0$

$0 = 0$ ✓

$8(8-8) = 0$

$8(0) = 0$

$0 = 0$ ✓

Example

- Solve (a – 4)(4a + 3) = 0. Check your solution.

$$a - 4 = 0$$
$$+4 \quad +4$$
$$a = 4$$

$$4a + 3 = 0$$
$$-3 \quad -3$$
$$\frac{4a}{4} = \frac{-3}{4}$$
$$a = \frac{-3}{4}$$

Checks

$$(4-4)(4 \cdot 4 + 3) = 0$$
$$0\,(19) = 0$$
$$0 = 0 \checkmark$$

$$\left(-\tfrac{3}{4} - 4\right)\left(4 \cdot -\tfrac{3}{4} + 3\right) = 0$$
$$\left(-4\tfrac{3}{4}\right)(-3+3) = 0$$
$$\left(-4\tfrac{3}{4}\right)(0) = 0$$
$$0 = 0 \checkmark$$

Example

- A child throws a ball up in the air. The height h of the ball t seconds after it has been thrown is given by the equation $h = -16t^2 + 8t + 4$. Solve $4 = -16t^2 + 8t + 4$ to find how long it would take the ball to reach the height from which it was thrown.

$$4 = -16t^2 + 8t + 4$$
$$-4 \qquad\qquad -4$$
$$0 = -16t^2 + 8t$$
$$0 = 8t(-2t + 1)$$

$$8t = 0$$
$$\frac{8t}{8} = \frac{0}{8}$$
$$t = 0$$

$$-2t + 1 = 0$$
$$-1 \quad -1$$
$$\frac{-2t}{-2} = \frac{-1}{-2}$$
$$t = 1/2 \text{ s}$$

Example

- Solve $x^2 - 4x - 21 = 0$. Check your solution.

$$(x-7)(x+3)=0$$

$$x-7=0 \qquad x+3=0$$

$$+7 \quad +7 \qquad -3 \quad -3$$

$$x=7 \qquad x=-3$$

Check

$$7^2-4(7)-21=0 \qquad (-3)^2-4(-3)-21=0$$

$$49-28-21=0 \qquad 9+12-21=0$$

$$0=0\ \checkmark \qquad 0=0\ \checkmark$$

Example

- Solve $x^2 – 2x = 3$. Check your solution.

$$\underline{\quad -3 \quad -3}$$

$$x^2-2x-3=0$$

$$(x-3)(x+1)=0$$

$$x-3=0 \qquad x+1=0$$

$$\underline{\;+3\;\;+3} \qquad \underline{\;-1\;\;-1}$$

$$x=3 \qquad x=-1$$

Check

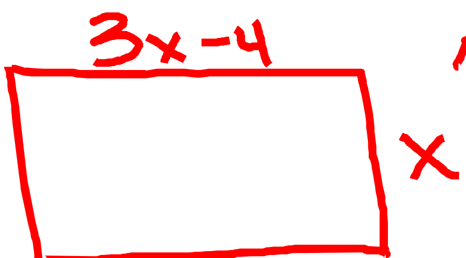
$$3^2-2(3)=3 \qquad (-1)^2-2(-1)=3$$

$$9-6=3 \qquad 1+2=3$$

$$3=3\,\checkmark \qquad 3=3\,\checkmark$$

Example

- The length of a rectangle is 4 feet less than three times its width. The area of the rectangle is 55 square feet. Find the measures of the sides.



5' x 11'

$A = lw$ $\quad 55 = (3x-4)(x)$

$55 = 3x^2 - 4x$

$-55 \qquad\qquad -55$

$0 = 3x^2 - 4x - 55$

$0 = (3x+11)(x-5)$

$3x + 11 = 0 \qquad x - 5 = 0$

$-11 \quad -11 \qquad +5 \quad +5$

$\frac{3x}{3} = \frac{-11}{3} \qquad x = 5$

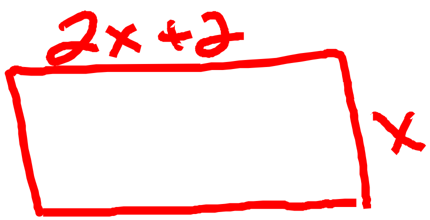
$\cancel{x = \frac{-11}{3}}$

5, 11

1, 55

Example

- The length of a rectangle is 2 feet more than twice its width. The area of the rectangle is 144 square feet. Find the measure of its sides.



8' × 18'

$A = lw$

$144 = (2x+2)(x)$

$144 = 2x^2 + 2x$

$-144 \qquad\qquad -144$

$0 = 2x^2 + 2x - 144$

$0 = 2(x^2 + x - 72)$

$0 = 2(x-8)(x+9)$

$x - 8 = 0$
$+8 \quad +8$
$x = 8$

$x + 9 = 0$
$-9 \quad -9$
$x = -9$

Assignments

- #1 – due today
  - P476: 4 – 10
- #2 – due next time
  - P476: 12 – 28 even, 29 – 32, 36 – 42

11-5

Solving Quadratic Equations by Completing the Square

Situation

- Sometimes you can't factor a polynomial
- So to solve for the roots, complete the square

- Completing the Square
  1. Move the constant to the other side
  2. Take half of the coefficient of x
  3. Square that number ↑
  4. Add that number ↑ to both sides of the equation
  5. Then solve by factoring!

Example

- Find the value of c that makes $x^2 - 8x + c$ a perfect square.

$c = 16$

$x^2 - 8x + 16$

$(x-4)(x-4)$

Example

- Find the value of c that makes $x^2 - 6x + c$ a perfect square.

$x^2 - 6x + 9$

$(x-3)(x-3)$

$c = 9$

Example

- Solve $x^2 + 12x - 13 = 0$ by completing the square.

$$+13 \quad +13$$

$$x^2 + 12x + 36 = 13 + 36$$

$$(x+6)(x+6) = 49$$

$$\sqrt{(x+6)^2} = \sqrt{49}$$

$$x + \cancel{6} = \pm 7$$

$$-\cancel{6} \quad -6$$

$$x = -6 \pm 7$$

$$x = 1, -13$$

Example

- Solve $x^2 + 6x – 16 = 0$ by completing the square.

$+16 \quad +16$

$x^2+6x+9=16+9$

$(x+3)(x+3)=25$

$\sqrt{(x+3)^2}=\sqrt{25}$

$x+3=\pm 5$

$-3 \quad -3$

$x=-3\pm 5$

$x=2,-8$

Example

$\sqrt{(x+3)^2}=\sqrt{7}$

$x+3=\pm\sqrt{7}$

$-3 \quad -3$

$x=-3\pm\sqrt{7}$

Special Note

- You can only complete the square if the coefficient of the first term is 1. If it is not 1, first divide each term by the coefficient.

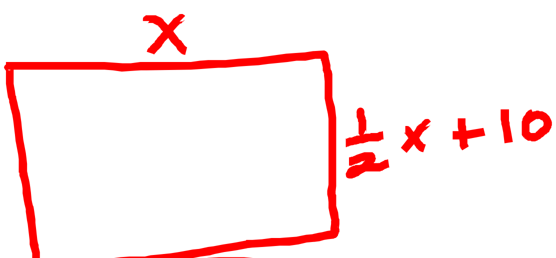
$$\frac{2x^2}{2} + \frac{6x}{2} + \frac{12}{2} = \frac{4}{2}$$

$$x^2 + 3x + 6 = 2$$

Example

- When constructing a room, the width is to be 10 feet more than half the length. Find the dimensions of the room to the nearest tenth of a foot, if its area is to be 135 square feet.

$A = 135\ ft^2$



$A = lw$

$x\left(\frac{1}{2}x + 10\right) = 135$

$2\left[\frac{1}{2}x^2 + 10x = 135\right]$

$x^2 + 20x + 100 = 270 + 100$

$\sqrt{(x+10)^2} = \sqrt{370}$

$x + 10 = \pm\sqrt{370}$

$-10 \qquad -10$

$x = -10 \pm \sqrt{370}$

$x = 9.24, \cancel{-29.24}$

$9' \times 14.5'$

Assignments

- #1 – due today
  - P481: 3 – 17 odd, 23 – 25 odd
- #2 – due next time
  - P481: 4 – 34 even, 36, 38 – 41

11-6

The Quadratic Formula

Summary of Methods to Solve Quadratic Equations

Method	When Is the Method Useful?
Graphing	Use only to estimate solutions.
Factoring	Use when the quadratic expression is easy to factor.
Completing the Square	Use when the coefficient of x^2 is 1 and all other coefficients are fairly small.

- So, what happens with the leading coefficient is not 1?
- Use the Quadratic Formula

Quadratic Formula

The Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a},\ a \neq 0$$

$$\frac{-6 \pm \sqrt{-18}}{2}$$

- Form: $ax^2 + bx + c = 0$
- Can't have a negative under the square root
  no real solutions
  - Not a real number

$$\frac{-6 \pm \sqrt{0}}{2}$$

$$\frac{-6}{2} = -3$$

- Equations can have 2, 1, or 0 real number solutions

Example

- Use the Quadratic Formula to solve $2x^2 – 5x + 3 = 0$.

$a = 2$

$b = -5$

$c = 3$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(3)}}{2(2)}$$

$$x = \frac{5 \pm \sqrt{25 - 24}}{4} \qquad x = \frac{5 \pm \sqrt{1}}{4} = \frac{5 \pm 1}{4}$$

$$= \frac{6}{4} = \frac{3}{2}$$

$$= \frac{4}{4} = 1$$

$$x = \frac{3}{2}, 1$$

Example

$\sqrt{24}$
$= \sqrt{4 \cdot 6}$
$\cancel{\sqrt{4 \cdot 16}}$
$2\sqrt{6}$

4
9
16
25
36 ...

- Use the Quadratic Formula to solve $x^2 + 4x + 2 = 0$.

$a = 1$
$b = 4$
$c = 2$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-4 \pm \sqrt{4^2 - 4(1)(2)}}{2(1)}$$

$\sqrt{8}$
$= \sqrt{4 \cdot 2}$
$\sqrt{4}\sqrt{2}$
$2\sqrt{2}$

$$x = \frac{-4 \pm \sqrt{16 - 8}}{2} = \frac{-4 \pm \sqrt{8}}{2} = \frac{-4 \pm 2\sqrt{2}}{2}$$

$$= -2 \pm \sqrt{2}$$

Example

- Use the Quadratic Formula to solve $-x^2 + 6x - 9 = 0$.

$a = -1$
$b = 6$
$c = -9$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-6 \pm \sqrt{6^2 - 4(-1)(-9)}}{2(-1)} = \frac{-6 \pm \sqrt{36 - 36}}{-2}$$

$$x = \frac{-6 \pm \sqrt{0}}{-2} = \frac{-6 \pm 0}{-2} = \frac{-6}{-2} = 3$$

Example

- Use the Quadratic Formula to solve $-3x^2 + 6x + 9 = 0$.

Example

- A punter kicks the football with an upward velocity of 58 ft/s and his foot meets the ball 1 foot off the ground. His formula is $h(t) = -16t^2 + 58t + 1$, where h(t) is the ball's height for any time t after the ball was kicked. What is the hang time (total amount of time the ball stays in the air)?

$t = 3.64s$

$-16t^2 + 58t + 1 = 0$

$a = -16$
$b = 58$
$c = 1$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-58 \pm \sqrt{58^2 - 4(-16)(1)}}{2(-16)}$$

$$x = \frac{-58 \pm \sqrt{3364 + 64}}{-32} = \frac{-58 \pm \sqrt{3428}}{-32}$$

$$= \frac{-58 \pm 58.55}{-32} = -.017,\ 3.64$$

Assignments

- #1 – due today
  - P486: 3 – 9 odd, 10
- #2 – due next time
  - P486: 12 – 24 even, 26 – 31

11-7

Exponential Functions

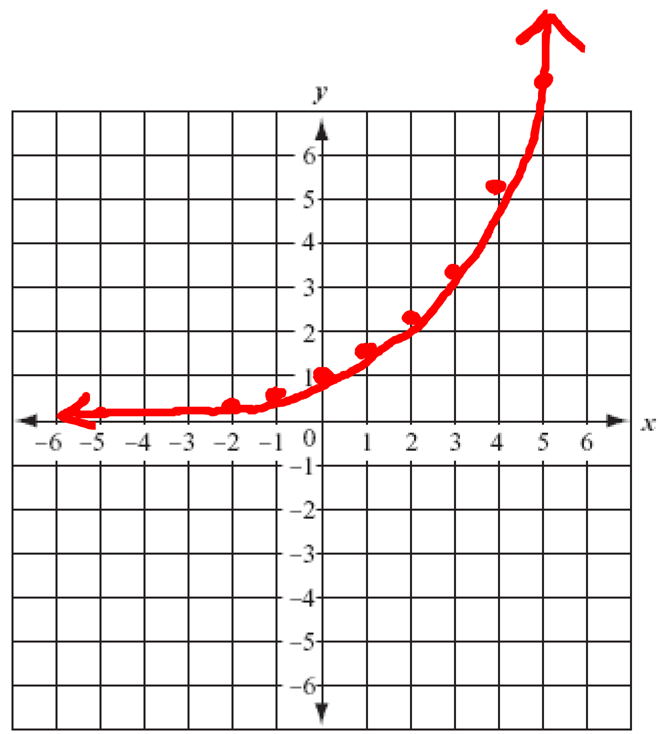
Exponential Function

- A function in the form $y = a^x$
  - Where $a > 0$ and $a \neq 1$
  - Another form is: $y = ab^x + c$
    - In this case, a is the coefficient
- To graph exponential function, make a table
- Initial Value –
  - The value of the function when $x = 0$
  - Also the y-intercept

Example

- Graph $y = 1.5^x$

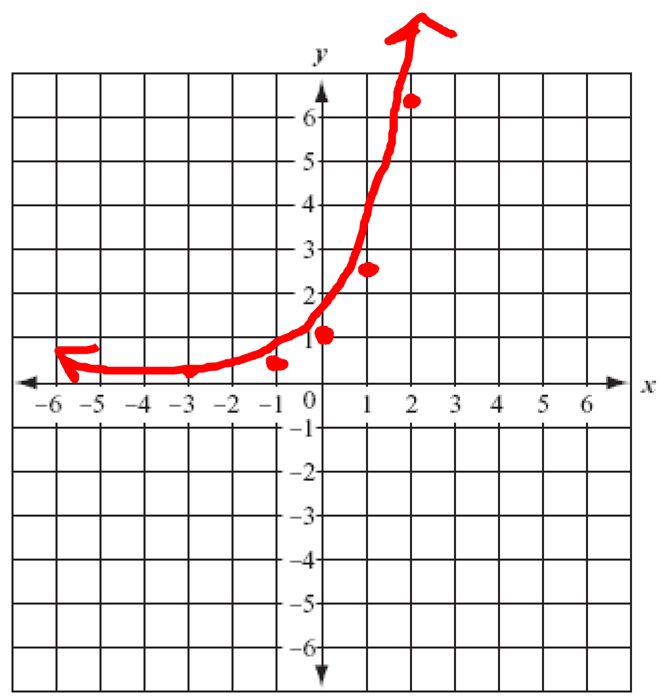
x	y
0	1
1	1.5
2	2.25
3	3.375
5	7.59
−1	2/3
−2	.4
−5	.13



Example

- Graph $y = 2.5^x$

x	y
0	1
1	2.5
2	6.25
−1	.4
−3	.064



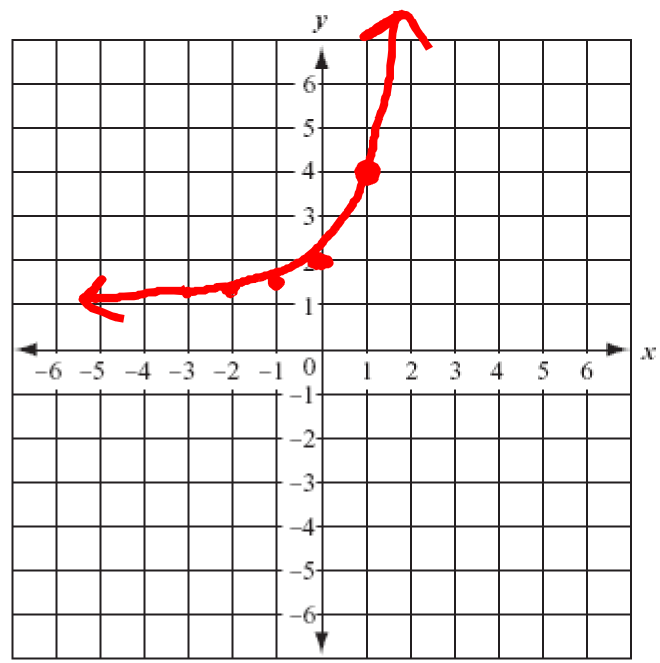
Example

x^y y^x

- Graph $y = 3^x + 1$. Then state the y-intercept.

$y=2$

x	y
0	2
1	4
−1	1.3
−2	1.1
−3	1.04

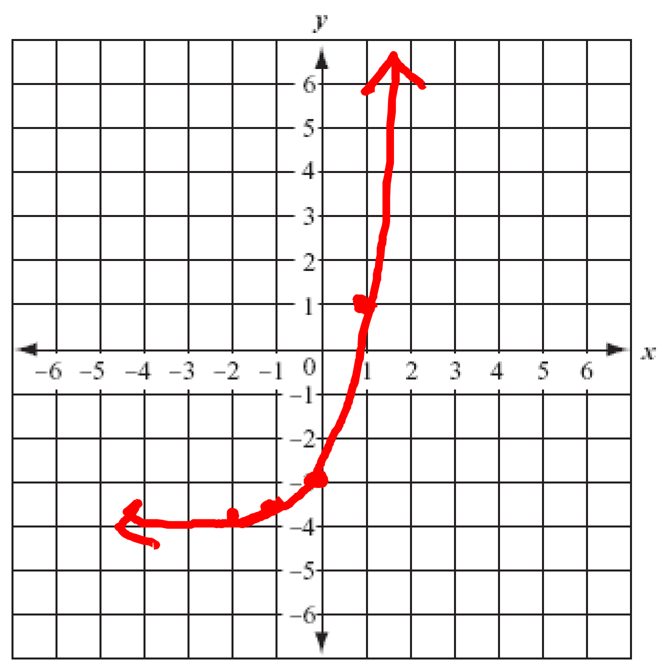


Example

- Graph $y = 5^x - 4$. Then state the y-intercept.

x	y
0	-3
1	1
-1	-3.8
-2	-3.96

$y = -3$



Growth and Decay

- Exponential functions are used to represent situations of exponential growth and decay
  - Exponential growth – growth that occurs rapidly
    - Money in a bank
  - Exponential decay – decay that occurs rapidly
    - Half-life of radioactive materials

Example

- When Taina was 10 years old, she received a certificate of deposit (CD) for \$2000 with an annual interest rate of 5%. After eight years, how much money will she have in the account?

balance

principal

rate in decimal form

$$B = P(1+r)^t$$

← time in years

$$B = 2000(1+.05)^8$$

$$= 2000(1.05)^8$$

$$= 2000(1.477)$$

$$= \$2954.91$$

Example

- When Marcus was 2 years old, his parents invested $1000 in a money market account with an annual average interest rate of 9%. After 15 years, how much money will he have in the account?

$$B = P(1+r)^t$$

$$= 1000(1+.09)^{15}$$

$$= 1000(1.09)^{15}$$

$$= 1000(3.64)$$

$$= \$3642.48$$

Assignments

- #1 – due today
  - P492: 3 – 5, 7 – 19 odd
- #2 – due next time
  - P492: 6 – 22 even, 23, 27 – 31

Ch 11 Review

- #1 – due today
  - P496: 11 – 49 odd
- #2 – due next time
  - P496: 1 – 10, 12 – 50 even, 51, 52