UNIT 5 NOTEBOOK

COMPARING & CONTRASTING FUNCTIONS

Name ANSWER KEY

Block _____ Teacher _____

Georgia Milestones Assessment System

Algebra I Formula Sheet

Below are the formulas you may find useful as you take the test. However, you may find that you do not need to use all of the formulas. You may refer to this formula sheet as often as needed.

Linear Formulas

Slope Formula

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Linear Equations

Slope-intercept Form: $y = mx + b$

Point-slope Form: $y - y_1 = m(x - x_1)$

Standard Form: $Ax + By = C$

Arithmetic Sequence Formulas

Recursive: $a_n = a_{n-1} + d$

Explicit: $a_n = a_1 + (n - 1)d$

Exponential Formulas

Exponential Equation

$y = ab^x$

Geometric Sequence Formulas

Recursive: $a_n = r(a_{n-1})$

Explicit: $a_n = a_1 \cdot r^{n-1}$

Compound Interest Formula

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

Quadratic Formulas

Quadratic Equations

Standard Form: $y = ax^2 + bx + c$

Vertex Form: $y = a(x - h)^2 + k$

Quadratic Formula

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

Average Rate of Change

The change in the y-value divided by the change in the x-value for two distinct points on a graph.

Statistics Formulas

Mean

$$\overline{x} = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n}$$

Interquartile Range

$IR = Q_3 - Q_1$

The difference between the first quartile and third quartile of a set of data.

Mean Absolute Deviation

$$\frac{\sum_{i=1}^{n} \left| x_i - \overline{x} \right|}{n}$$

The sum of the distances between each data value and the mean, divided by the number of data values.

UNIT 5 CALENDAR

Day 1	Day 2	Day 3	Day 4	Day 5
Multi-Step Equations p. 5-7	Multi-Step Inequalities p. 8-11	**Skills Check (F): Eq. & Ineq.** Rate of Change p. 12-15	Graph Eq. & Ineq. p. 16-18	**Quiz 5.1 (F)**
Day 6	**Day 7**	**Day 8**	**Day 9**	**Day 10**
Distinguishing Between Functions p. 19-22	**Skills Check (A): Identify Func. Type** Characteristics p. 23-28	Comparing Functions p. 29-32	**Task (A): Characteristics**	**Quiz 5.2 (A)**
Day 11	**Day 12**	**Day 13**	**Day 14**	
Transformations p. 33-35	**Skills Check (A): Transformations** Sequences p. 36-39	Review Study Guide p. 40-44	**Unit 5 Test (F & A) Notebook Due!**	
You must show ALL your work to receive a stamp (even for multiple choice)!				

I can...

- ❑ I can solve one-variable equations and inequalities.
- ❑ I can calculate and interpret the average rate of change.
- ❑ I can graph a linear equation or inequality.
- ❑ I can identify key features by graphing and analyzing linear, quadratic, and exponential functions.
- ❑ I can identify the effect of transformations on a graph of quadratic or exponential functions.
- ❑ I can identify and write arithmetic or geometric sequences and use them to model situations.

My grades this unit are...

_____/10 Skills ✓ (F): Eq. & Ineq.
_____/50 Quiz 5.1 (F)
_____/10 Skills ✓ (A): Functions
_____/50 Quiz 5.2 (A)
_____/10 Skills ✓ (A): Transformations
_____/25 Notebook
_____/50 Task (A): Characteristics
_____/100 FoA Test
_____/100 U5 Test

Tutoring

	MON	TUES	WED	THUR	FRI
AM (7:45-8:15)	**Room 213**	**Room 213**	**Room 213**	**Room 213**	NONE
PM	NONE	**LEARNING LINKS (3:45-4:45)**	NONE	**LEARNING LINKS (3:45-4:45)**	NONE

Bell Activity

Date: _____	Date: _____
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Bell Activity

Date: _____	Date: _____
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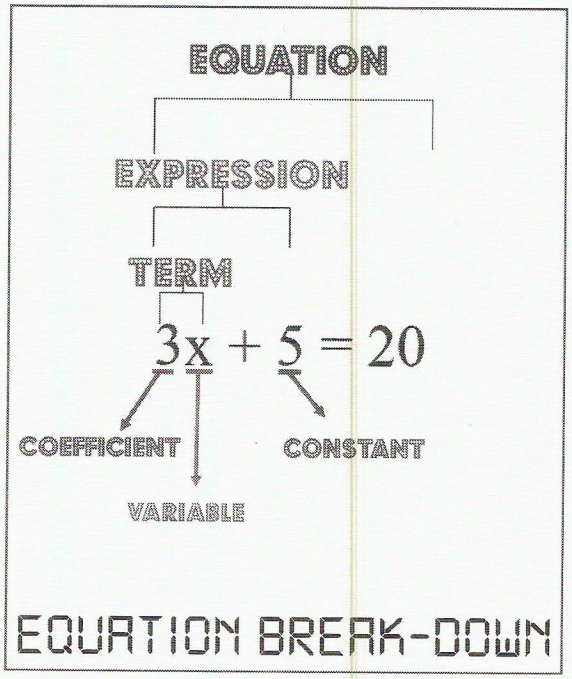
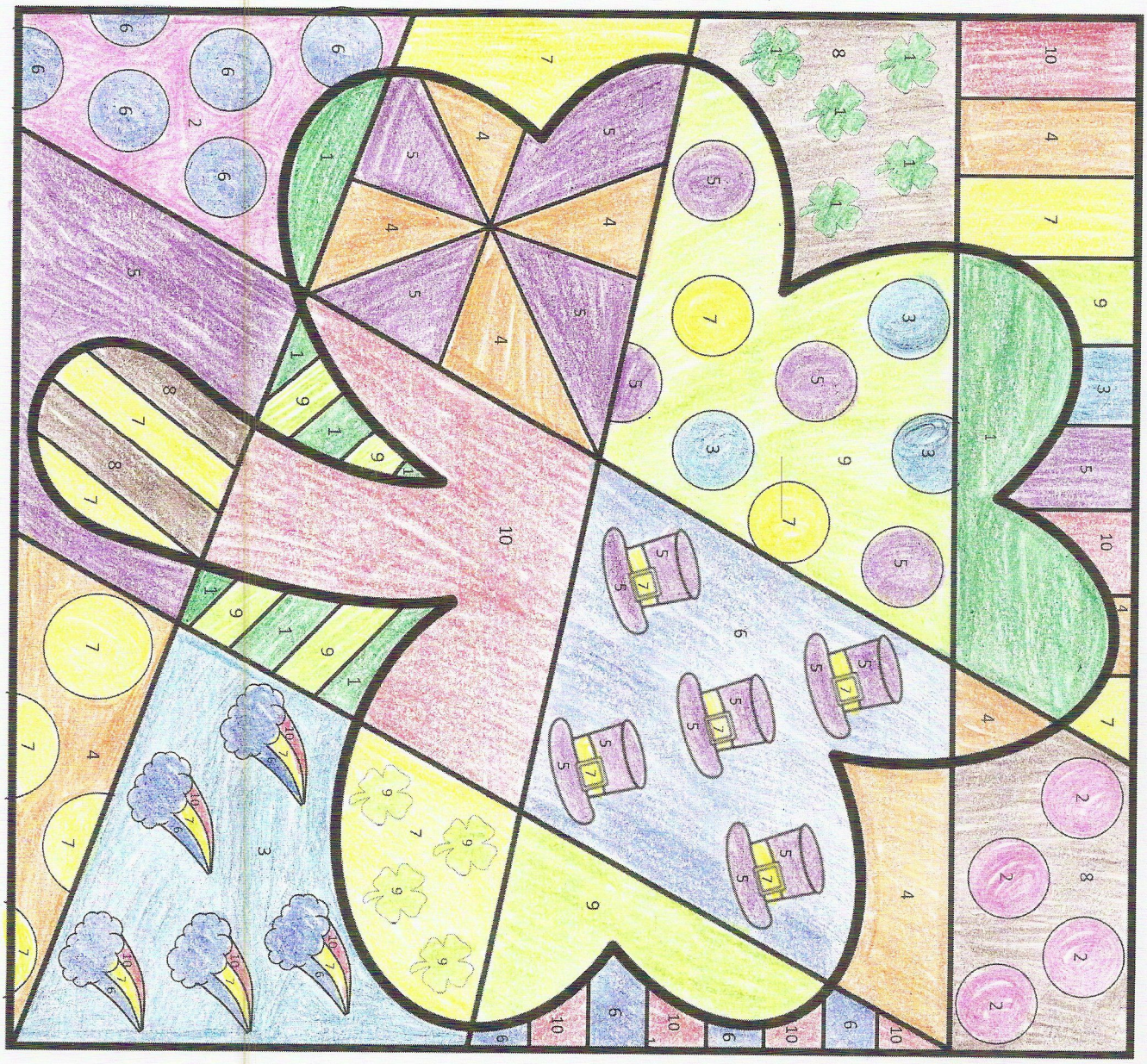
Notes: Multi-Step Equations



Steps for Solving Multi-Step Equations

C	Clear Parenthesis ( )
C	Combine like terms on each side of the equation
M	Move variables to one side
S	Solve



Clover designed by "Art with Jenny K"
http://www.teacherspayteachers.com/Store/Art-With-Jenny-K

Classwork/Homework: Multi-Step Equations

Directions: *Solve each equation. Identify matching answers between Column 1 and Column 2, then color the shamrock accordingly.*

Column 1

Dark Green 1. $13x + 7 = 8x + 27$ — $x=4$
$13x = 8x + 20$
$5x = 20$

Pink 2. $2x - 1 = 7x + 44$ — $x=-9$
$-1 = 5x + 44$
$-45 = 5x$

Light Blue 3. $-5x + 2 = 10 - 9x$ — $x=2$
$4x + 2 = 10$
$4x = 8$

Orange 4. $2(4x - 3) = 4x - 78$ — $x=-18$
$8x - 6 = 4x - 78$
$4x = -72$

Purple 5. $12 - 9x = -3(x + 10)$ — $x=7$
$12 - 9x = -3x - 30$
$42 = 6x$

Dark Blue 6. $8x - 2(x + 9) = x + 47$ — $x=13$
$8x - 2x - 18 = x + 47$
$6x - 18 = x + 47$
$5x = 65$

Yellow 7. $-5(2x - 6) = 4(x + 11)$ — $x=-1$
$-10x + 30 = 4x + 44$
$-14 = 14x$

Brown 8. $13x - 33 = 7(2x - 4)$ — $x=-5$
$13x - 33 = 14x - 28$
$-5 = x$

Light Green 9. $-6x + 18 = 7 - (4x + 9)$ — $x=10$
$-6x + 18 = 7 - 4x - 9$
$18 = 2x - 2$
$20 = 2x$

Red 10. $10 + 8(2x + 4) = 8 - x$ — $x=-2$
$10 + 16x + 32 = 8 - x$
$42 + 16x = 8 - x$
$17x = -34$
$x = -2$

Column 2

Red: $4x + 10 = 7x + 16$ — $x=-2$
$-6 = 3x$

Orange: $10x - 3 = 8x - 39$ — $x=-18$
$2x - 3 = -39$
$2x = -36$

Yellow: $-6x + 11 = 7 - 10x$ — $x=-1$
$4x + 11 = 7$
$4x = -4$

Light Green: $4(3x - 1) = 5x + 66$ — $x=10$
$12x - 4 = 5x + 66$
$7x = 70$

Dark Green: $6 - 6x = -2(x + 5)$ — $x=4$
$6 - 6x = -2x - 10$
$16 = 4x$

Light Blue: $17x - 9(x + 4) = 3x - 26$ — $x=2$
$17x - 9x - 36 = 3x - 26$
$8x - 36 = 3x - 26$
$5x = 10$

Dark Blue: $-8(2x - 9) = 20 - 12x$ — $x=13$
$-16x + 72 = 20 - 12x$
$52 = 4x$

Purple: $5x - 11 = 6(2x - 10)$ — $x=7$
$5x - 11 = 12x - 60$
$49 = 7x$

Pink: $-7x - 27 = 8 - (x - 19)$ — $x=-9$
$-7x - 27 = 8 - x + 19$
$-27 = 6x + 27$
$-54 = 6x$

Brown: $13 + 3(3x + 8) = x - 3$ — $x=-5$
$13 + 9x + 24 = x - 3$
$8x + 37 = -3$
$8x = -40$

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Classwork/Homework: Unit 6 Spiral

MEAN ABSOLUTE DEVIATION

Three steps:

1. **Find the mean of all values**
2. **Find the distance of each value from that mean**
   (subtract the mean from each value, ignore minus signs)
3. **Then find the mean of those distances**

1. Find the mean absolute deviation for the set below. S = {85, 90, 68, 75, 79}

85
90
68
75
+ 79
397
÷ 5
79.4

−79.4

= 5.6
= 10.6
= 11.4
= 4.4
= 0.4
32.4
÷ 5
6.48

2. Find the mean absolute deviation of the fulfilled items on Sherrie's registry. $29, $58, $15, $129, $75, $22

29
58
15
129
75
+ 22
328/6 = 54.7

−54.7

25.7
3.3
39.7
74.3
20.3
32.7
196/6 = 32.7

3. Find the mean absolute deviation for the set below. S = {65, 90, 85, 70, 70, 95, 55}

65
90
85
70
70
95
+ 55
530/7 = 75.7

−75.7

10.7
14.3
9.3
5.7
5.7
19.3
20.7
85.7/7 = 12.2

Notes: Multi-Step Inequalities

Steps to Solve:

1. Distribute if necessary.
2. Simplify each side of the inequality by combining like terms.
3. Move the variable to the same side.
4. Move the constant to the other side.
5. Remove the coefficient of the variable.
   *When multiplying or dividing by a negative flip your inequality sign.

Solve each inequality.

1) $-3(3v+5)-3 \le -4v-38$

$-9v-15-3 \le -4v-38$

$-9v-18 \le -4v-38$

$+9v \quad +9v$

$-18 \le 5v-38$

$+38 \quad +38$

$\frac{20}{5} \le \frac{5v}{5}$

$4 \le v$

2) $-5(n+3) > -19-5n$

$-5n-15 > -19-5n$

$+5n \quad +5n$

$-15 > -19$

NO SOLUTION

3) $-25+4k \ge -(1-k)$

$-25+4k \ge -1+k$

$-k \quad -k$

$-25+3k \ge -1$

$+25 \quad +25$

$\frac{3k}{3} \ge \frac{24}{3}$

$k \ge 8$

4) $7(-5p-4) < 3-4p$

$-35p-28 < 3-4p$

$+35p \quad +35p$

$-28 < 3+31p$

$-3 \quad -3$

$\frac{-31}{31} < \frac{31p}{31}$

$-1 < p$

Classwork/Homework: Multi-Step Inequalities

Solve each inequality.

1) $4 + 6x < -(-2 - 2x) + 4x$

$4+6x < 2+2x+4x$

$4+6x < 2+6x$

$-6x \quad -6x$

$4 < 2$

NO SOLUTION

2) $-32 + 4n < 4(4n + 4)$

$-32+4n < 16n+16$

$-4n \quad -4n$

$-32 < 12n+16$

$-16 \quad -16$

$\frac{-48}{12} < \frac{12n}{12}$

$-4 < n$

3) $-2(5a + 7) - 4 \geq -5a + 7$

$-10a-14-4 \geq -5a+7$

$-10a-18 \geq -5a+7$

$+10a \quad +10a$

$-18 \geq 5a+7$

$-7 \quad -7$

$\frac{-25}{5} \geq \frac{5a}{5}$

$-5 > a$

4) $2 - 7(r - 2) \geq -5r + 32$

$2-7r+14 \geq -5r+32$

$-7r+16 \geq -5r+32$

$+7r \quad +7r$

$16 \geq 2r+32$

$-32 \quad -32$

$\frac{-16}{2} \geq \frac{2r}{2}$

$-8 \geq r$

5) $4(n - 3) > 8n - 36$

$4n-12 > 8n-36$

$-4n \quad -4n$

$-12 > 4n-36$

$+36 \quad +36$

$\frac{24}{4} > \frac{4n}{4}$

$6 > n$

6) $-6 - 3x \leq 3x - 2(3x + 2)$

$-6-3x \leq 3x-6x-4$

$-6-3x \leq -3x-4$

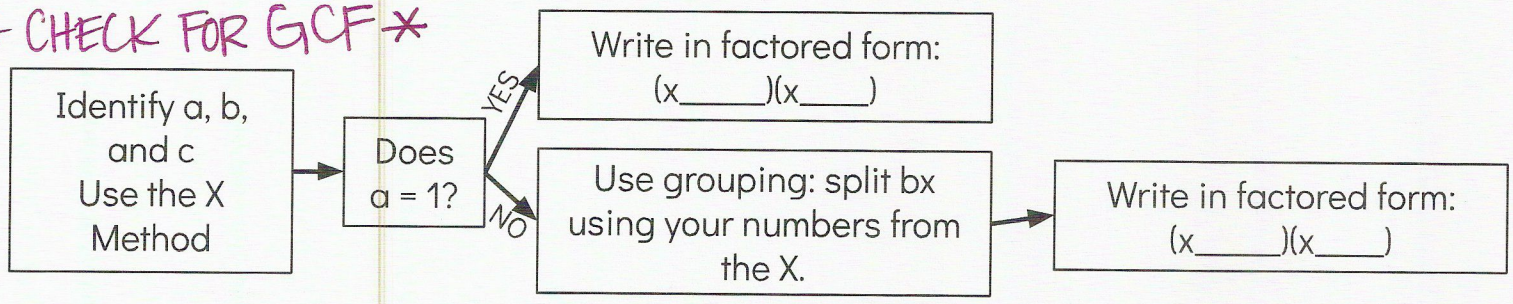
$+3x \quad +3x$

$-6 \leq -4$

Infinite Solutions

Classwork/Homework: Unit 3 Spiral

* CHECK FOR GCF *



Factor each completely.

1) $6n^2 - 24n - 360$ → $6(n^2 - 4n - 60)$

-60 / -10, 6 / -4

$6(n-10)(n+6)$

2) $a^2 - 100$

-100 / -10, 10 / 0

$(a-10)(a+10)$

3) $3n^2 - 10n + 7$

21 / -7, -3 / -10

$3n^2 - 7n - 3n + 7$

$n(3n-7) - 1(3n-7)$

$(n-1)(3n-7)$

4) $7a^2 + 31a + 12$

84 / 3, 28 / 31

$7a^2 + 3a + 28a + 12$

$a(7a+3) + 4(7a+3)$

$(a+4)(7a+3)$

5) $2x^2 + 5x - 7$

-14 / 7, -2 / 5

$2x^2 + 7x - 2x - 7$

$x(2x+7) - 1(2x+7)$

$(x-1)(2x+7)$

6) $7b^2 + 5b - 2$

-14 / 7, -2 / 5

$7b^2 + 7b - 2b - 2$

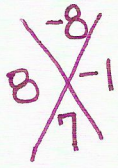
$7b(b+1) - 2(b+1)$

$(7b-2)(b+1)$

Classwork/Homework: Unit 3 Spiral

Factor each completely.

1) $12k^2 + 42k - 24$ → $6(2k^2+7k-4)$



$2k^2+8k-1k-4$

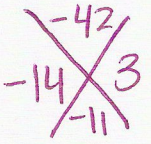
$2k(k+4)-1(k+4)$

$\boxed{6(2k-1)(k+4)}$

2) $28k^2 - 44k - 24$

$4(7k^2-11k-6)$

Bring Down GCF



$7k^2-14k+3k-6$

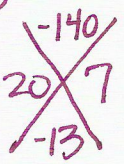
$7k(k-2)+3(k-2)$

$\boxed{4(7k+3)(k-2)}$

3) $12n^2 - 78n - 420$

$6(2n^2-13n-70)$

Bring GCF to Answer

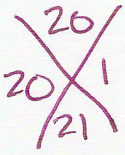


$2n^2-20n+7n-70$

$2n(n-10)+7(n-10)$

$\boxed{6(2n+7)(n-10)}$

4) $2x^2 + 21x + 10$

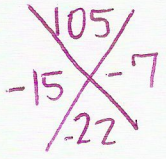


$2x^2+20x+x+10$

$2x(x+10)+1(x+10)$

$\boxed{(2x+1)(x+10)}$

5) $5n^2 - 22n + 21$



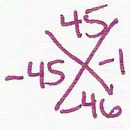
$5n^2-15n-7n+21$

$5n(n-3)-7(n-3)$

$\boxed{(5n-7)(n-3)}$

6) $-20x^2 + 184x - 36$

$-4(5x^2-46x+9)$

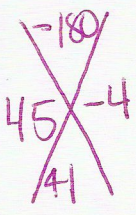


$5x^2-45x-1x+9$

$5x(x-9)-1(x-9)$

$\boxed{-4(5x-1)(x-9)}$

7) $5m^2 + 41m - 36$

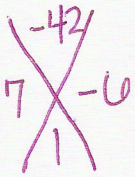


$5m^2+45m-4m-36$

$5m(m+9)-4(m+9)$

$\boxed{(5m-4)(m+9)}$

8) $7x^2 + x - 6$



$7x^2+7x-6x-6$

$7x(x+1)-6(x+1)$

$\boxed{(7x-6)(x+1)}$

Notes: Rate of Change

From Two Points:

If you're given two points

(x_1, y_1) **and** (x_2, y_2)

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

(-2, 4) and (3, -6)

$x_1\ y_1 \quad x_2\ y_2$

$$\frac{-6-4}{3-(-2)} = \frac{-10}{5} = \boxed{-2}$$

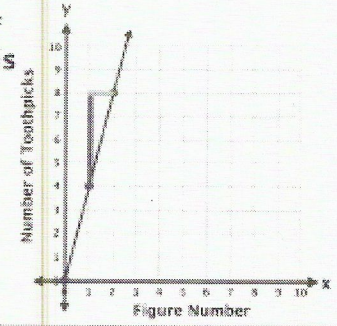
From a Graph:

Finding the rate of change on a graph is called:

RISE over RUN

or

$$\frac{\text{RISE}}{\text{RUN}}$$



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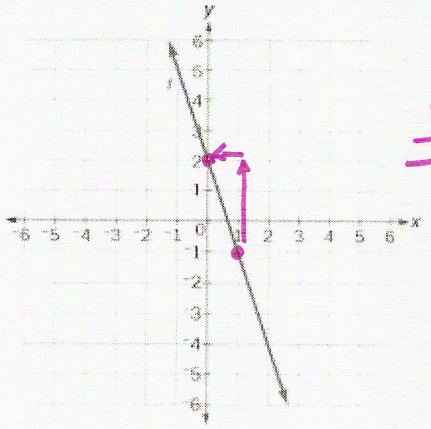


$$\frac{3}{-1} = \boxed{-3}$$

From an Equation:

Standard Form

$Ax + By = C$

$3x + 2y = 8$

$-3x \qquad -3x$

$$\frac{2y}{2} = \frac{-3x}{2} + \frac{8}{2}$$

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

Slope-Intercept Form

$y = mx + b$

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

To graph:

Go up 4 units from origin (0,0) then "rise" -3 units and "run" 2 units

down 3 units

$3x - 4y = 8$

$-3x \quad -3x$

$$\frac{-4y}{-4} = \frac{-3x}{-4} + \frac{8}{-4}$$

$$y = \frac{3}{4}x - 2$$

$\boxed{m = 3/4}$

From a Table:

Δx	Hours	Distance	Δy
	1	60	
+1			+60
	2	120	
+1			+60
	3	180	
+1			+60
	4	240	

$$\text{Slope} = \frac{\text{Change in } y}{\text{Change in } x} = \frac{\Delta y}{\Delta x}$$

$$= \frac{+60 \text{ miles}}{-1 \text{ hour}} = 60 \text{ miles per hour}$$

x	y
0	3
2	11
4	19
6	27
8	35

+2 +8

$$\frac{\Delta y}{\Delta x} = \frac{8}{2} = \boxed{4}$$

Classwork/Homework: Rate of Change

1) (-1,3) (2,5) slope = $\frac{2}{3}$

$\frac{5-3}{2-(-1)} = \frac{2}{3}$

2) (5,-4) (-4,4) slope = $-\frac{8}{9}$

$\frac{4-(-4)}{-4-5} = \frac{8}{-9}$

3) $2x - 4y = 12$ slope = $\frac{1}{2}$

$-2x \quad -2x$

$\frac{-4y}{-4} = \frac{-2x}{-4} + \frac{12}{-4}$

$y = \frac{1}{2}x - 3$

4) $-3x - y = 7$ slope = -3

$+3x \quad +3x$

$\frac{-y}{-1} = \frac{3x}{-1} + \frac{7}{-1}$

$y = -3x - 7$

5)

x	y
-4	-12
-2	-6
0	0
2	6

+2 +6

$\frac{6}{2}$

slope = 3

6)

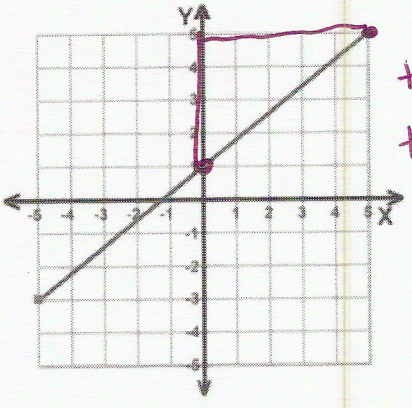
x	2	4	6	8	10	12	14
y	3	8	13	18	23	28	33

+2 +5

$\frac{5}{2}$

slope = $\frac{5}{2}$

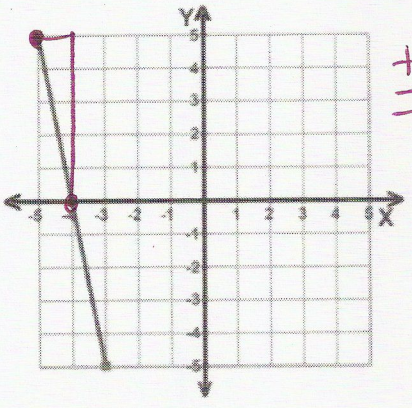
7)



$\frac{+4}{+5}$

slope = $\frac{4}{5}$

8)

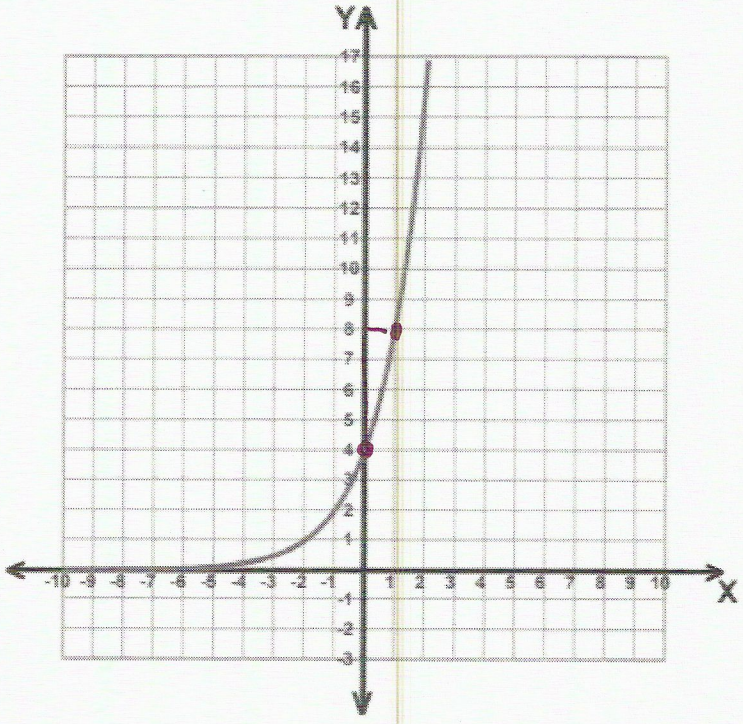


$\frac{+5}{-1}$

slope = -5

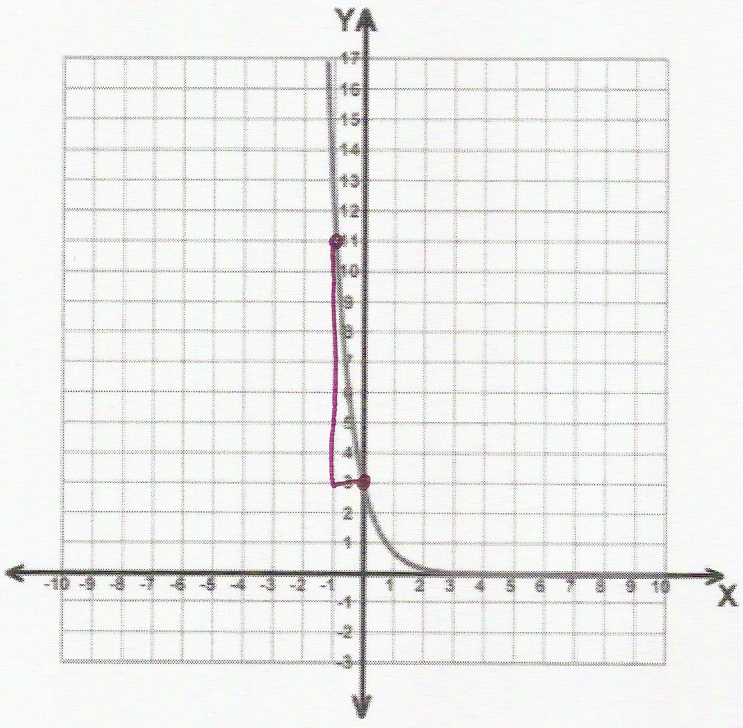
Classwork/Homework: Rate of Change

1) Find the average rate of change given the interval [0, 1].



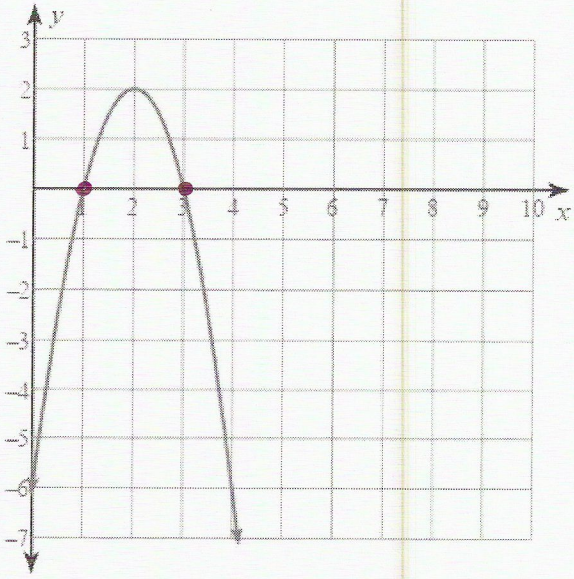
$\frac{4}{1} = \boxed{4}$

2) Find the average rate of change given the interval [-1, 0].



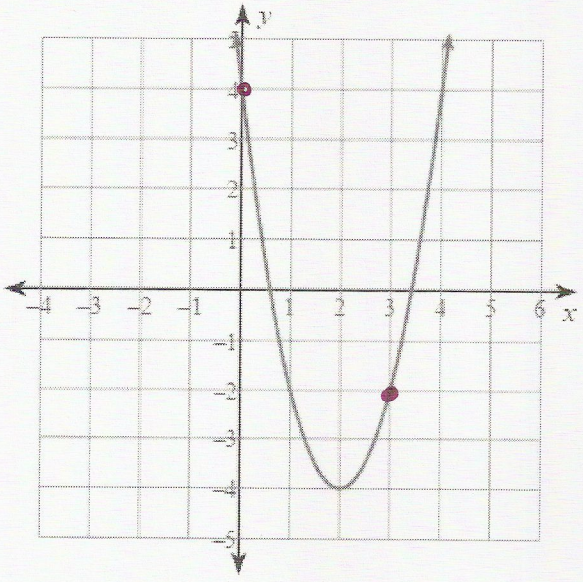
$\frac{-8}{1} = \boxed{-8}$

3) Find the average rate of change given the interval [1, 3].



$\frac{0}{2} = \boxed{0}$

4) Find the average rate of change given the interval [0, 3].



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

Classwork/Homework: Rate of Change

Find the average rate of change over the interval [2, 5].

1) $y = \frac{4}{5}x - 4$

$y = \frac{4}{5}(2) - 4 = -2.4$

$y = \frac{4}{5}(5) - 4 = 0$

$(2, -2.4)(5, 0)$
$x_1\ y_1\ x_2\ y_2$

$ROC = \frac{0-(-2.4)}{5-2} = \frac{2.4}{3} = \boxed{0.8 \text{ or } \frac{4}{5}}$

2) $y = \frac{2}{3}x - 1$

$y = \frac{2}{3}(2) - 1 = 1/3$

$y = \frac{2}{3}(5) - 1 = 2\,1/3$

$(2, 1/3)(5, 2\,1/3)$

$ROC = \frac{2\,1/3 - 1/3}{5-2} = \boxed{\frac{2}{3}}$

3) $y = -3x + 5$

$y = -3(2) + 5 = -1$

$y = -3(5) + 5 = -10$

$(2, -1)(5, -10)$

$\frac{-10-(-1)}{5-2} = \frac{-9}{3} = \boxed{-3}$

4) $y = x^2 + 2x + 2$

$y = (2)^2 + 2(2) + 2 = 10$

$y = (5)^2 + 2(5) + 2 =$

$(2, 10)(5, 37)$

$\frac{37-10}{5-2} = \frac{27}{3} = \boxed{9}$

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

$y = -3(2+3)^2 + 2 = -73$

$y = -3(5+3)^2 + 2 = -190$

$(2, -73)(5, -190)$

$\frac{-190-(-73)}{5-2} = \frac{-117}{3} = \boxed{-39}$

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

$y = -2(2-4)^2 + 4 = -4$

$y = -2(5-4)^2 + 4 = 2$

$(2, -4)(5, 2)$

$\frac{2-(-4)}{5-2} = \frac{6}{3} = \boxed{2}$

7) $f(x) = \frac{1}{2} \cdot 3^x$

$f(x) = \frac{1}{2} \cdot 3^2 = 4.5$

$f(x) = \frac{1}{2} \cdot 3^5 = 121.5$

$(2, 4.5)(5, 121.5)$

$\frac{121.5-4.5}{5-2} = \frac{117}{3} = \boxed{39}$

8) $f(x) = 5 \cdot \left(\frac{1}{2}\right)^x$

$f(x) = 5\left(\frac{1}{2}\right)^2 = 1.25$

$f(x) = 5(1/2)^5 = .15625$

$(2, 1.25)(5, .15625)$

$\frac{.15625-1.25}{5-2} = \frac{.03125}{3}$

$\approx \boxed{.01041}$

Notes: Graphing Equations & Inequalities

Steps for an Equation:

1. Write in slope-intercept form.
2. Plot the y-intercept on the y-axis.
3. Move from the y-intercept based on the slope (rise over run).
4. Connect your points to create a line.

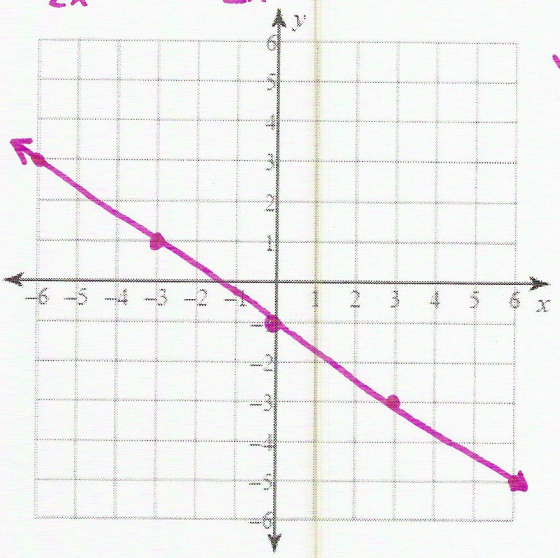
Steps for an Inequality:

1. Follow the steps for an equation. (Flip your sign when you multiply or divide by a negative.)
2. For < or > → dashed line
   For ≤ or ≥ → solid line
3. Shade above for > or ≥
   Shade below for < or ≤

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

$\frac{3y}{3} = \frac{-2x}{3} - \frac{3}{3}$

$y = -\frac{2}{3}x - 1$

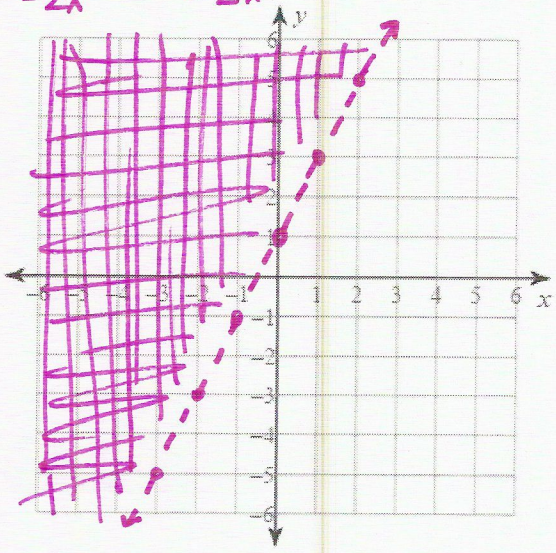


2) $2x - y < -1$
$-2x \quad -2x$

$\frac{-y}{-1} < \frac{-2x}{-1} - \frac{1}{-1}$ ← Flip Sign!

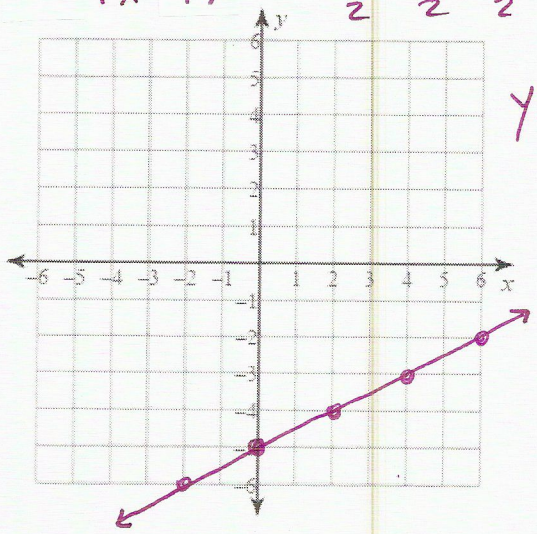
$y > 2x + 1$

- Dashed line
- Shade Above = Greater



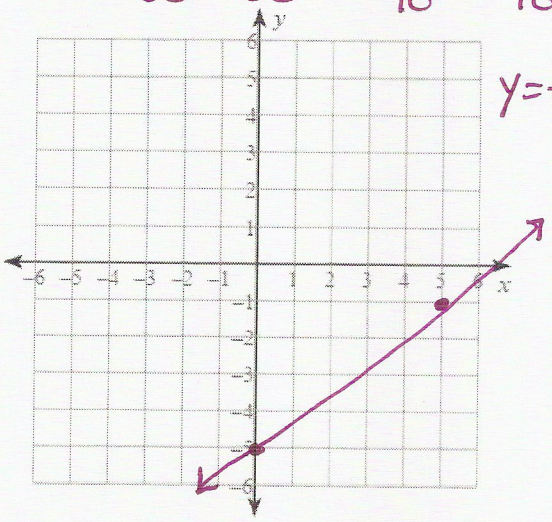
Classwork/Homework: Graphing Equations & Inequalities

1) $2y - x = -10$ → $\frac{2y}{2} = \frac{x}{2} - \frac{10}{2}$ (+x, +x)



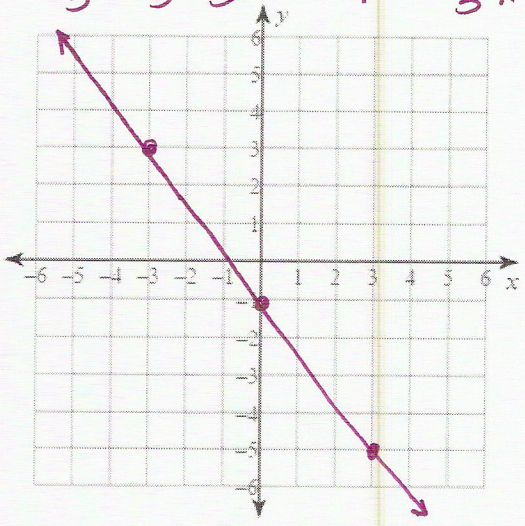
$y = \frac{1}{2}x - 5$

2) $10y + 50 = 18x$ → $\frac{10y}{10} = \frac{18x}{10} - \frac{50}{10}$ (−50, −50)

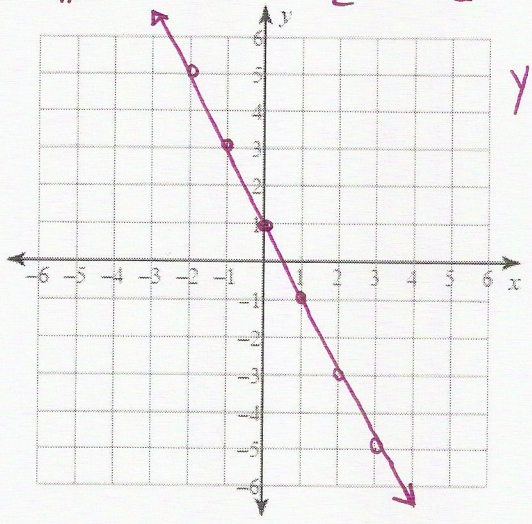


$y = \frac{4}{5}x - 5$

3) $\frac{-3y}{-3} = \frac{4x}{-3} + \frac{3}{-3}$ → $y = -\frac{4}{3}x - 1$

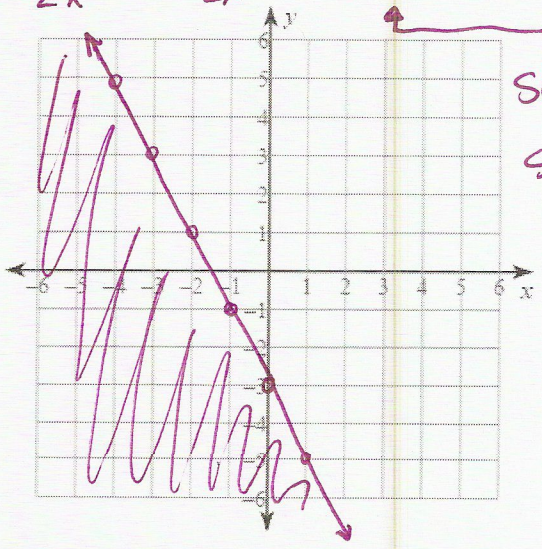


4) $4x + 2y = 2$ → $\frac{2y}{2} = \frac{-4x}{2} + \frac{2}{2}$ (−4x, −4x)



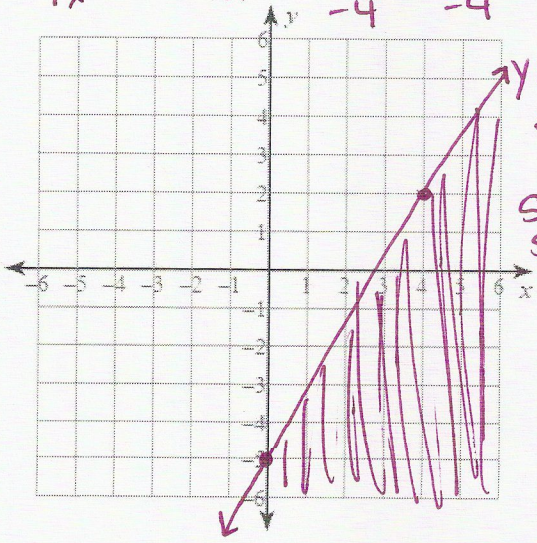
$y = -2x + 1$

5) $2x + y \leq -3$ → $y \leq -2x - 3$ (−2x, −2x)



SOLID LINE & SHADE BELOW

6) $7x - 4y \geq 20$ → $\frac{-4y}{-4} \geq \frac{-7x}{-4} + \frac{20}{-4}$ (−7x, −7x)

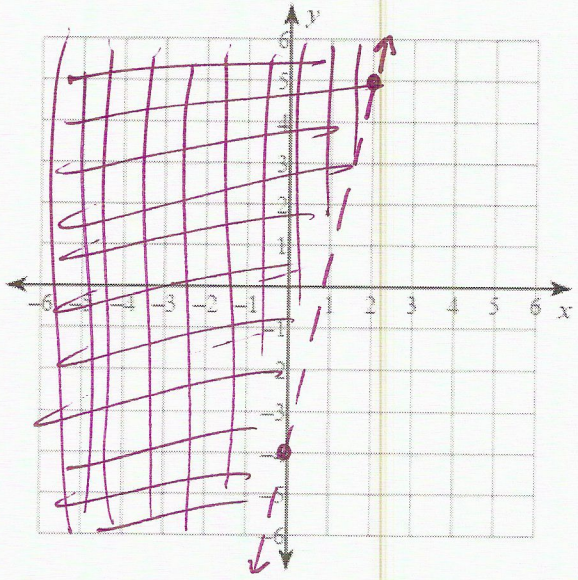


$y \leq \frac{7}{4}x - 5$

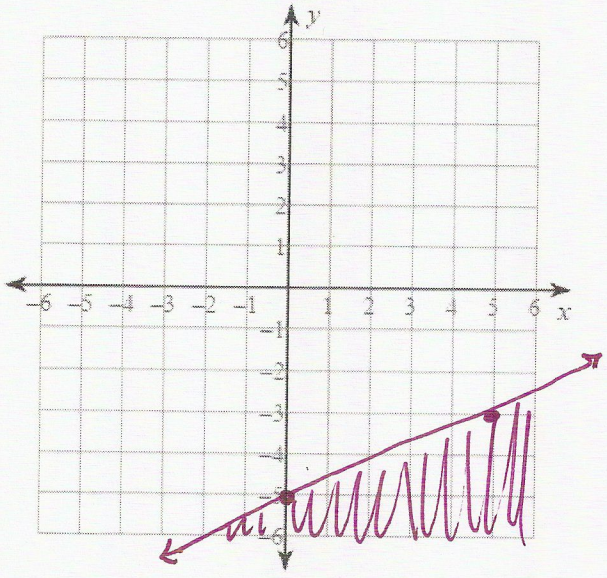
SOLID & SHADE BELOW

Classwork/Homework: Graphing Equations & Inequalities

7) $y > \frac{9}{2}x - 4$



8) $y \leq \frac{2}{5}x - 5$



9) $x + 3y > 0$

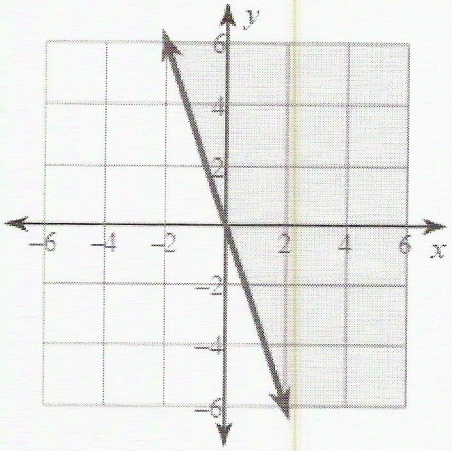
$-x \quad -x$

$\frac{3y}{3} > \frac{-x}{3} \rightarrow$ $y > -\frac{1}{3}x$

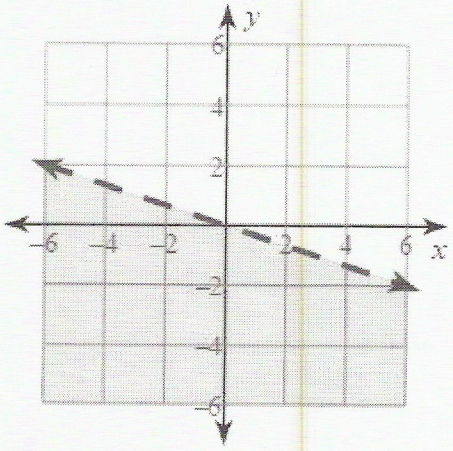
↕ DASHED

Greater = Shade ABOVE

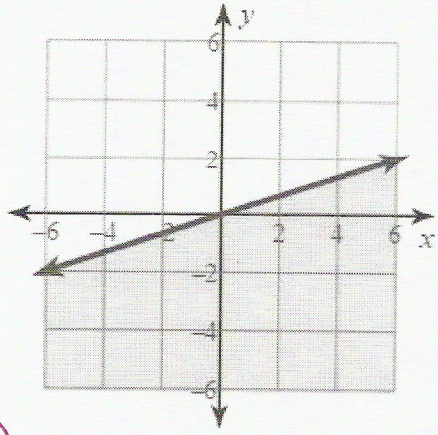
A)



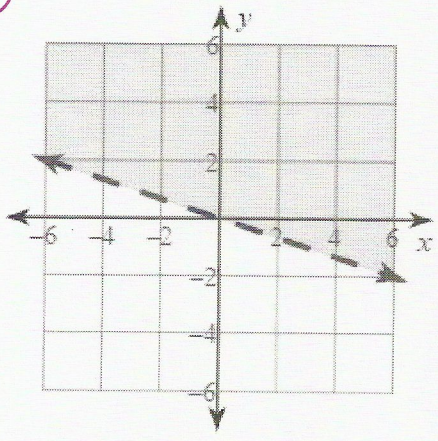
B)



C)

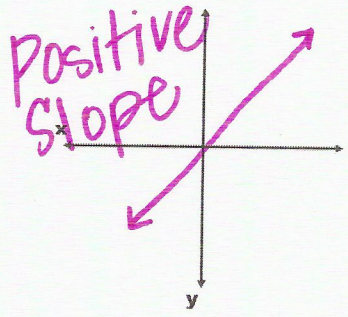


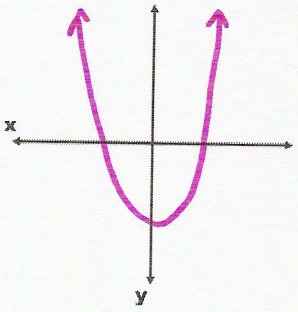
D)



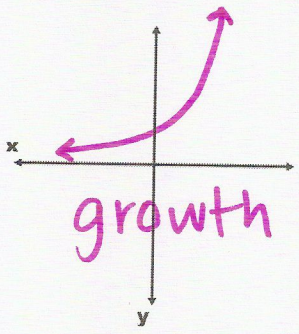
Notes: Distinguishing between Functions

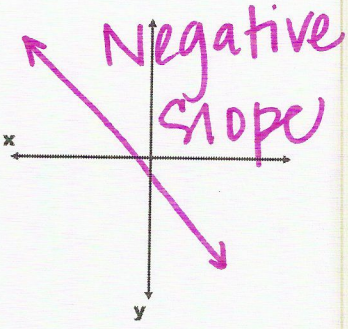
Linear Functions	Quadratic Functions	Exponential Functions
$y = mx + b$ $y = (slope)x + y\text{-}intercept$ slope = # you add/sub each time y-intercept: starting amount or y-value when x = 0	**$y = a(x - h)^2 + k$** $y = opens(x - x\text{-}value)^2 + y\text{-}value$ (h, k) *is vertex* **$y = ax^2 + bx + c$** $y = opens(x^2) + bx + y\text{-}intercept$ *Use the axis of symmetry to find the x-coordinate of your vertex: x = -b/2a	**$y = ab^x$** $y = y\text{-}intercept(constant\ ratio)^x$ y-intercept: starting amount or y-value when x = 0 constant ratio = # you multiply by each time

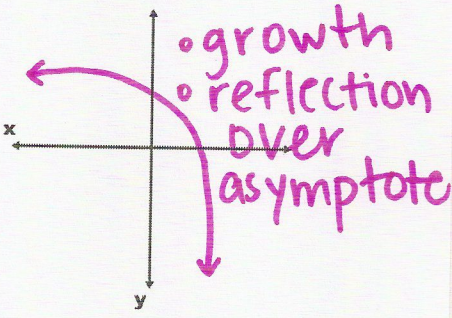


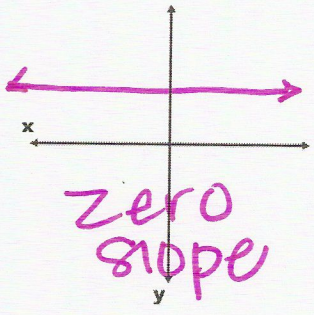


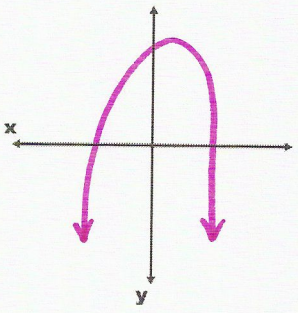
- opens up
- a is positive

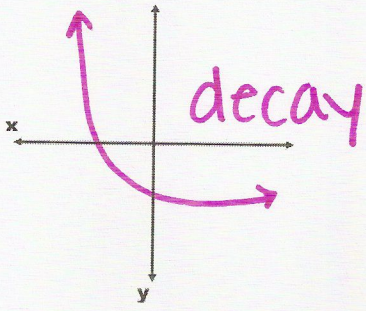


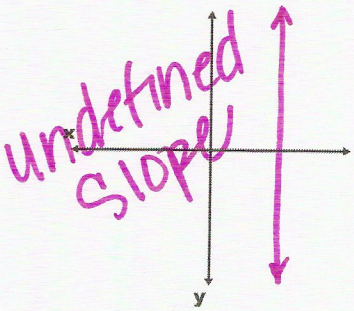




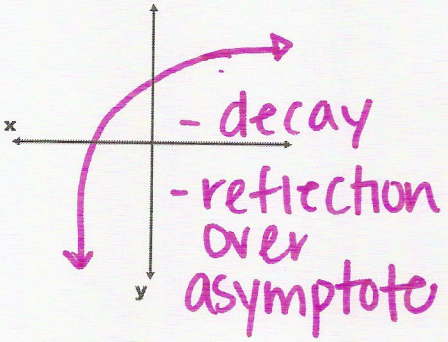








- opens down
- a is negative
- Reflection over x-axis



Tables

Linear functions have **constant** (same) **first differences** (add same number over and over).	Quadratic functions have **constant second differences**.	Exponential functions have **constant ratios** (multiply by same number over and over).

Linear Function

x	y	
2	4	
5	3	
8	2	
11	1	

(+3, +3, +3 down the x column; −1, −1, −1 down the y column)

Quadratic Function

x	y	
0	3	
1	2	−1
2	3	+1
3	6	+3
4	11	+5

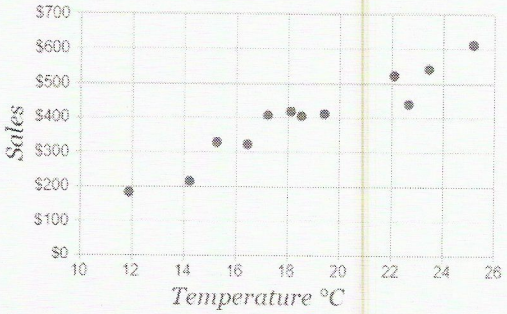
(+2, +2, +2 down the y column)

Exponential Function

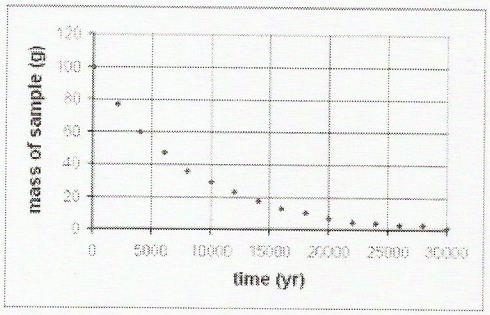
x	$f(x) = 2(3)^x$	
1	6	
2	18	×3
3	54	×3
4	162	×3

(+1, +1, +1 down the x column)

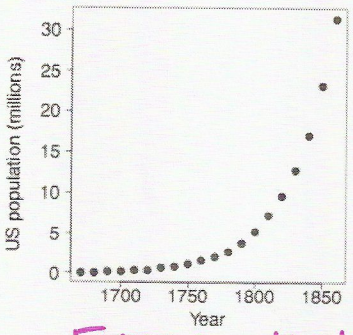
Scatterplots: Identify if it is linear or exponential and growth or decay.



Linear Growth



Exponential Decay



Exponential Growth

PRACTICE: Classify each equation/table/graph as linear, quadratic, or exponential:

a. $f(x) = 3x^2 + 2$

Quadratic

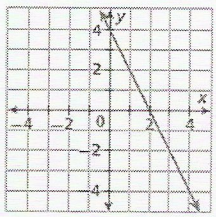
b. $y = 5^x$

Exponential

c. $f(x) = 2$

Linear

d.



Linear

e.

Time (h)	0	1	2	3
Bacteria	10	20	40	80

×2 ×2 ×2

Exponential

f.

x	y	
−2	7	−3
−1	4	−3
0	1	−3
1	−2	−3
2	−5	

Linear

g.

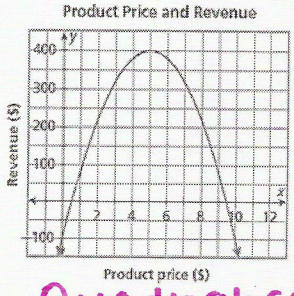
x	−3	−2	−1	0	1	2	3
y	3	0	−1	0	3	8	15

−3 −1 +1 +3 +5 +7

+2 +2 +2 +2 +2

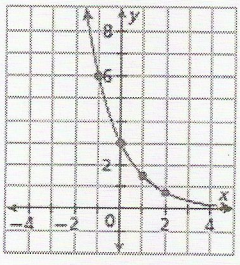
Quadratic

h.



Quadratic

i.



Exponential

Classwork/Homework: Identify Functions

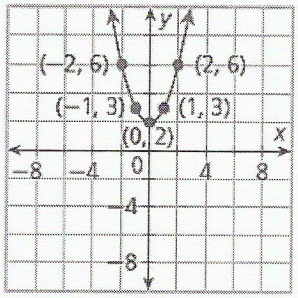
Part I: Classify each equation as linear, quadratic, or exponential.

A. $f(x) = 4(2)^x + 1$ — Exponential

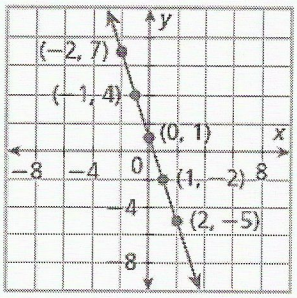
B. $y = 7(.25)^{3x}$ — Exponential

C. $y = 4x^2 + 2x - 1$ — Quadratic

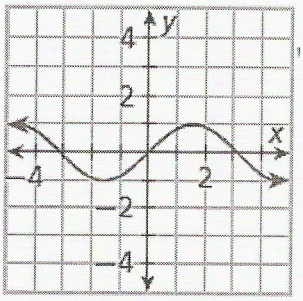
Part II: Determine if the following graphs represent an exponential function, linear function, quadratic function, or neither.



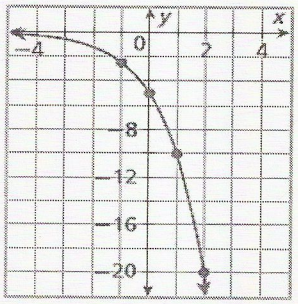
Quadratic



Linear



Neither



Exponential

Part III: Determine if the following tables represent linear, quadratic, exponential, or neither and explain why.

x	y		
−2	6		
		−3	
−1	3		+2
		−1	
0	2		+2
		+1	
1	3		+2
		+3	
2	6		

Quadratic

Volleyball Tournament	
Round	Teams Left
1	16
2	8
3	4
4	2

(+1 between each; ·½ between each)

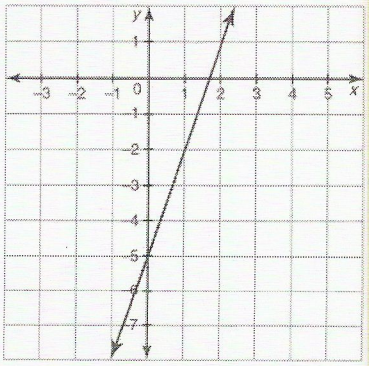
Exponential

x	$f(x) = 2(3)^x$
1	6
2	18
3	54
4	162

Exponential

Part IV: For each table or graph below, identify if it is linear, quadratic, or exponential.

Type: Linear



Type: Exponential

x	−3	−2	−1	0	1	2	3
y	4	8	16	32	64	128	256

(·2 between each)

Type: Quadratic

x	−3	−2	−1	0	1	2	3
y	0	5	8	9	8	5	0

(+5, +3, +1, −1, −3, −5; −2 between each)

Classwork/Homework: Unit 1 Spiral

Directions: Simplify the following polynomials. **Answers must be in standard form.**

1. $(x + 2)(x + 7)$

$x^2+7x+2x+14$

$\boxed{x^2+9x+14}$

2. $(x + 8)(x + 3)$

$x^2+3x+8x+24$

$\boxed{x^2+11x+24}$

3. $(b + 4)(b - 2)$

$b^2-2b+4b-8$

$\boxed{b^2+2b-8}$

4. $(w - 7)(w + 3)$

$w^2+3w-7w-21$

$\boxed{w^2-4w-21}$

5. $(m - 5)(m - 2)$

$m^2-2m-5m+10$

$\boxed{m^2-7m+10}$

6. $(y - 1)(y - 3)$

$y^2-3y-1y+3$

$\boxed{y^2-4y+3}$

7. $(2x + 3)(x + 1)$

$2x^2+2x+3x+3$

$\boxed{2x^2+5x+3}$

8. $(k + 4)(3k + 2)$

$3k^2+2k+12k+8$

$\boxed{3k^2+14k+8}$

9. $(4m + n)(m - 2n)$

$4m^2-8mn+nm-2n^2$

$\boxed{4m^2-7mn-2n^2}$

10. $(w + 6)(3w - 4)$

$3w^2-4w+18w-24$

$\boxed{3w^2+14w-24}$

11. $(5x + 3)(x - 2)$

$5x^2-10x+3x-6$

$\boxed{5x^2-7x-6}$

12. $(2a - 4b)(7a - 2b)$

$14a^2-4ab-28ab+8b^2$

$\boxed{14a^2-32ab+8b^2}$

13. $(x + 4)^2 = (x+4)(x+4)$

$x^2+4x+4x+16$

$\boxed{x^2+8x+16}$

14. $(a - 3)^2 = (a-3)(a-3)$

$a^2-3a-3a+9$

$\boxed{a^2-6a+9}$

15. $(4m + 1)^2 = (4m+1)(4m+1)$

$16m^2+4m+4m+1$

$\boxed{16m^2+8m+1}$

Directions: Simplify the radicals below.

1. $\sqrt{125x^2}$

$25 \cdot 5$, $5 \cdot 5$, $x \cdot x$

$\boxed{5x\sqrt{5}}$

2. $\sqrt{245u^4v^4}$

$49 \cdot 5$, $7 \cdot 7$, u^4, $u^2 u^2$, $v^{4/2} = v^2$

$\boxed{7u^2v^2\sqrt{5}}$

3. $-3\sqrt{100ab^{6/2}}$

$10 \cdot 10$, b^3

$-3 \cdot 10b^3\sqrt{a}$

$\boxed{-30b^3\sqrt{a}}$

4. $\sqrt{80a^2b^3c^3} = \sqrt{80}\sqrt{a^{2/2}}\sqrt{b^3}\sqrt{c^3}$

$16 \cdot 5$, $4 \cdot 4$, a, $b^{2/2}b$, $c^{2/2}c$, b, c

$\boxed{4abc\sqrt{5bc}}$

5. $\sqrt{512p^9q^4r^{10}}$

$16 \cdot 32$, $16 \cdot 2$, $\sqrt{p^9}$, $p^{8/2}p$, $\sqrt{q^{4/2}}$, $\sqrt{r^{10/2}}$

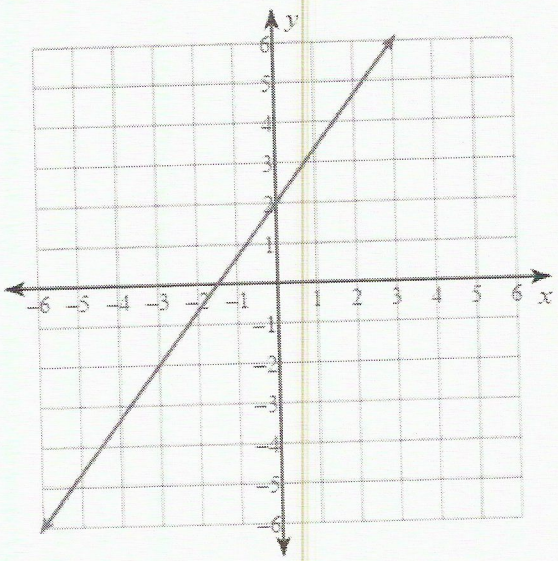
$\boxed{16p^4q^2r^5\sqrt{2p}}$

6. $-2\sqrt{192x^{25}y^{18}}$

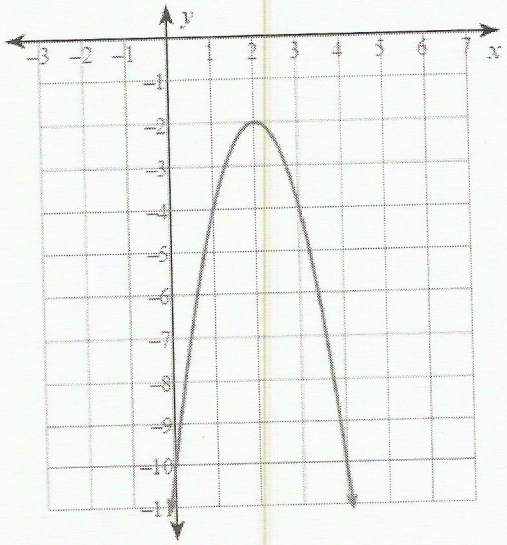
$64 \cdot 3$, $8 \cdot 8$, $\sqrt{x^{25}}$, $x^{24/2}x$, $\sqrt{y^{18/2}}$

$-2 \cdot 8x^{12}y^9\sqrt{3x} \rightarrow \boxed{-16x^{12}y^9\sqrt{3x}}$

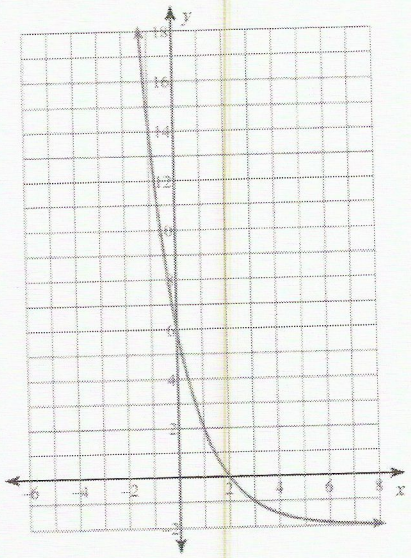
Notes: Characteristics of Functions



Domain All Real #s
Range All Real #s
End Behavior:
As x decreases → y decreases
As x increases → y increases
x-intercept(s) (-1.5, 0)
Y-intercept (0, 2)
Asymptote N/A
Growth or Decay Growth
Vertex N/A
Axis of Symmetry N/A
Minimum/Maximum N/A when N/A



Domain All Real #s
Range $y \leq -2$
End Behavior:
As x decreases → y decreases
As x increases → y decreases
x-intercept(s) none
y-intercept (0, -10)
Asymptote
Growth or Decay
Vertex (2, -2)
Axis of Symmetry $x = 2$
Minimum/Maximum Max when $y = -2$



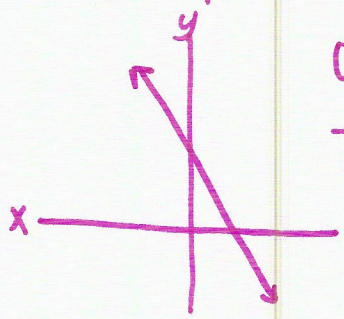
Domain All Real #s
Range $y > -2$
End Behavior:
As x decreases → y increases
As x increases → y approaches -2
x-intercept(s) (2, 0)
Y-intercept (0, 6)
Asymptote $y = -2$
Growth or Decay Decay
Vertex
Axis of Symmetry
Minimum/Maximum ____ when ____

Notes: Characteristics of Functions

$2x + y = 5$

$-2x \quad -2x$

$y = -2x + 5$



$0 = -2x + 5$

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

Domain All Real #s
Range All Real #s
End Behavior:
As x decreases → y increases
As x increases → y decreases
x-intercept(s) $(5/2, 0)$
Y-intercept $(0, 5)$
Asymptote ———
Growth or Decay Decay
Vertex ———
Axis of Symmetry ———
Minimum/Maximum ——— when ———

$f(x) = 3x^2 + 7x - 6$

$x = \frac{-b}{2a} = \frac{-7}{2(3)} = \frac{-7}{6}$

$f(x) = 3(-7/6)^2 + 7(-7/6) - 6$

$f(x) = -10.08\overline{3}$

x-intercepts:

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

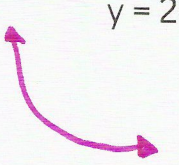
$x = \frac{-7 \pm \sqrt{(7)^2 - 4(3)(-6)}}{2(3)}$

$\frac{-7 \pm 11}{6}$

$x = 2/3, -3$

Domain All Real #s
Range $y \geq -10.08\overline{3}$
End Behavior:
As x decreases → y increases
As x increases → y increases
x-intercept(s) $(2/3, 0)$ and $(-3, 0)$
y-intercept $(0, -6)$
Asymptote ———
Growth or Decay ———
Vertex $(-7/6, -10.08\overline{3})$
Axis of Symmetry $x = -7/6$
Minimum/Maximum MIN when $y = -10.08\overline{3}$

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



$y = 2(1/2)^{0-3} + 1$

$y = 17$

Domain All Real #s
Range $y > 1$
End Behavior:
As x decreases → y increases
As x increases → y approaches 1
x-intercept(s) None
Y-intercept $(0, 17)$
Asymptote $y = 1$
Growth or Decay Decay
Vertex ———
Axis of Symmetry ———
Minimum/Maximum ——— when ———

Notes: Average Rate of Change

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta Y}{\Delta X}$$

① Identify which function has the greatest rate of change over the interval [0, 2].

$f(x) = 2(2)^{x+1} + 1$ $\quad g(x) = x^2 - 6x + 4$ $\quad h(x) = 3x - 1$

$2(2)^{0+1} + 1 = 5$, $2(2)^{2+1} + 1 = 17$

$(0, 5)\ (2, 17)$

$x_1\ y_1\ \ x_2\ y_2$

$\frac{17-5}{2-0}$

$\frac{12}{2} = 6$

$0^2 - 6(0) + 4 = 4$

$2^2 - 6(2) + 4 = -4$

$(0, 4)(2, -4)$

$\frac{-4-4}{2-0} = \frac{-8}{2} = -4$

$3(0) - 1 = -1$

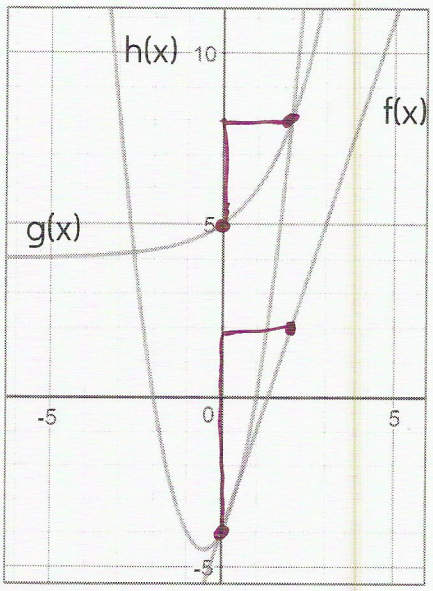
$3(2) - 1 = 5$

$(0, -1)(2, 5)$

$\frac{5-(-1)}{2-0} = \frac{6}{2} = 3$

f(x) has the greatest ROC

② Given the graph below, identify which function has the greatest rate of change from [0, 2].



$f(x) = \frac{6}{2} = 3$

$g(x) = \frac{3}{2}$

$h(x) = \frac{12}{2} = 6$

h(x) has the greatest ROC

③ Which function has the greatest rate of change over the interval [-1, 1]?

x	$f(x)$
−1	$\frac{1}{3}$
0	1
1	3
2	9
3	27
4	81

$\frac{2\frac{2}{3}}{2} = \frac{8}{3} \div 2$

$\frac{8}{3} \cdot \frac{1}{2} = \frac{8}{6} = \frac{4}{3}$

+2

x	$g(x)$
−1	−8
0	−5
1	−2
2	1
3	4
4	7

+6

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

x	$h(x)$
−1	0
0	−1
1	0
2	3
3	8
4	15

$\frac{0}{2} = 0$

g(x) has the greatest ROC

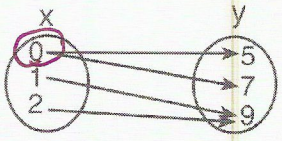
Classwork/Homework: Characteristics of Functions

B 1. What is the domain of $f(x) = 2^x$?

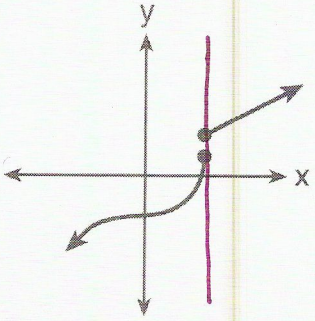
A. all integers
(B.) all real numbers
C. $x \geq 0$
D. $x \leq 0$

C 2. Which diagram represents a relation in which each member of the domain corresponds to only one member of its range?

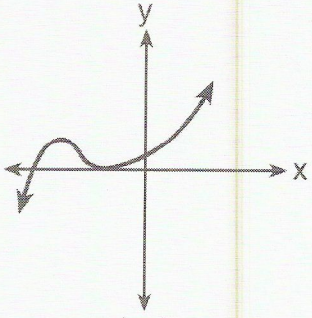
A.



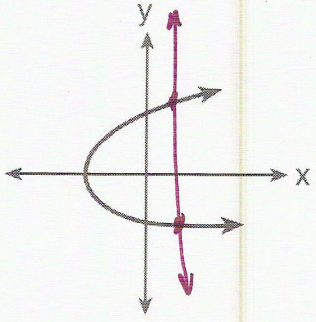
B.



(C.)



D.



A 3. The coordinates of the turning point of the graph of $y = 2x^2 - 4x + 1$ are
↳ vertex: $\frac{-b}{2a}$
$\frac{-(-4)}{2(2)} = \frac{4}{4} = 1$ $y = 2(1)^2 - 4(1) + 1$
$y = -1$

(A.) (1, −1)
B. (1, 1)
C. (−1, 5)
D. (2, 1)

B 4. Which is an equation of the axis of symmetry of the parabola whose equation is $y = 3x^2 - 12x - 13$?
$x = \frac{-b}{2a} = \frac{-(-12)}{2(3)} = \frac{12}{6} = 2$

A. $x = -4$
(B.) $x = 2$
C. $x = 3$
D. $x = 4$

D 5. What is the y-intercept of the graph of the parabola whose equation is $y = x^2 - 2x - 8$?
$y = 0^2 - 2(0) - 8$ ↑ c is y-int.

A. (4, 0)
B. (0, 4)
C. (−8, 0)
(D.) (0, −8)

C 6. What is the slope of the line whose equation is $5y = 2x + 10$?
$\frac{5y}{5} = \frac{2x}{5} + \frac{10}{5} \rightarrow y = \frac{2}{5}x + 2$

A. $\frac{5}{2}$
B. 2
(C.) $\frac{2}{5}$
D. 5

A 7. The roots of the equation $3x^2 - 27x = 0$ are
↳ solve $3x(x - 9) = 0$

(A.) 0 and 9
B. 0 and −9
C. 0 and 3
D. 0 and −3
$\frac{3x}{3} = \frac{0}{3}$ $x = 0$
$x - 9 = 0$ $+9 \quad +9$ $x = 9$

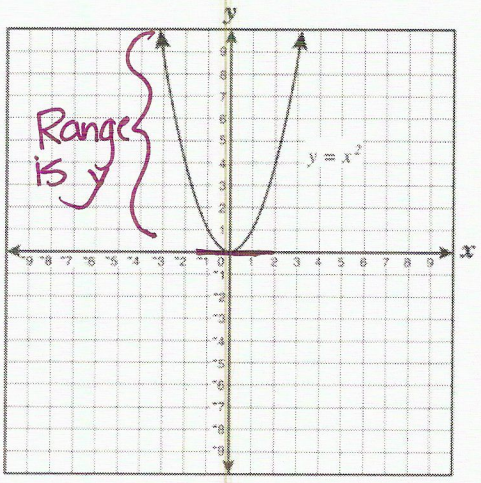
C 8. What are the x-intercepts of the graph of $y = 12x^2 - 5x - 2$? ↳ solve

A. 1 and $-\frac{1}{6}$
B. −1 and $\frac{1}{6}$
(C.) $\frac{2}{3}$ and $-\frac{1}{4}$
D. $-\frac{2}{3}$ and $\frac{1}{4}$

-24, -8, 3, -5
$12x^2 - 8x + 3x - 2$
$4x(3x - 2) + 1(3x - 2)$
$4x + 1 = 0$ $3x - 2 = 0$
$\frac{4x}{4} = \frac{-1}{4}$ $\frac{3x}{3} = \frac{2}{3}$
$x = -\frac{1}{4}$ $x = \frac{2}{3}$

Classwork/Homework: Characteristics of Functions

C 9. The following is the graph of the equation $y = x^2$, in which y is a function of x.



Which of these describes the *range* of the function?

A. x is all real numbers

B. y is all real numbers

(C.) $y \geq 0$

D. $x \geq 0$

A 10. Which ordered pair is the vertex of $f(x) = x^2 + 6x + 5$?

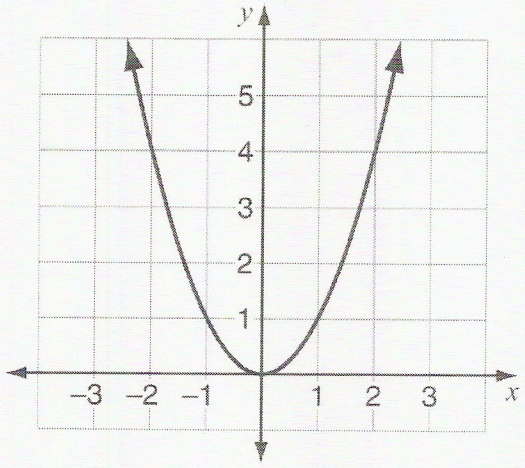
(A.) $(-3, -4)$ B. $(-2, -3)$

C. $(-1, 0)$ D. $(0, -5)$

$\frac{-6}{2(1)} = \frac{-6}{2} = -3$

$(-3)^2 + 6(-3) + 5 = -4$

A 11. Look at this graph of a function.



What is the domain of the function?

(A.) all real numbers

B. all real numbers greater than or equal to 0

C. all real numbers between 0 and 4

D. all real numbers between −2 and 2

B 12. Paul graphs the equation $y = 2^x$.

Where does his graph intersect the y-axis? (0, #)

A. $(0, 0)$ (B.) $(0, 1)$ C. $(1, 0)$ D. $(2, 0)$

A 13. Which is the y-intercept for the function $f(x) = 3x - 6$?

(A.) $(0, -6)$ B. $(-6, 0)$

C. $(0, 2)$ D. $(2, 0)$

D 14. What are the zeros of $f(x) = x^2 + 7x + 5$?

↳ quad formula

A. $\left\{\frac{7 \pm 2\sqrt{5}}{2}\right\}$ B. $\left\{\frac{-7 \pm 2\sqrt{5}}{2}\right\}$

C. $\left\{\frac{7 \pm \sqrt{29}}{2}\right\}$ (D.) $\left\{\frac{-7 \pm \sqrt{29}}{2}\right\}$

$x = \frac{-7 \pm \sqrt{(7)^2 - 4(1)(5)}}{2(1)} = \frac{-7 \pm \sqrt{29}}{2}$

Classwork/Homework: Characteristics of Functions

B 15. What is the y-intercept of the function $f(x) = \frac{1}{2}(2x - 4)$?

$\frac{1}{2}(2(0)-4) = -2$

A. $(0, -4)$ (B.) $(0, -2)$ C. $(0, 1)$

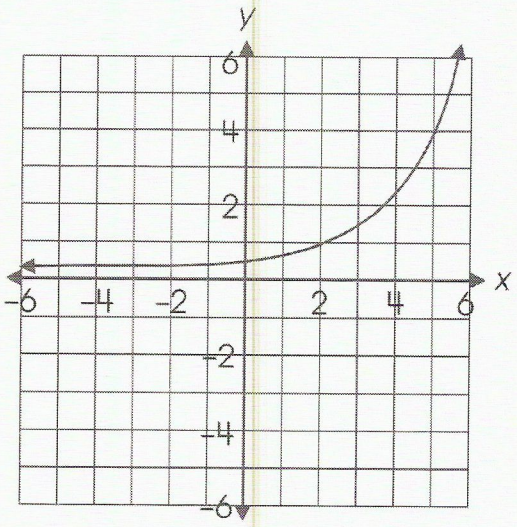
B 16. What is the minimum point of the graph of $y = x^2 + 4$?

↳ vertex

$x = \frac{-0}{2(1)} = 0 \quad y = 0^2 + 4 = 4$

A. $(-2, 0)$ (B.) $(0, 4)$ C. $(4, 0)$

17. A relationship is shown.



As the value of y decreases, what happens to the value of x?

(A.) The value of x decreases.

B. The value of x increases.

C. The value of x stays the same.

D. The value of x increases and decreases.

C 18. Which statement is true about the functions $f(x) = -15x^2 + 32$ and $g(x) = -17x^2 + 5x + 32$?

↳ y-INT.

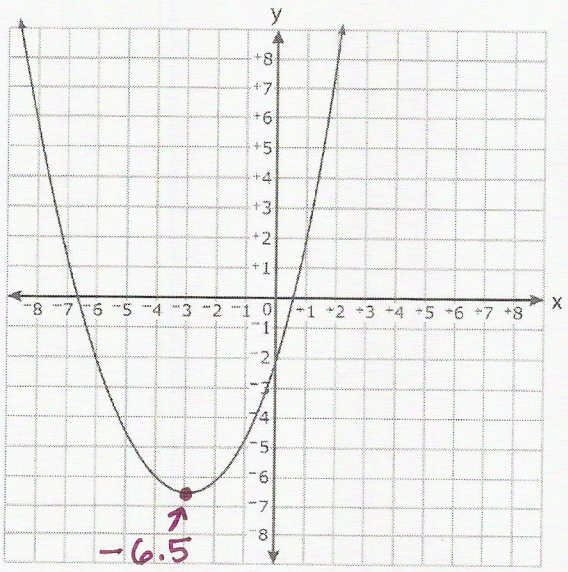
A. $f(x)$ and $g(x)$ have the same zeros.

B. $f(x)$ has a higher maximum than $g(x)$.

(C.) $f(x)$ and $g(x)$ have the same y-intercept.

D. $f(x)$ rises and falls more sharply than $g(x)$.

19. William wanted to compare the minimum value of the function $y = 2x^2 + 6x - 3$ with the minimum value of the function graphed below.



What is the value of the smaller minimum?

(A.) -7.5 B. -6.5 C. -3

$x = \frac{-6}{2(2)} = \frac{-6}{4} = \frac{-3}{2} = -1.5$

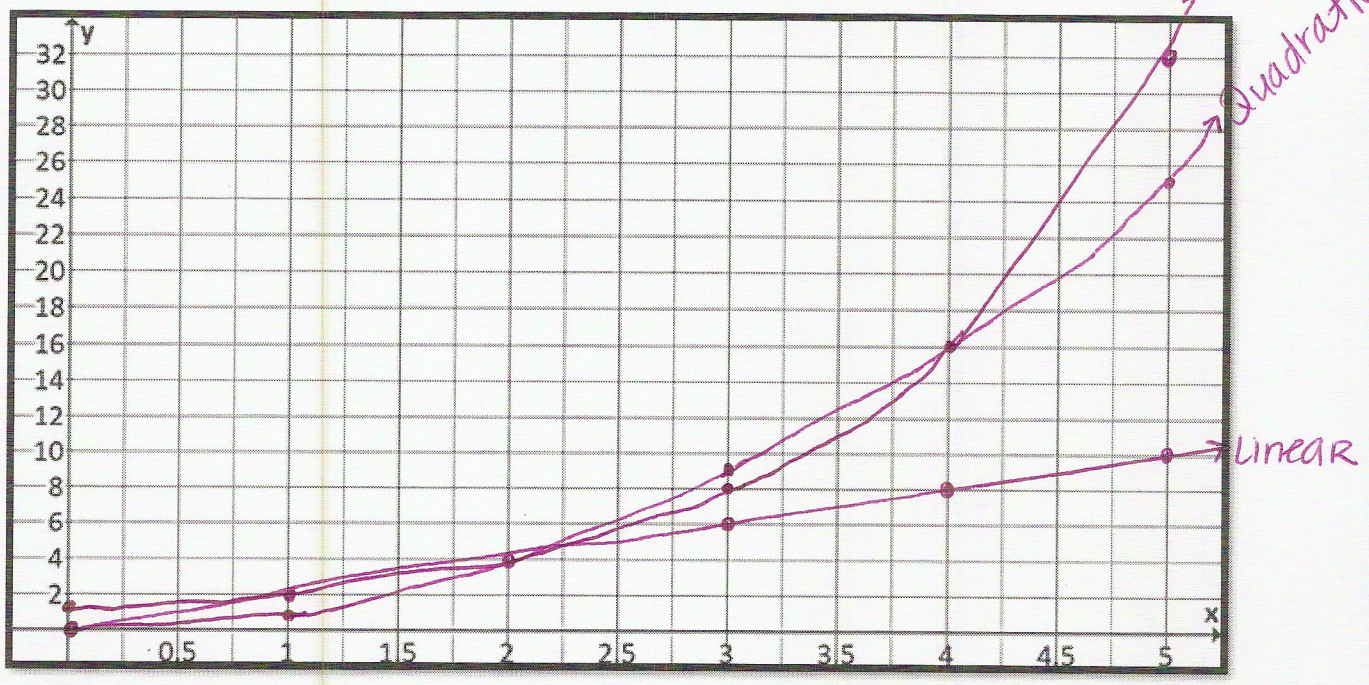
$y = 2(-1.5)^2 + 6(-1.5) - 3 = -7.5$

Notes: Comparing Functions (Linear, Quadratic & Exponential)

For the following functions, create a table and graph each function in a different color.

LINEAR Quadratic Exponential

x	y = 2x	x	$y = x^2$	x	$y = 2^x$
0	0	0	0	0	1
1	2	1	1	1	2
2	4	2	4	2	4
3	6	3	9	3	8
4	8	4	16	4	16
5	10	5	25	5	32



a) Which function shows a constant rate of change in its y values?

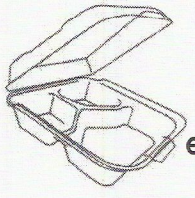
Linear

b) Which function is largest between [0, 3]?

Quadratic

c) Eventually, which type of function shows the most rapid rate of growth in its y values?

Exponential



Take Away: The graphs of exponential functions eventually exceed the graphs of linear and quadratic functions.

Notes: Function Table Comparisons

Example 1: Identify if each model is linear or exponential. Then, write an equation to represent the scenario and complete the table.

Model 1: A prize will be awarded that begins with $10 and increases by $5 each week for 8 weeks.

Week	0	1	2	3	4	5	6	7	8
$	10	15	20	25	30	35	40	45	50

Model 2: A prize will be awarded that begins with $1.50 and doubles each week for 8 weeks.

Week	0	1	2	3	4	5	6	7	8
$	1.50	3	6	9	18	36	72	144	288

For which weeks is the prize better for model 1?

0 - 4 weeks

When is model 2 the best prize?

5 or more weeks

2. Identify whether the following real-world examples should be modeled by a linear, quadratic, or exponential function.

Real-World Example	Linear	Quadratic	Exponential
Each ink cartridge purchased for a printer costs $12	✓	○	○
Throwing a ball	○	✓	○
The amount of money you earn when you get paid an hourly wage	✓	○	○
A bank account balance earning an annual interest rate	○	○	✓
Maximizing the area of a rectangular fenced area in a large field	○	✓	○
Population growth of a city	○	○	✓

Classwork/Homework: Comparing Functions

Determine whether each function has a constant or variable rate of change.
Use rates of change to determine whether each function is linear or nonlinear.

1.

x	4	5	7	10	12
y	−2	−1	1	4	6

(+1, +2, +3, +2 / +1, +2, +3, +2)

Constant
Linear

2.

x	−2	3	4	6	8
y	−4	6	8	14	20

(+5, +1, +2, +2 / +10, +2, +6, +6)

variable
Nonlinear

3.

x	0	3	9	12	18
y	14	12	8	6	2

(+3, +6, +3, +6 / −2, −4, −2, −4)

constant, Linear

4.

x	−8	−6	−4	−2	0
y	−3	1	3	5	9

(+2, +2, +2, +2 / +4, +2, +2, +4)

variable, nonlinear

5. Complete the tables for each function below. Find the rate of change over [0, 4] for each function.

Linear

$y = 5x + 10$	
x	y
0	10
1	15
2	20
3	25
4	30

(+4, +20)

Exponential

$y = 1 + 5^x$	
x	y
0	2
1	6
2	26
3	126
4	626

(+4, +624)

Quadratic

$y = 5x^2 + 5x$	
x	y
0	0
1	10
2	30
3	60
4	100

(+4, +100)

$ROC = \frac{\Delta y}{\Delta x}$

Rate of change: $\frac{20}{4} = 5$; $\frac{624}{4} = 156$; $\frac{100}{4} = 25$

Compare the rates of change. (Greatest to Least): Exponential, Quadratic, Linear

6. Three functions are given below. Complete the tables and find the rate of change over [0, 3] for each function.

Linear

$y = 4x + 10$	
x	y
0	10
1	14
2	18
3	22
4	26

(+3, +12)

Exponential

$y = 1 + 4^x$	
x	y
0	2
1	5
2	17
3	65
4	257

(+3, +63)

Quadratic

$y = 4x^2 + 4x$	
x	y
0	0
1	8
2	24
3	48
4	80

(+3)

Rate of change: $\frac{12}{3} = 4$; $\frac{63}{3} = 21$; $\frac{48}{3} = 16$

Compare the rates of change. (Least to Greatest): Linear, Quadratic, Exponential

Classwork/Homework: Unit 1 Spiral

Simplify.

1) $-5\sqrt{3} - 3\sqrt{3}$

$-8\sqrt{3}$

2) $2\sqrt{8} - 1\sqrt{8}$

$\sqrt{8}$

3) $\sqrt{5} \cdot \sqrt{3}$

$\sqrt{15}$

4) $-3\sqrt{5} + 2\sqrt{5}$

$-\sqrt{5}$

5) $-3\sqrt{27} - 3\sqrt{27} - 3\sqrt{27}$

$-9\sqrt{27} = -9 \cdot 3\sqrt{3}$

$9 \uparrow 3$ (3 3)

$= -27\sqrt{3}$

6) $-3\sqrt{12} + 3\sqrt{3} + 3\sqrt{20}$

$4 \uparrow 3$ (2 2) $\quad 4 \uparrow 5$ (2 2)

$-3 \cdot 2\sqrt{3} + 3\sqrt{3} + 3 \cdot 2\sqrt{5}$

$-6\sqrt{3} + 3\sqrt{3} + 6\sqrt{5}$

$-3\sqrt{3} + 6\sqrt{5}$

7) $-2\sqrt{45} - 3\sqrt{20} - 2\sqrt{6}$

$9 \uparrow 5$ (3 3) $\quad 4 \uparrow 5$ (2 2)

$-2 \cdot 3\sqrt{5} - 3 \cdot 2\sqrt{5} - 2\sqrt{6}$

$-6\sqrt{5} - 6\sqrt{5} - 2\sqrt{6}$

$-12\sqrt{5} - 2\sqrt{6}$

8) $\sqrt{6} \cdot \sqrt{2}$

$\sqrt{12} = 2\sqrt{3}$

$4 \uparrow 3$ (2 2)

Notes: Transformations of Functions

Quadratic

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

- a: (−) Reflection over x-axis; $a > 1$ stretch; $0 < a < 1$ shrink
- h: (+) Left, (−) Right
- k: (+) Up, (−) Down

Exponential

$$y = a(b)^{x - h} + k$$

- a: (−) reflection over asymptote; $a > 1$ Stretch; $0 < a < 1$ Shrink
- h: (+) Left, (−) Right
- k: (+) up, (−) Down

Equation	Parent Equation	Reflection Over _____	Shrink or Stretch	Horizontal Shift (Left or Right)	Vertical Shift (Up or Down)
1. $y = -3x^2 - 4$	$y = x^2$	Yes, over x-axis	Stretch by 3	None	Down 4
2. $y = 2(3)^{x+4} + 3$	$y = 3^x$	No	Stretch by 2	Left 4	Up 3
3. $y = -\frac{1}{2}(4)^{x-3} - 5$	$y = 4^x$	Yes, over asymptote	Shrink by ½	Right 3	Down 5
4. $y = -\frac{1}{4}(x+2)^2 + 6$	$y = x^2$	Yes X-Axis	Shrink by ¼	Left 2	Up 6

Given the function $f(x) = 3x^2 + 4$, describe how the graph would shift and write the resulting function.

5. $y = f(x - 2)$ Right 2

$f(x) = 3(x-2)^2 + 4$

6. $y = f(x) - 2$ DOWN 2

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

7. Write the transformation of $y = f(x)$ when the graph is moved 2 units to the right and 4 units up.

$f(x) = 3(x-2)^2 + 8$

Classwork/Homework: Transformations of Functions

Equation	Parent Equation	Reflection Over _____	Shrink or Stretch	Horizontal Shift (Left or Right)	Vertical Shift (Up or Down)
1. $y = -(4)2^{x+1}$	$y = 2^x$	Yes, over asymptote	Stretch by 4	Left 1	None
2. $y = -3(3)^{x+5} + 3$	$y = 3^x$	Yes, Over Asymptote	Stretch by 3	Left 5	Up 3
3. $y = -2x^2 + 3$	$y = x^2$	Yes over x-axis	Stretch by 2	None	Up 3
4. $y = -\frac{1}{2}(x-2)^2$	$y = x^2$	Yes, over the x-axis	Shrink by ½	Right 2	None
5. $y = 3/2(2)^x - 3$	$y = 2^x$	NO	Stretch by 3/2	None	Down 3
6. $y = (1/4)^{x+6} + 3$	$y = (1/4)^x$	No	None	Left 6	Up 3
7. $y = 1/2(3)^{x+3}$	$y = 3^x$	NO	Shrink by 1/2	Left 3	None
8. $y = -2(x-3)^2$	$y = x^2$	Yes, over the x-axis	Stretch by 2	Right 3	None

Given the function $f(x) = 3x^2 + 4$, describe how the graph would shift and write the resulting function.

9. $y = f(x + 4)$ — left 4 — $f(x) = 3(x+4)^2 + 4$

10. $y = f(x + 2) - 7$ — left 2, down 7 — $f(x) = 3(x+2)^2 - 3$

11. Write the transformation of $y = f(x)$ when the graph is moved 2 units to the left and 3 units down.

$f(x) = 3(x+2)^2 + 1$

Classwork/Homework: Unit 3 Spiral

Solve each equation with the quadratic formula.

1) $m^2 - 5m - 14 = 0$

$a=1 \quad b=-5 \quad c=-14$

$$x = \frac{5 \pm \sqrt{(-5)^2 - 4(1)(-14)}}{2(1)}$$

$$x = \frac{5 \pm \sqrt{81}}{2} \quad \frac{5+9}{2} = \boxed{7} \quad \frac{5-9}{2} = \boxed{-2}$$

2) $b^2 - 4b + 4 = 0$

$a=1 \quad b=-4 \quad c=4$

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

$$x = \frac{4 \pm \sqrt{0}}{2} = \frac{4}{2} = \boxed{2}$$

3) $2m^2 + 2m - 12 = 0$

$a=2 \quad b=2 \quad c=-12$

$$x = \frac{-2 \pm \sqrt{(2)^2 - 4(2)(-12)}}{2(2)}$$

$$x = \frac{-2 \pm \sqrt{100}}{4} \quad \frac{-2+100}{4} = \boxed{24.5} \quad \frac{-2-100}{4} = \boxed{-25.5}$$

4) $2x^2 - 3x - 5 = 0$

$a=2 \quad b=-3 \quad c=-5$

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

$$x = \frac{3 \pm \sqrt{49}}{4} \quad \frac{3+7}{4} = \boxed{\frac{5}{2} \text{ or } 2.5} \quad \frac{3-7}{4} = \frac{-4}{4} = \boxed{-1}$$

5) $x^2 + 4x + 3 = 0$

$a=1 \quad b=4 \quad c=3$

$$x = \frac{-4 \pm \sqrt{(4)^2 - 4(1)(3)}}{2(1)}$$

$$x = \frac{-4 \pm \sqrt{4}}{2} \quad \frac{-4+2}{2} = \boxed{-1} \quad \frac{-4-2}{2} = \boxed{-3}$$

6) $2x^2 + 3x - 20 = 0$

$a=2 \quad b=3 \quad c=-20$

$$x = \frac{-3 \pm \sqrt{(3)^2 - 4(2)(-20)}}{2(2)}$$

$$x = \frac{-3 \pm \sqrt{169}}{4} \quad \frac{-3+13}{4} = \boxed{\frac{5}{2}} \quad \frac{-3-13}{4} = \boxed{-4}$$

7) $4b^2 + 8b + 7 = 4 \rightarrow 4b^2 + 8b + 3 = 0$

$a=4 \quad b=8 \quad c=3$

$$x = \frac{-8 \pm \sqrt{(8)^2 - 4(4)(3)}}{2(4)}$$

$$x = \frac{-8 \pm \sqrt{16}}{8} \quad \frac{-8+4}{8} = \boxed{-\frac{1}{2}} \quad \frac{-8-4}{8} = \boxed{-3}$$

8) $2m^2 - 7m - 13 = -10$

$2m^2 - 7m - 3 = 0$

$a=2 \quad b=-7 \quad c=-3$

$$x = \frac{7 \pm \sqrt{(-7)^2 - 4(2)(-3)}}{2(2)}$$

$$x = \frac{7 \pm \sqrt{73}}{4}$$

NOTES: Arithmetic & Geometric Sequences

Information	Arithmetic	Geometric
Type of Function	Linear	Exponential
Created by...	Adding or Subtracting the same number each time. Called a **difference**	Multiplying by the same number each time. Called a **ratio**
Explicit Formula (allows you to find nth term)	$a_n = a_1 + d(n-1)$ a_n: nth term value a_1: 1st term n: term number d: difference	$a_n = a_1 * r^{n-1}$ a_n: nth term value a_1: 1st term n: term number r: ratio
Recursive Formula (allows you to find next term)	a_1 = first number $a_n = a_{n-1} + d$ a_n: nth term value a_{n-1}: term before nth term d: difference	a_1 = first number $a_n = r(a_{n-1})$ a_n: nth term value a_{n-1}: term before nth term r: ratio
Generating a Pattern	Find the first 3 terms: $a_n = 4 + (n-1)3$	Find the first 3 terms: $a_n = 3 \cdot 5^{n-1}$

n	a_n
1	4
2	7
3	10

n	a_n
1	3
2	15
3	75

Converting to Function Form	Convert: $a_n = 4 + (n-1)3$	Convert: $a_n = 3 \cdot 5^{n-1}$
	$f(x) = 4 + 3x - 3$ $f(x) = 3x + 1$	$f(x) = 3(5)^{x-1}$

NOTES: ARITHMETIC & GEOMETRIC SEQUENCES

Arithmetic	Geometric
Add or Subtract by the same number (common difference)	Multiply by the same number (constant ratio)
Explicit: $a_n = a_1 + (n-1)d$	Explicit: $a_n = a_1 \cdot r^{n-1}$
Recursive: $a_n = a_{n-1} + d$	Recursive: $a_n = r(a_{n-1})$

For each of the following problems, determine if it is arithmetic or geometric, create an explicit rule and then answer the question:

1. In the NCAA men's basketball tournament, 64 teams compete in round 1. Fewer teams remain in each following round, as shown in the graph. How many teams compete in Round 6?

Type: geometric

Explicit Formula: $a_n = 64(\frac{1}{2})^{n-1}$

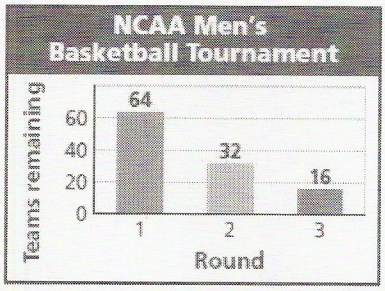
Solution: $a_6 = 64(\frac{1}{2})^{6-1}$

$a_6 = 2$

64, 32, 16

$a_1 = 64$

$r = \frac{1}{2}$



2. The odometer on a car reads 60,473 on Day 1. Every day, the car is driven 54 miles. If this pattern continues, what is the odometer reading on Day 20?

$a_1 = 60473$ $d = 54$

$a_n = 60473 + (n-1) \cdot 54$

$= 60473 + 54n - 54$

Type: Arithmetic

Explicit Formula: $a_n = 60419 + 54n$

Solution: $a_{20} = 60419 + 54(20)$

$a_{20} = 61{,}499$

3. To package and ship an item, it costs \$5.75 for the first pound and \$0.75 for each additional pound. What is the cost of shipping of 12 pound package?

$a_n = 5.75 + (n-1) \cdot (.75)$

$= 5.75 + 0.75n - 0.75$

Type: Arithmetic

Explicit Formula: $a_n = 0.75n + 5$

Solution: $a_{12} = 0.75(12) + 5$

$a_{12} = \$14$

4. The table shows a car's value for 3 years after it is purchased. How much will the car be worth in the 10th year?

Type: Geometric

Explicit Formula: $a_n = 10000(0.8)^{n-1}$

Solution: $a_{10} = 10000(.8)^{10-1}$

$a_{10} = \$1{,}342.18$

Year	Value (\$)
1	10,000
2	8,000
3	6,400

Classwork/Homework: Sequences

For each of the following sequences, define the first term and common difference/constant ratio. Then create a simplified explicit formula and recursive formula.

a. 1, 8, 15 ...	b. 4, 0, -4 ...	c. 400, 200, 100 ...
Type: Arithmetic	Type: Arithmetic	Type: Geometric
Explicit: $a_1 = 1$ $d = 7$ $a_n = 1 + (n-1) \cdot 7$ $1 + 7n - 7$ $a_n = 7n - 6$	Explicit: $a_1 = 4$ $d = -4$ $a_n = 4 + (n-1)(-4)$ $= 4 - 4n + 4$ $a_n = -4n + 8$	Explicit: $a_1 = 400$ $r = 1/2$ $a_n = 400(1/2)^{n-1}$
Recursive: $a_n = a_{n-1} + 7$	Recursive: $a_n = a_{n-1} - 4$	Recursive: $a_n = \frac{1}{2}(a_{n-1})$

① Seats in a concert hall are arranged in the pattern shown.
How many seats are in the 15th row?

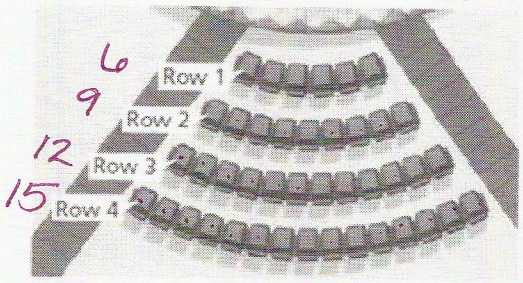
$a_1 = 6$ $d = 3$
$a_n = 6 + (n-1) \cdot 3$
$6 + 3n - 3$

Type: Arithmetic

Explicit Formula: $a_n = 3n + 3$

Solution: $a_{15} = 3(15) + 3$

$a_{15} = 48$ seats



② Three years ago, the annual tuition at a university was $3000. The tuition for the next few years can be modeled in the table to the right. Let the year 2016 represent year 1.

Type: Geometric $a_1 = 3000$ $r = \frac{3300}{3000}$

Explicit Formula: $a_n = 3000(1.1)^{n-1}$ $r = 1.1$

a. How much was the tuition in 2013? $n = -3$ $2049.04

b. How much will the tuition be in 2020? $n = 4$ $3993

Year	Tuition
2016	$3000
2017	$3300
2018	$3630

Classwork/Homework: EOC Preparation

D 1. The solution to the quadratic equation $2x^2 + 5x - 1 = 0$ is $a=2 \quad b=5 \quad c=-1$

A. $\frac{5 \pm \sqrt{17}}{4}$ B. $\frac{-5 \pm \sqrt{17}}{4}$

C. $\frac{5 \pm \sqrt{33}}{4}$ (D.) $\frac{-5 \pm \sqrt{33}}{4}$

$x = \frac{-5 \pm \sqrt{(5)^2 - 4(2)(-1)}}{2(2)} = \frac{-5 \pm \sqrt{33}}{4}$

A 2. The solution set of $x^2 - 64 = 0$ is

$+64 \quad +64$

(A.) $\{8, -8\}$ B. $\{-8\}$

C. $\{8\}$ D. $\{16, -4\}$

$\sqrt{x^2} = \sqrt{64}$

$x = \pm 8$

C 3. The expression $(x-4)^2$ is equivalent to

A. $x^2 - 16$ B. $x^2 + 16$

(C.) $x^2 - 8x + 16$ D. $x^2 + 8x + 16$

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

$x^2 - 4x - 4x + 16$

D 4. The expression $6\sqrt{50} + 6\sqrt{2}$ written in simplest radical form is

A. $6\sqrt{52}$ B. $12\sqrt{52}$

C. $17\sqrt{2}$ (D.) $36\sqrt{2}$

$6\sqrt{25 \cdot 2} + 6\sqrt{2}$

$5 \quad 5$

$6 \cdot 5\sqrt{2} + 6\sqrt{2}$

$30\sqrt{2} + 6\sqrt{2}$

C 5. The inequality $3x + 2 > x + 8$ is equivalent to

$-x \quad -x$

A. $x > -\frac{3}{2}$ B. $x > \frac{3}{2}$

(C.) $x > 3$ D. $x < 3$

$2x + 2 > 8$

$-2 \quad -2$

$\frac{2x}{2} > \frac{6}{2}$

$x > 3$

D 6. What is the solution for the following system of equations?

$2x + y = 7$

$x - 2y = 6$

$+2y \quad +2y$

$x = 2y + 6$

$2(2y + 6) + y = 7$

$4y + 12 + y = 7$

$5y + 12 = 7$

$5y = -5$

$y = -1$

A. $(3, 1)$ B. $(1, 3)$

C. $(-1, 4)$ (D.) $(4, -1)$

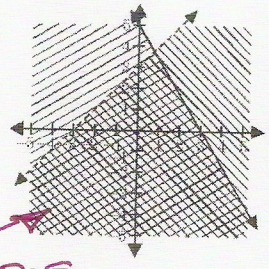
A 7. Which ordered pair is in the solution set of the system of inequalities shown in the graph?

(A.) $(0, 0)$

B. $(1, 5)$

C. $(-3, 3)$

D. $(3, 3)$



Solutions

D 8. A cellular telephone company has two plans. Plan *A* charges \$11 a month and \$0.21 per minute. Plan *B* charges \$20 a month and \$0.10 per minute. After how much time, to the *nearest minute*, will the cost of plan *A* be equal to the cost of plan *B*?

$0.8(60) = 48$ min

A. 1 hr 22 min B. 1 hr 36 min

C. 81 hr 8 min (D.) 81 hr 48 min

A $\Rightarrow 0.21x + 11 = y$

B $\Rightarrow 0.10x + 20 = y$

$0.21x + 11 = 0.10x + 20$

$-11 \quad -11$

$0.21x = 0.10x + 9$

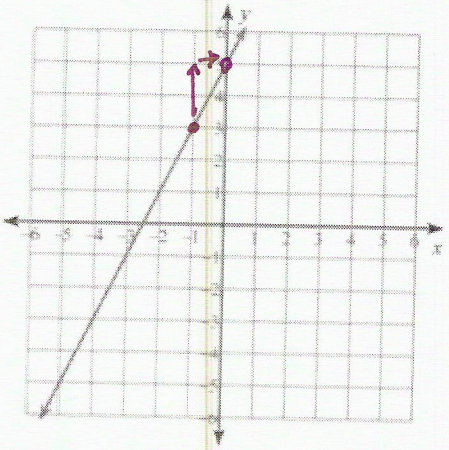
$-0.10x \quad -0.10x$

$\frac{0.11x}{0.11} = \frac{9}{0.11}$

$x = 81.8$

Unit 5 Study Guide

1. A line is shown on the coordinate grid below.



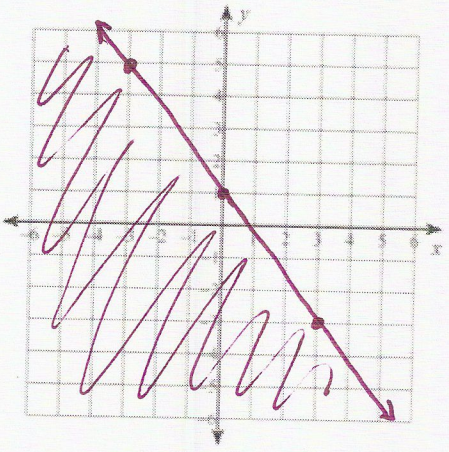
$m=2$ $b=5$ $y=mx+b$

Write the equation that best represents an equation of this line.

$y=2x+5$

2. Graph $y \leq -4/3x + 1$.

↑ SOLID



3. Solve: $14 - 2x \leq -6(x + 1)$

$14-2x \leq -6x-6$

$+6x \quad +6x$

$14+4x \leq -6$

$-14 \quad -14$

$\frac{4x}{4} \leq \frac{-20}{4}$

$x \leq -5$

4. Solve: $-7(3x + 6) = 7(-3x - 8)$

$-21x-42=-21x-56$

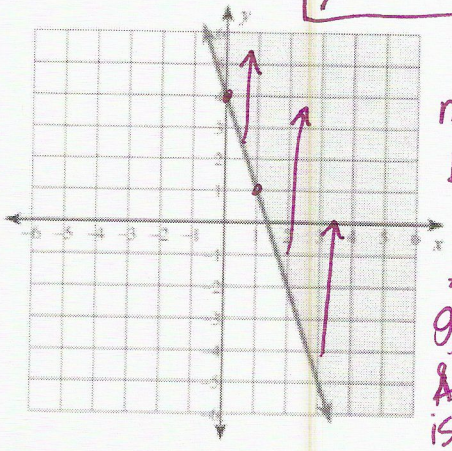
$+21x \quad +21x$

$-42=-56$

NO SOLUTION

5. Write an inequality to represent the graph below.

$y \geq -3x+4$



$m=\frac{3}{-1}=-3$

$b=4$

Above → greater than ≥

~~A~~ solid is equal to

6. Given the table below, what is the rate of change?

x	y
-1	13
-3	16
-5	19
-7	22
-9	25
-11	28

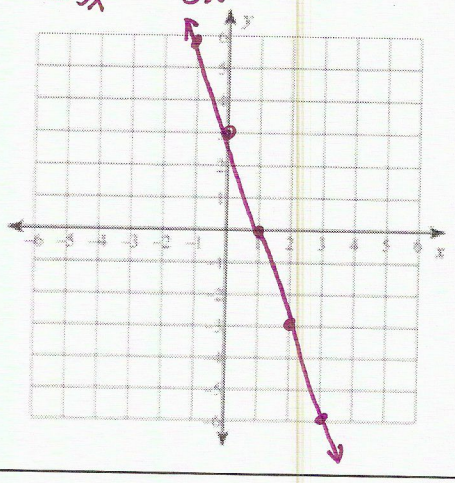
-2 → -9 → 3

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

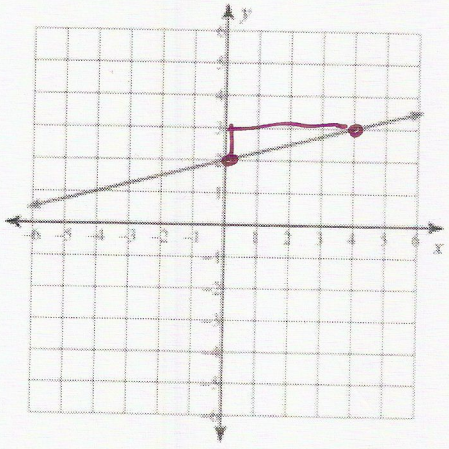
Unit 5 Study Guide

7. Graph the equation the equation $3x + y = 3$.

$-3x \quad -3x \rightarrow y = -3x + 3$



8. What is the rate of change of the graph below?



$\frac{1}{4}$

9. Find the rate of change given the two points: (-4, -15) and (16, 16).

$x_1, y_1 \quad x_2, y_2$

$$\frac{16-(-15)}{16-(-4)} = \frac{31}{20}$$

10. What is the rate of change given the equation $3x + 2y = -8$?

$-3x \quad -3x$

$$\frac{2y}{2} = \frac{-3x}{2} - \frac{8}{2}$$

$$y = -\frac{3}{2}x - 4$$

Rate of change $-3/2$

11. Solve: $-10 + \frac{x}{4} = -2$

$+10 \quad +10$

$$4 \cdot \frac{x}{4} = 8 \cdot 4$$

$$x = 32$$

Short Response #1:

Solve the equation: $3(5x - 2) = 3(x + 2)$

$$15x - 6 = 3x + 6$$

$-3x \quad -3x$

$$12x - 6 = 6$$

$+6 \quad +6$

$$\frac{12x}{12} = \frac{12}{12}$$

$$x = 1$$

Short Response #2:

Solve the inequality: $-3(x + 2) - 4 < -2x + 10$

$$-3x - 6 - 4 < -2x + 10$$

$$-3x - 10 < -2x + 10$$

$+3x \quad +3x$

$$-10 < x + 10$$

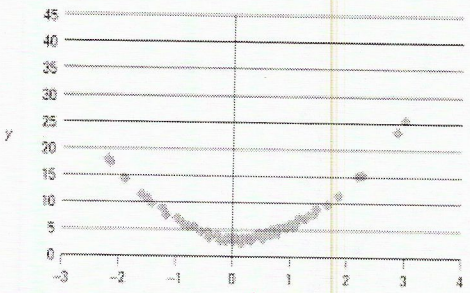
$-10 \quad -10$

$$-20 < x$$

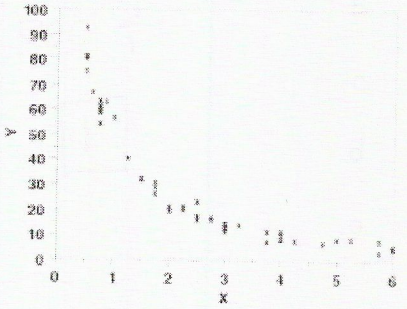
Unit 5 Study Guide

Learning Target #2: Compare & Contrast Functions

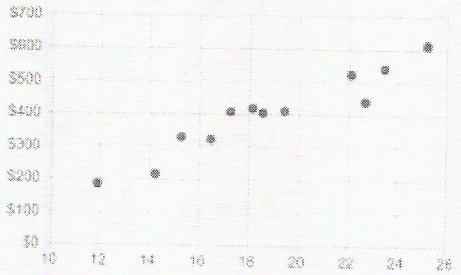
12. Identify what type of function each scatter plot best represents (linear, quadratic, or exponential) and growth/increasing or decay/decreasing if applicable.



Quadratic



Exponential Decay



Linear Growth

13. What is the y-intercept of the graph of $h(x) = 3^x - 2$? ↳ (0, #)

$h(x) = 3^0 - 2 = -1$

(0, -1)

14. Write a function to model the sequence in the table below. Geometric

$a_1 = 300$ $r = 1.5$

Week	Population
1	300
2	450
3	675

$a_n = 300(1.5)^{n-1}$

15. A ball is dropped by a height of 600 meters. The table shows the height of each bounce.

Bounce	1	2	3	4
Height	300	150	75	37.5

Make corrections to 150

What type of sequence is modeled by the table and what is the common difference or ratio?

Geometric, $r = 1/2$ or 0.5

16. What is the **range** of *EACH* function below?

a. $y = 3x - 2$

All Real #s

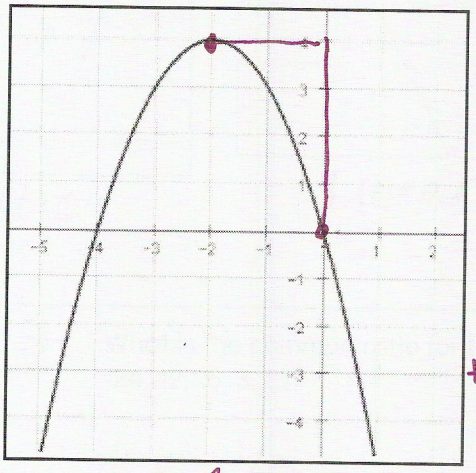
b. $y = 2x^2 + 3x - 5$ $y \geq -6.125$

$x = \frac{-b}{2a} = \frac{-3}{2(2)} = \frac{-3}{4}$ $y = 2(-3/4)^2 + 3(-3/4) - 5$

c. $y = 2(1/2)^x + 3$ $y > 3$

17. Which function has a greater rate of change over the interval [-2, 0]?

Function 1



$m = \frac{4}{-2} = -2$

Function 2

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

+1 +1 +3

$\frac{3}{1} = 3$

FUNCTION 2