7th Grade Advanced Math

Book 1: Linear Equations

Block 2: Sequences and Slope

Guided Practice

(notes)

Name: _____

Period: _____

You may use your guided notes on the test!
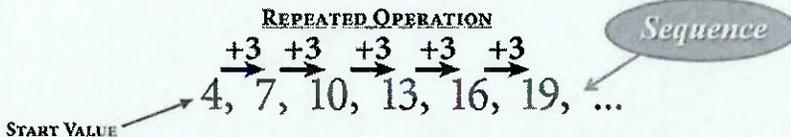
Lesson 1 – Recursive Routines

Warm-Up

Write the first five non-zero multiples of 2.   Write the first five non-zero multiples of 6.

_____ _____ _____ _____ _____   _____ _____ _____ _____ _____

Vocabulary

REPEATED OPERATION

$+3 \quad +3 \quad +3 \quad +3 \quad +3$

Recursive Sequence _____

Sequence

START VALUE → 4, 7, 10, 13, 16, 19, ...

_____

_____

Recursive Routine _____

_____

	The recursive *routine* for the *sequence* above

For the recursive sequences below, state the start value, operation and the next three terms.

Routine →

Start Value: 4
Operation: Add 3
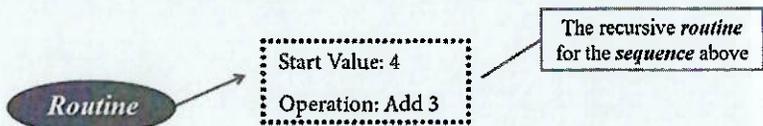
8, 17, 26, 35, 44, ...   Start Value (SV): ____   Operation: ____   Next Three Terms: ____ ____ ____

6, 2, –2, –6, –10, ...   Start Value (SV): ____   Operation: ____   Next Three Terms: ____ ____ ____

67, 56, 45, 34, ...   Start Value (SV): ____   Operation: ____   Next Three Terms: ____ ____ ____

Resting Metabolic Rate (RMR) represents the number of calories your body burns daily when at rest. In the table below, choose the weight and gender that best describes you to determine your approximate RMR. Record your value below.

Weight _____ Gender _____ RMR _____

MALE		FEMALE	
Weight (lbs)	RMR (kcal)	Weight (lbs)	RMR (kcal)
80	1290	80	1130
90	1340	90	1170
100	1400	100	1230
120	1490	120	1320
140	1600	140	1430
160	1720	160	1550
180	1830	180	1660

Choose an activity that you would most like to participate in from the list. Record your choice and the calories burned per minute.

Activity: _____ Calories Burned Per Minute: _____

Activity	Aerobics	Downhill Skiing	Bowling	Horseback Riding	Flag Football
Calories Burned per Minute	7	6	3	4	8

Insert the name of your activity at the top of the first column. How many calories has your body burned during a full day before you participate in your chosen activity? _____ What is this value called? _____
Where would this fit in the table? _____

Determine the total daily calories burned through the first five minutes of your activity. Continue your calculations to determine the total daily calories burned for 10 minutes, 20 minutes and 30 minutes. Say you want to burn 2,000 total calories for one day.

Minutes Spent (Insert activity)	Total Daily Calories Burned
0	
1	
2	
3	
4	
5	
10	
20	
30	
	≈ 2,000

How many minutes will you need to participate in your activity? _____

Is this reasonable? _____ Describe the recursive routine for your table (when going up one minute at a time) by giving the start value and the operation that must be performed to arrive at the next term.
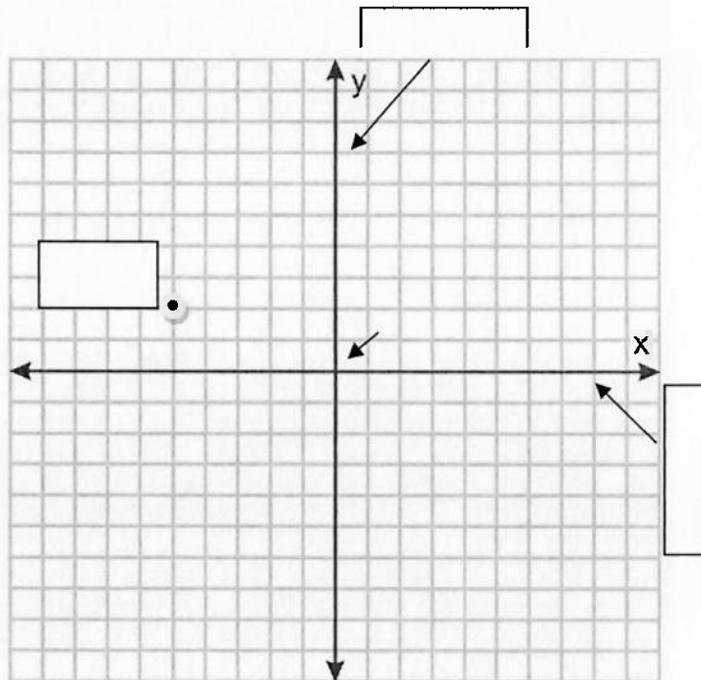
Lesson 2 – Linear Plots

Vocabulary
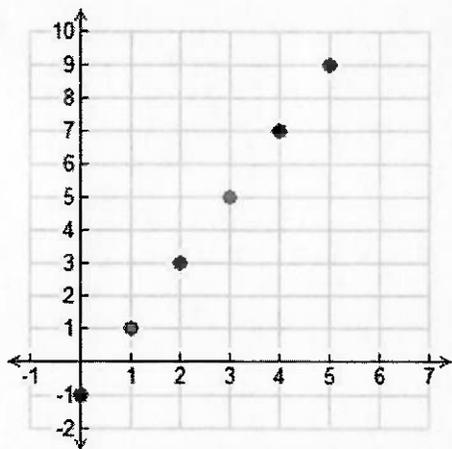
Coordinate Plane _____

_____

Axes

_____

_____

Origin

_____

_____

Quadrants _____

_____

Ordered Pair _____

_____

Describe the linear relationship given by the *y*-coordinates on the graph. Make an input-output table of the ordered pairs on the scatter plot.

x	y

SV = _____

Operation = _____

Recursive Routines for Linear Relationships

<u>Start Value</u> The *y*-value that corresponds to an *x*-value of 0.
<u>Operation</u> The amount the *y*-value increases or decreases for each unit on the *x*-axis.

Let's write a recursive routine for perimeter of a rectangle.

rectangles x	perimeter y

Lesson 3 – Recursive Routine Applications
Warm-Up: Write a recursive routine that describes each sequence. Find the 7th term.

1. 7, 4, 1, –2, …   SV =   Operation =   7th Term =

2. 9, 17, 25, 33, …   SV =   Operation =   7th Term =

3. $\frac{1}{4}, \frac{3}{4}, 1\frac{1}{4}, 1\frac{3}{4}$ SV =   Operation =   7th Term =

Recursive routines are useful when dealing with a variety of real-world situations.
✓   Recursive routines can be illustrated with _____, _____, and by _____.
✓   Using multiple ways of showing a recursive routine helps to reach a variety of audiences. It is important to think about what type of graphic (table, graph, words, etc.) best illustrates the situation.

William and his sister, Jennifer, each worked summer jobs. William mowed lawns in his neighborhood. Jennifer baby-sat for two different families. By the end of the summer, William had put $410 in a savings account. Jennifer put $275 in her account. After school started, Jennifer continued baby-sitting and earned $20 per week. She put all her earnings in her savings account. William stopped working and withdrew $15 per week from his savings account for spending money.

Step 1: Write a recursive routine (start value and operation) for the amount in William's savings account each week after school begins.
SV: Operation:

Step 2: Write a recursive routine for the amount in Jennifer's savings account each week after school begins.
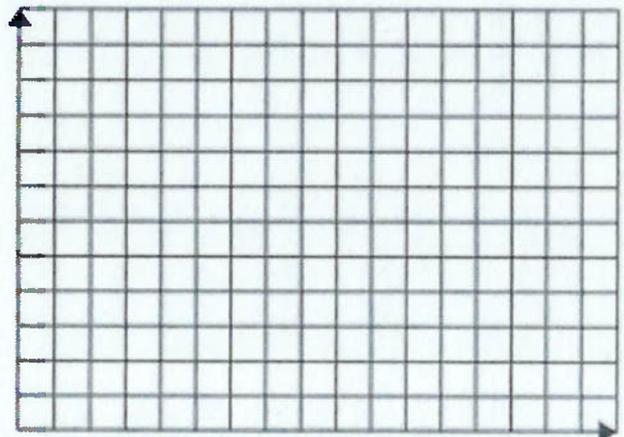SV: Operation:

Step 3: Fill in the input-output tables shown below for the first 10 weeks after school starts.

Weeks After School Starts	William's Total Savings
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Weeks After School Starts	Jennifer's Total Savings
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Step 4: On the SAME first-quadrant coordinate plane, graph William and Jennifer's total savings for the first ten weeks. Use   to designate Jennifer's amounts and   to represent William's amounts. Put weeks on the x-axis and $$ on the y-axis.

Step 5: After what week does Jennifer have more money than her brother?

_____

Which illustration (table, graph or recursive routine) best shows this?
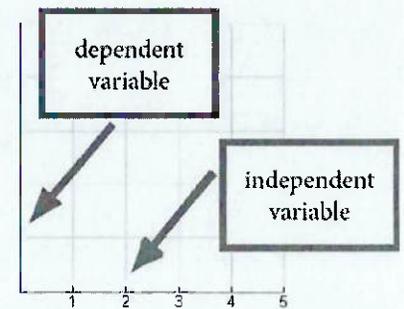
_____

Lesson 4 – Rate of Change

Vocabulary

Independent Variable (input) _____

_____

Dependent Variable (output or outcome) _____

_____

A few things to remember when creating tables and graphing:

✓   Always put the _____ the first column of a table and on the *x*-axis of a graph.

The x-axis represents the _____ variable. The *y*-axis represents the _____ variable.

✓   Most real-world situations take place in the first quadrant. Think about your situation before graphing and decide if negative numbers would ever make sense.

✓   Choose a range (lowest to the highest number) for the *y*-axis that allows the viewer of your graph to see all points easily. Also, make sure your increments on the *y*-axis are reasonable.

Rate of Change _____

_____

There are many situations where the operation is not given for just one step. In order to determine the operation needed for each situation, you must calculate the _____.

Rate of change = calculating the change in the output (*y*-values) divided by the change in input (*x*-values).

✓   Rate of change is also called *unit rate*.

Situation	Rate	Rate of Change	Operation
Colton eats 560 calories in 10 minutes.			
Karen goes down 90 steps in 4 minutes.			

Determine the rate of change for each situation.

A flower grew 15 inches in 5 weeks.   An elevator descended 40 feet in 4 seconds.

Rate of Change

The rate of change is the change in *y*-values over the change in *x*-values.

$$\dfrac{\text{change in } y \text{ - values}}{\text{change in } x \text{ - values}}$$

x	y
−1	19
1	1
2	−8
5	−35
7	−53

ROC _____

SV _____

y = _____x + _____

x	y
0	−5
1	1
2	7
3	13
4	19

ROC _____

SV _____

y = _____x + _____

x	y
−1	22
1	14
3	6
6	−6
7	−10

ROC _____

SV _____

y = _____x + _____

Lesson 5 – Recursive Routines to Equations

x	y
−1	−8
0	−15
1	−22
2	−29
3	−36

Rate of Change (ROC) _____

Start Value (SV) _____

y = _____x + _____

x	y
−1	9
2	15
3	17
5	21
8	27

Rate of Change (ROC) _____

Start Value (SV) _____

y = _____x + _____

Vocabulary

Linear Equations _____

Function _____

_____

Y-intercept _____

_____

Good to Know! When the solutions of a linear equation are graphed, they form a line. Almost all linear equations are also linear functions.

Writing Linear Equations from Recursive Routines

$$y = mx + b$$

1. Determine the rate of change.

2. Determine the start value from a described situation, graph or table.

3. Write the linear equation by filling in the start value (b) and the rate of change (m) in the equation:

$$y = mx + b$$

a. Start Value = 4   Rate of Change = +5

b. Start Value = −7   Rate of Change = +2

c. Start Value = 0   Rate of Change = −12

d. Start Value = −8   Rate of Change = +0

Write the linear equation for each recursive routine.

a. Rate of Change: +4,   Start Value: −23

b. Rate of Change: −0.3,   *y*-intercept: 2.8

c. Rate of Change: +2,   *y*-intercept: 0

d. Rate of Change: 0,   Start Value: 7

Lesson 6 – Input-Output Tables from Equations

$$y = 3x + 8$$

x	y

$$y = 5x - 4$$

x	y

$$y = -2x + 1$$

x	y

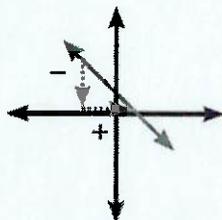**Lesson 7 – Calculating Slope from Graphs**

Vocabulary

Slope _____

Good to Know!
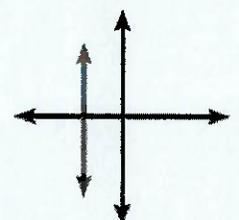A line can have a slope that is positive, negative, zero or undefined.
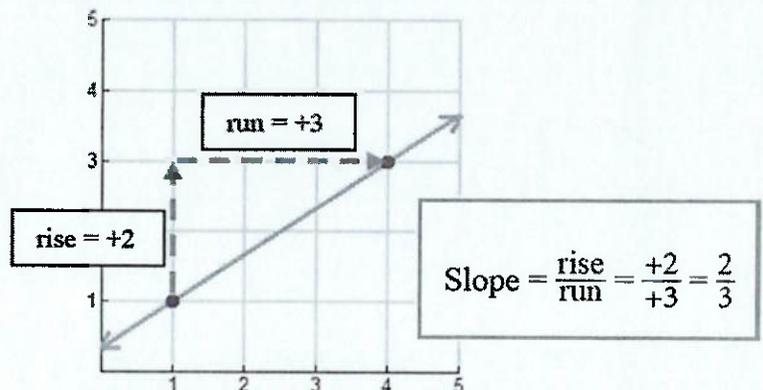

positive slope   negative slope   zero slope   undefined slope
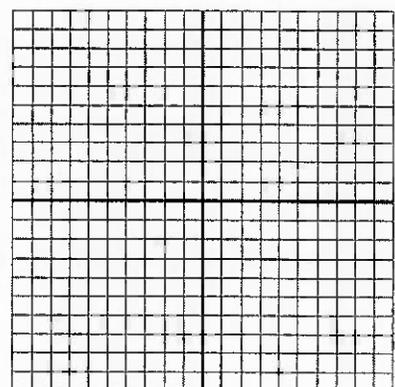
Slope Triangle _____
_____
_____
_____
_____

run = +3

rise = +2

$$\text{Slope} = \frac{\text{rise}}{\text{run}} = \frac{+2}{+3} = \frac{2}{3}$$
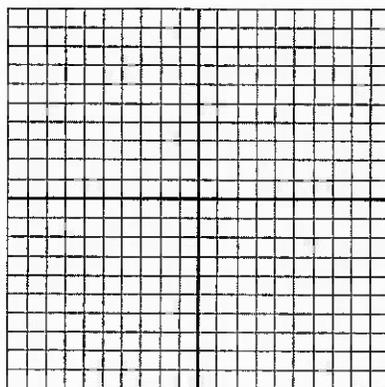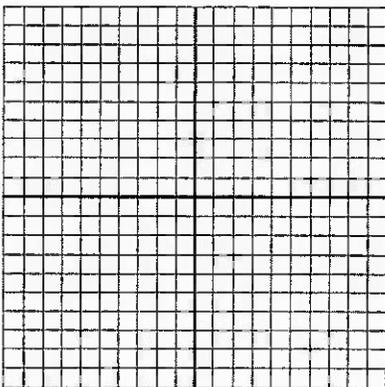
Finding Slope

The slope of a line is the ratio of the change in *y*-values to the change in *x*-values.

$$\textbf{Slope} = \textbf{Rate of Change} = \frac{\textbf{change in } y\textbf{-values}}{\textbf{change in } x\textbf{-values}} = \frac{\textbf{rise}}{\textbf{run}}$$

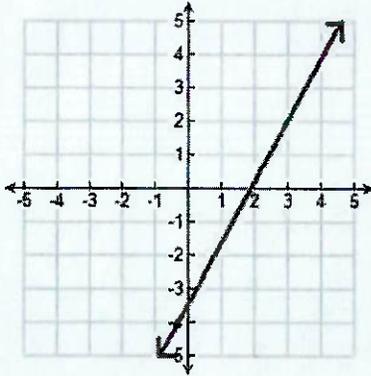| x	y
2	7
5	1

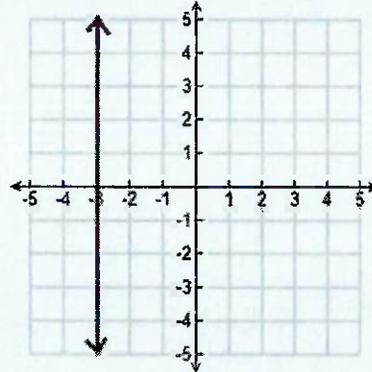(0, 1) and (2, 4)

(3, 7) and (−1, 5)

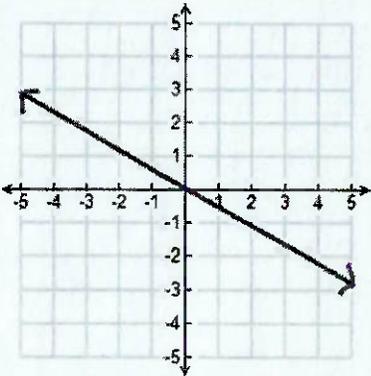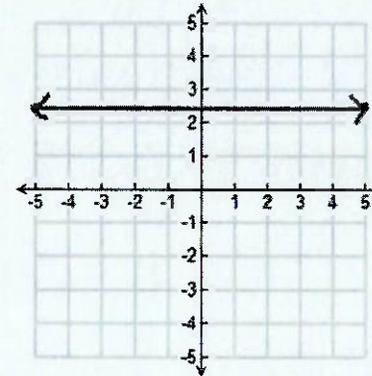# Is the slope of each line positive, negative, zero or undefined?

1.

2.

3.

4.

Remember!

You have learned three methods for calculating slope. All three methods will work in any situation. Depending on the way the linear relationship is presented, there may be one method that is easier to use than the other two methods.

RATE OF CHANGE   Easiest method when information is presented in an input-output table.

SLOPE TRIANGLE   Easiest method when information is presented in a graph.

SLOPE FORMULA   Easiest method when given two ordered pairs.

Explore!   # Find That Formula

Ginger got a job in downtown Oklahoma City. She bought a parking pass at a garage not far from her place of work. The table shows her total parking expenses based on the number of weeks she has been parking at the garage.

Week x	Total Expenses, y
6	$50
10	$74
12	$86
24	$158

Step 1   Calculate the rate of change (the change in y over the change in x) for the table above.

Step 2   Graph the ordered pairs on a Quadrant I coordinate plane like the one shown below. Draw a line through the points.

Step 3   Make a slope triangle and determine the slope of the line.

Step 4   What do you notice about the rate of change and the slope of the line?

Step 5   If you were given the table of values in the table to the right, what would the rate of change (or slope) ratio look like?

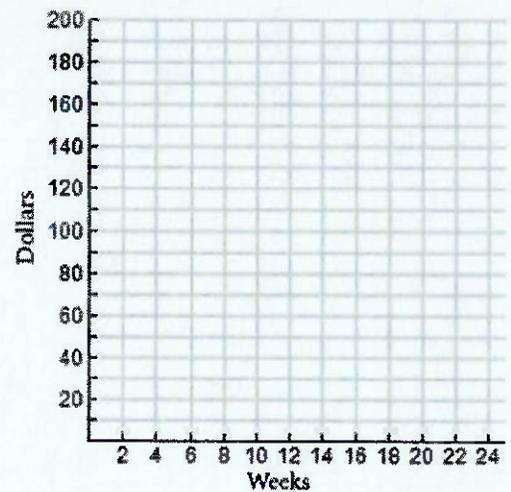| x	y
x_1	y_1
x_2	y_2

Step 6   The ratio developed in **Step 5** is called the "Slope Formula". The subscripts identify two different points. Try your formula on these points from the table above: (6, 50) and (12, 86).

Did you get the same slope as you did in **Steps 1 and 3**?

Step 7   You have learned three methods for finding slope: rate of change, slope triangles and the slope formula. Which method do you like the best? Why?

The Slope Formula

The formula for the slope of a line that goes through a point with coordinates (x_1, y_1) and another point with coordinates (x_2, y_2) is:

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1}$$

> You read x_1 as "x sub one." Think of it as saying, "the x-coordinate of the first point."

Use the following two points to write the equation for the line in slope intercept form (y = mx + b)

2 coordinates	Find the slope	Substitute an ordered pair in for the x and y values and solve for b
(3, 2) and (8, 5)		
(1, –1) and (3, –5)		
(6, –2) and (6, 4)		
(–2, 1) and (6, –5)		
(5, 3) and (–2, 3)		