

# Chapter 5 Notes

**\*STUDENT COPY\***

**Final Mark: /8**

Marks → Requirement ↓	2	1	0
<b>Notes Present</b>	All notes present	Most notes present	Less than half of notes present
<b>Organization / Neatness</b>	Notes in chronological order, name and date on everything	Almost all notes in chronological order, name and date on most pages	Mostly out of order, name and date often missing
<b>Questions</b>	Question column completed on all notes, higher level questions attempted	Most question columns complete, some higher level questions	Less than half of the question columns complete
<b>Main Ideas and Reflections</b>	All 'main ideas' and 'reflections' complete <u>with care</u> in notes	Most 'main ideas' and 'reflections' complete in notes	Less than half of the 'main ideas' and 'reflections' complete

\*If your mark does not total up to at least 4 out of 8, your notes are INCOMPLETE and must be fixed up as soon as possible and re-evaluated.

**\*TEACHER COPY\***

**Final Mark: /8**

Marks → Requirement ↓	2	1	0
<b>Notes Present</b>	All notes present	Most notes present	Less than half of notes present
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<b>Main Ideas and Reflections</b>	All 'main ideas' and 'reflections' complete <u>with care</u> in notes	Most 'main ideas' and 'reflections' complete in notes	Less than half of the 'main ideas' and 'reflections' complete

# 5.1 – Representing Relations

Name:

Date:

**Goal:** to discuss the concept of a relation and to represent relations in different ways

**Toolkit:**

**Main Ideas:**

**Definitions:**

Set –

Element –

Relation –

There are many ways to represent a relationship between two sets. Be prepared to recognize these terms and match them to the different representations:

**Words, Table, Diagram, Arrow Diagram, Bar Graph, Ordered Pairs, Line Graph**

Ex1)

Ex1) When we talk about a Gulf Islands community, we may want to know on which island it is located.

Community	Gulf Island
Fulford Harbour	Salt Spring Island
Gillies Bay	Texada Island
Sturdies Bay	Galiano Island
Long Harbour	Salt Spring Island
Blubber Bay	Texada Island
Vesuvius	Salt Spring Island

a) What type of relation is presented?

b) Describe the relation in words

c) Represent the relation as an arrow diagram

d) Represent the relation as a set of ordered pairs

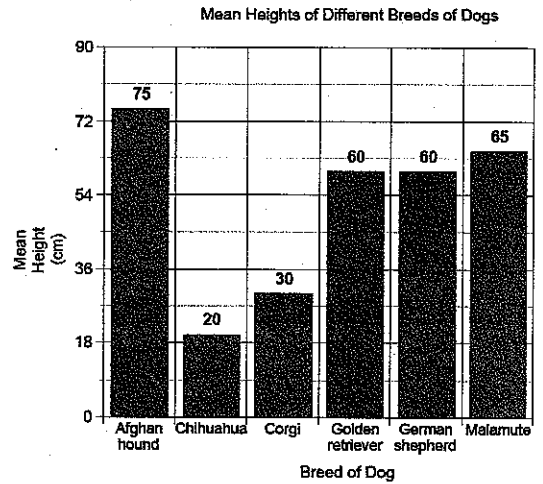
Note: could this be made into a bar graph?

Ex2)

Ex2) This \_\_\_\_\_ shows the relationship between different breeds and their mean (average) heights.

Represent this relation

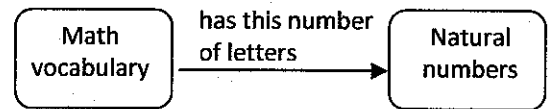
- a) In words
- b) As a table
- c) As an arrow diagram



Ex3)

Ex3) In the \_\_\_\_\_,

- a) Describe the relation in words
- b) List 2 ordered pairs that belong to the relation



**Reflection:** Which method of representing a relation makes the most sense to you? Why? List its advantages and disadvantages.

## 5.2A – Properties of Functions

Name:

Date:

**Goal:** to develop the concept of a function and to be able to recognize functions

**Toolkit:**

**Main Ideas:**

### Definitions

**Domain** – The set of first elements of a relation is called the **domain**

**Range** – The set of second elements of a relation is called the **range**

**Function** – A **function** is a special type of relation where each element in the domain is associated with exactly one element in the range (OR a set of ordered pairs in which no two ordered pairs have the same first co-ordinate)

**Independent Variable** – An **independent variable** is a variable whose value is not determined by the value of another variable

**Dependent Variable** – A **dependent variable** is a variable whose value is determined by the value of another (the independent) variable

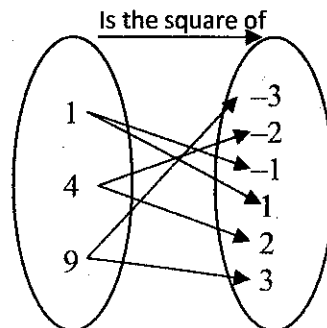
Ex1)

Ex1) State the domain and range for each relation:

a)

Animal	# of legs
Chicken	2
Dog	4
Cat	4
Spider	8
Ladybug	6
Eagle	2

b)



c)  $\{ (-2, 4), (-1, 1), (1, 1), (2, 4), (3, 9) \}$

Functions

How do we determine whether a relation is also a **function**?

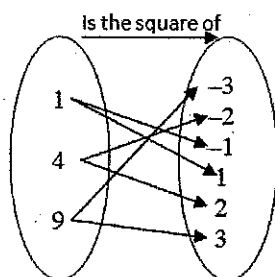
For a table of values or ordered pairs:

Animal	# of legs
Chicken	2
Dog	4
Cat	4
Spider	8
Ladybug	6
Eagle	2

$\{ (-2, 4), (-1,1), (1, 1), (2,4), (3,9) \}$

$\{ (1, 1), (1,2), (3, 3), (3,4) \}$

For an arrow diagram:



Ex2)

Ex2) Students are doing a “nickel drive” fund raiser. The amount of money they raise will **depend on** the number of nickels turned in.

- label the domain/range, independent/dependent variables
- is this relation a function, or not a function?

Number of nickels, $n$	Amount raised, $A$ (\$)
0	0
50	2.50
100	5.00
150	7.50
200	10.00
Would this pattern continue?	

**Reflection:** Complete the Frayer model on the next page.

**5.2A – Functions FRAYER MODEL**

Name:

Date:

**Goal:** to represent information about function in a Frayer model (refer to page 274 for ideas)

*Hint: try to leave a little space in each box in case you want to add ideas as we go through the unit*

<p><b>Definition(s)</b></p>	<p><b>Essential Characteristics</b></p>
<p><b>Function</b></p>	
<p><b>Example(s)</b></p>	<p><b>Non-example(s)</b></p>

**Reflection:** How does this model help you? What works for you? What doesn't?

**5.2B – Function Notation**

Name:

Date:

**Goal:** to define and work with function notation

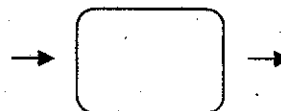
**Toolkit:**

**Main Ideas:**

Functions

Ways to think about functions:

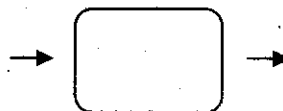
- rules
- formulas
- input/output machines



Input/output

A domain value goes IN, then the function machine changes it, and the (one and only) matching range value comes OUT.

Recall the “nickel drive” fund raiser. What does the machine do?  
Account for: independent/dependent, domain/range, input/output, the variables



Function notation

Function notation shows us mathematically that the Amount of money raised (A) depends on (is a function of) the number of nickels (n) that come in.

We say:

Ex1)

Ex1) Write the equation  $y = 2x - 5$  in function notation.  
label: independent/dependent, domain/range, input/output, the variables

$$y = 2x - 5$$

\_\_\_\_\_ depends on \_\_\_\_\_, so \_\_\_\_\_ is a function of \_\_\_\_\_ and we write  
 $f(\quad) =$

Note: we can use letters other than  $f$  such as  $g, h, k$

Note: we can work in the opposite direction by changing function notation back into the more familiar equations in 2 variables, e.g.

$$g(x) = 3x + 4 \rightarrow y = 3x + 4$$

Ex2)

Ex2) The equation  $C = 23n + 550$  represents the cost ( $C$ ) of a banquet where  $n$  people attend.

a) Describe the function

b) Write the function in function notation.

c) Find  $C(100) = \underline{\quad}$  and explain what this represents

d) Find  $n$  for  $C(n) = 4000$  and explain what this represents

Ex3)

Ex3) For the function  $f(x) = 3x - 4$

a) Write as a 2-variable equation

b) Determine the values of  $f(6), f(4), f(-2)$

c) Determine the value of  $x$  for  $f(x) = 2$  and for  $f(x) = -1$

**Reflection:** For example 2 about the banquet, what values of  $n$  do not make sense as possible domain values? (Look back: what does  $n$  represent?)



5.3/5.4 – Interpreting and Drawing Graphs

Name:

Date:

**Goal:** to practice interpreting graphs and to practice drawing graphs (working back and forth between situations and their matching graphs)

**Toolkit:**

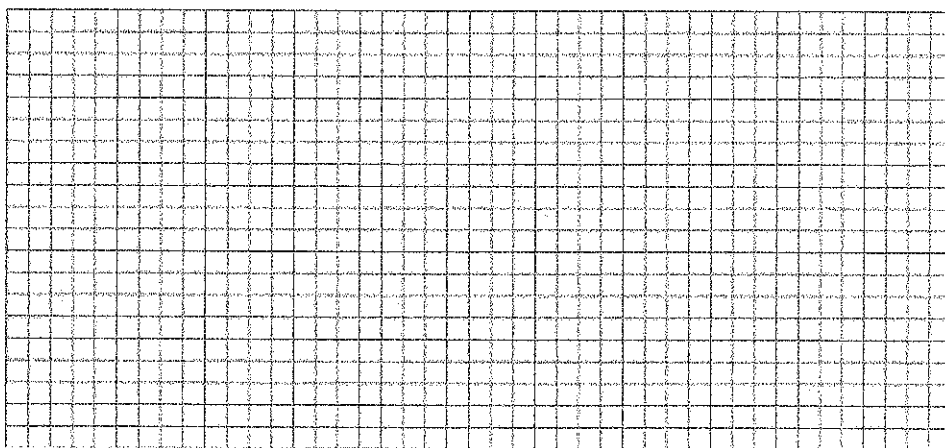
**Main Ideas:**

“Try This” p. 277

Work with a partner on the “Try This” on page 277

A

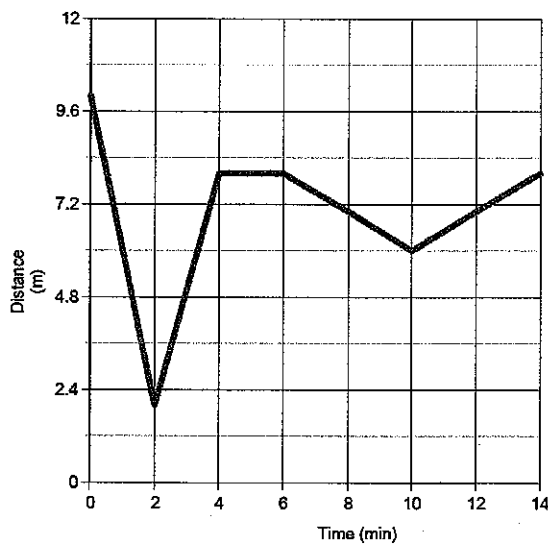
B



C

Ex1)

Ex1) Label key information on the following graph. When/how is it increasing? Decreasing?



Ex2) Interpret Graph

Ex2) Using the graph, EXPLAIN the answer to each question:

a) Who is the oldest? How old is s/he?

b) Who is the youngest? How old is s/he?

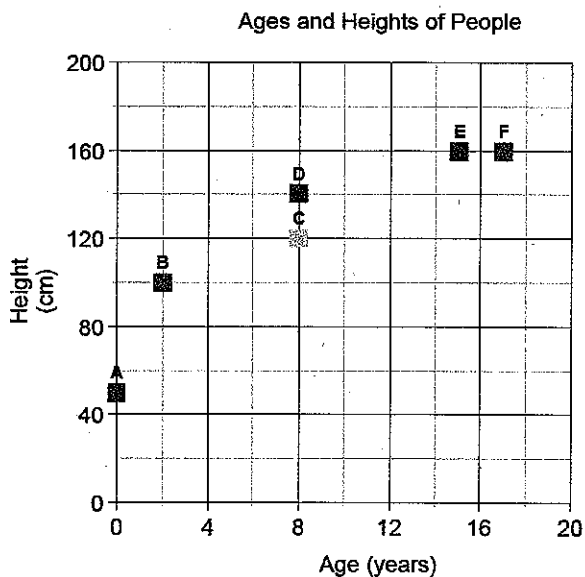
c) Who has the same height? What is that height?

d) Who has the same age? What is that age?

e) Which person is taller for his/her age: person E or F?

f) What are the coordinates (ordered pairs) for persons C and D?

g) Is this a function?



Ex3) Graph →  
Situation

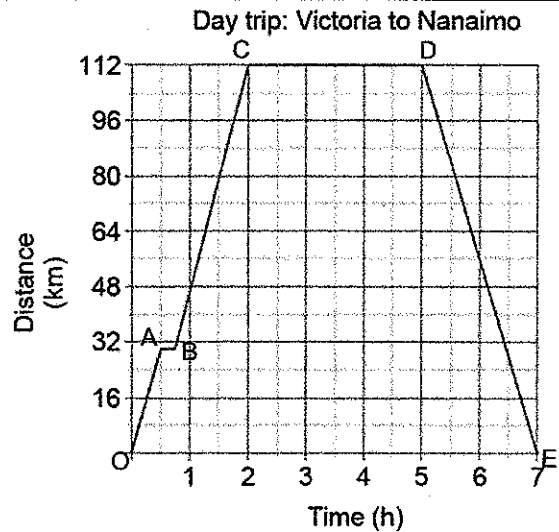
Ex3) Use the graph to answer the following questions and to describe the journey for each segment of the graph.

a) How far is it from Victoria to Nanaimo?

b) Where do you start the day trip? End it?

c) Which is the independent variable? the dependent variable?

d) Fill in the following chart:



Segment	Graph	Journey
OA	The graph goes up to the right, so as time increases, the distance from Victoria increases.	
AB	The graph is _____, so as time increases, the distance from Victoria _____.	
BC		The car travels approximately 80 km toward Nanaimo and _____.
CD		
DE	The graph goes down to the right, so as time increases, the distance _____.	The car takes 2 h to return to Victoria.

Ex4) Situation →  
graph

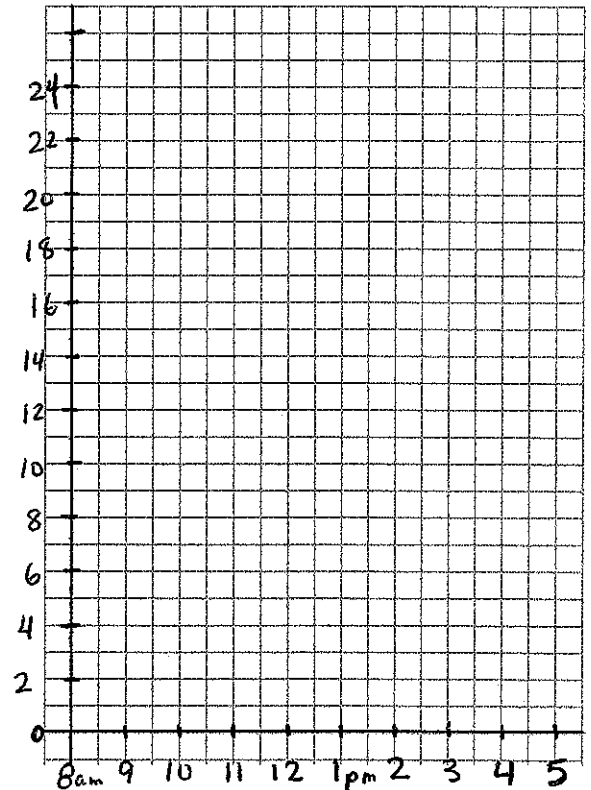
Ex4) SKETCH a graph to represent the following situation:

Our classroom has different classes in it throughout the day. Different classes prefer the room to be warmer or colder. During the first block of the day, the classroom is too cold at  $16^{\circ}\text{C}$ . We turn up the heat at 8:30 to  $20^{\circ}\text{C}$ . By lunch, the heat outside and the bodies in the room have made the classroom too hot, at  $22^{\circ}\text{C}$ . We turn the heat down to  $18^{\circ}\text{C}$ . At 4:00, the school shuts off the heat and the room returns to the same temperature it was first thing this morning.

Start your graph at 8:00am and end it at 5:00pm.

You need to include:

- ✓ Title
- ✓ Axis labels (with units)
- ✓ Smart scales (how far apart you space the #s)
- ✓ Label the segments (OA, AB, etc.)



**Reflection:** Why are the points joined on the graphs in Examples 1, 3, 4 but NOT joined in the graph in Example 2?

5.5A – Graphing Relations and Functions

Name:

Date:

**Goal:** to examine the properties of graphs of relations and graphs of functions

**Toolkit:**

- Discrete vs Continuous

**Main Ideas:**

**Definitions**

**Function** – a function has ordered pairs with different first coordinates (see VLT below)

**Domain** – the domain is the set of values of the independent variable (*x-axis*) [first element]

**Range** – the range is the set of values of the dependent variable (*y-axis*) [second element]

**Discrete** –

**Continuous** –

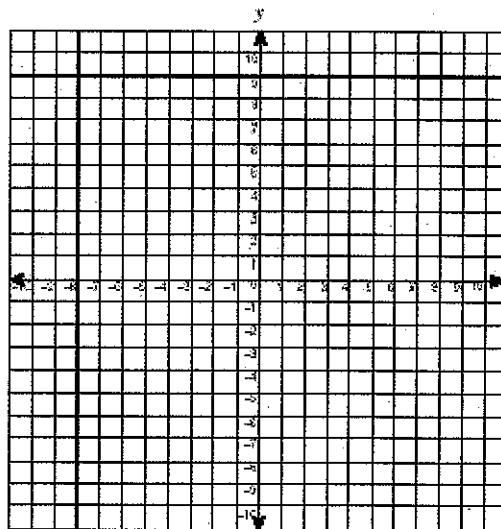
**Warm-up**

Warm-up: consider the relation that associates every natural number with its double

As a table of values:

Natural number ( <i>x</i> )	Double the number ( <i>y</i> )
1	
2	
3	
4	
5	

As a graph:



What is the domain value if the range value is 8?

As a formula:

$y =$

Functions

Is the relation in the warm-up a FUNCTION? How can we tell?

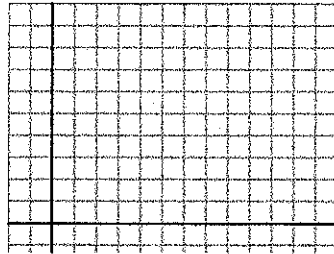
Empty rounded rectangular box for student response.

Non-functions

What if it is not a function? We can still call it a \_\_\_\_\_.

Graph the table of values

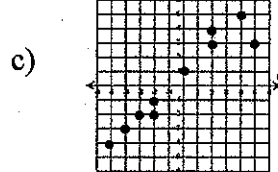
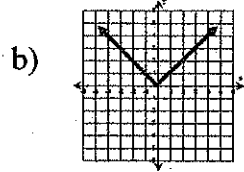
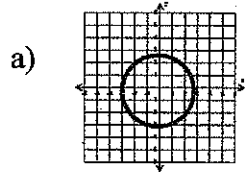
x	y
1	2
2	3
3	4
1	4
3	2



VLT:

Ex1)

Ex1) State whether each relation is a FUNCTION (yes or no) and whether it is discrete or continuous.



Function? Yes No

Function? Yes No

Function? Yes No

Discrete / Continuous

Discrete / Continuous

Discrete / Continuous

Ex2)

Ex2) EXPLAIN whether the graph for each situation should be discrete or continuous.

a) The amount of money charged to your online music account is a function of the number of songs you download.

b) The amount of water in a bathtub is a function of time passing as it is filled, emptied, etc.

**Reflection:** Return to your Frayer model from 5.2 and add anything you wish to. What are ALL the ways we have so far of recognizing a function?

5.5B – Domain and Range

Name:

Date:

**Goal:** to determine (and express mathematically) the domain and range of graphs and other relations

**Toolkit: Inequality Signs**

$>$  is

$<$  is

$\geq$  is

$\leq$  is

$<$  is Like an L for Left/Less than/Lower than

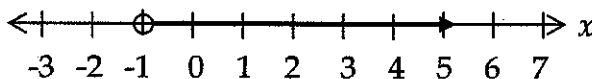
$>$  is the other one

**Main Ideas:**

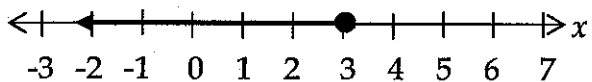
**Review**

Write an inequality that is represented by each graph.

$\circ$  = point not included ( $>$  or  $<$ )      $\bullet$  = point included ( $\geq$  or  $\leq$ )

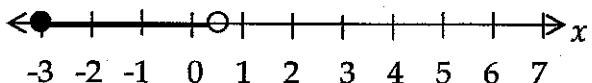


\_\_\_\_\_



\_\_\_\_\_

\*New?



\_\_\_\_\_

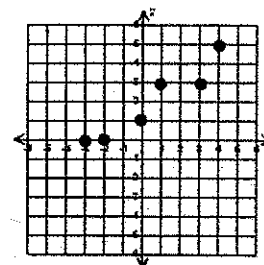
**Domain and Range**

The domain is the set of all \_\_\_ values (so we'll use the \_\_\_-axis to help us)

The range is the set of all \_\_\_ values (so we'll use the \_\_\_-axis to help us)

Ex1) State the domain and range for this relation.

**Hint:** For **discrete** graphs with only a few points, list their coordinates (ordered pairs), then list all the first coordinates (x) for the domain, and second (y) for range.



Domain:

Range:

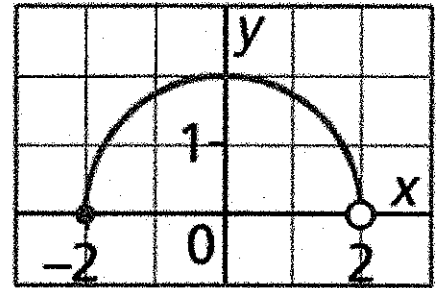
Ex2) For a **continuous** relation, we cannot describe every single  $x$ -value or  $y$ -value (there are infinitely many!).

Since we can't list ALL the domain values or ALL the range values, it helps to think about "minimum" and "maximum" values:

**Domain:**

How far **left** does the graph go? (min) \_\_\_\_\_

How far **right**? (max) \_\_\_\_\_

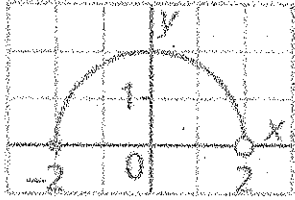
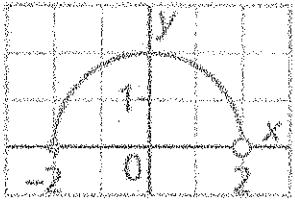


**Range:**

How far **down** does the graph go? (min) \_\_\_\_\_

How far **up**? (max) \_\_\_\_\_

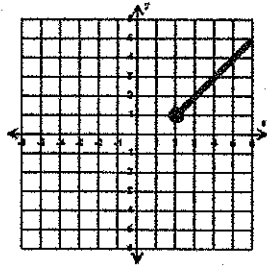
There are 4 different ways to state domain and range:

Domain	Range
<p><i>In words:</i> All real numbers between -2 and 2, including -2 but not 2.</p>	<p><i>In words:</i></p>
<p><i>Number Line:</i></p> 	<p><i>Number Line:</i></p> 
<p><i>Interval Notation:</i></p> <p style="text-align: center;"><math>[-2, 2)</math></p>	<p><i>Interval Notation:</i></p>
<p><i>Set Notation:</i></p>	<p><i>Set Notation:</i></p>

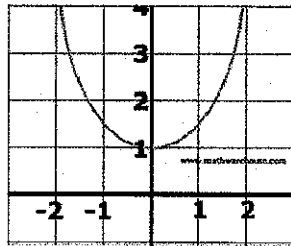


Ex3) State the domain and range for each relation

a)



b)



**Reflection:** Describe in words how you would find the domain and range of a function using its graph. You may wish to use a specific graph to help explain.

# 5.6 – Properties of Linear Relations

Name:

Date:

**Goal:** to identify and represent linear relations in different ways

### Toolkit:

- Independent Variable
- Dependent Variable
- Constant =
- Reducing fractions
- Anything you remember about linear relations!

### Main Ideas:

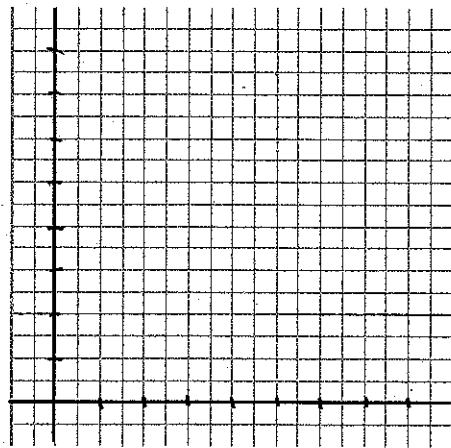
### Warm-up

Warm-up: During a certain stretch of a road trip, you set your cruise control and start a timer (at zero) and reset your trip-meter to zero. Your friend watches to see how many kilometers you've gone after 30 minutes, one hour, an hour and a half, etc. and she keeps track of it in a table.

a) Identify the independent → and dependent → variables

Time (h)	Distance (km)
0	0
0.5	45
1	90
1.5	135
2	180
2.5	225
3	270

b) Graph the data from the table



c) What do you notice about the pattern?

d) What is the rate of change?

Rate of Change = \_\_\_\_\_

For a linear relation,

Ex1) Recognizing a linear relation in table form

Ex1) Which tables of values represent linear relations? Identify the independent and dependent variables for each relation and IF LINEAR, find the rate of change.

a) Temperatures in Celsius (C) and Fahrenheit (F)

C	F
0	32
5	41
10	50
15	59

b) Number of bacteria ( $n$ ) growing on an old sandwich after  $t$  minutes

$t$	$n$
0	6
5	12
10	24
15	48
20	96

c) The amount of HST (T for tax) charged on different purchases of Amount (A)

A	T
15	1.80
30	3.60
45	5.40
60	7.20
75	9.00

d) How else could we determine whether these tables of values represent linear relations?

e) Below are the equations for each table of values. What do you notice about the equations of the *linear relations*? Relate the equation to what you know from the table of values.

a)  $F = \frac{9}{5}C + 32$

b)  $n = 6(2)^{\frac{t}{5}}$

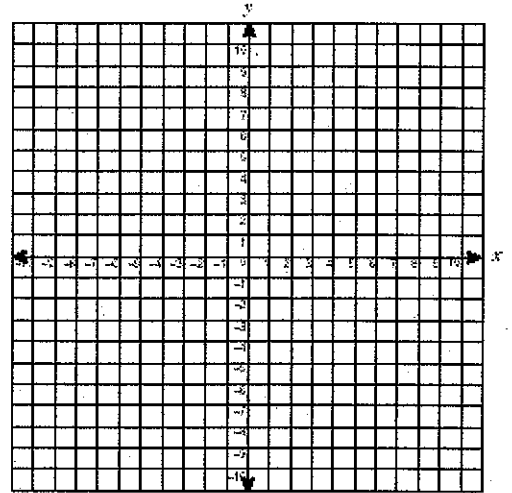
c)  $T = 0.12A + 0$

Ex2) Recognizing a linear relation in equation form

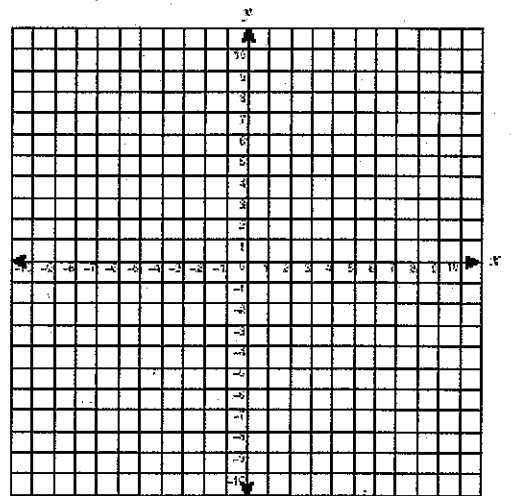
Ex2) Create a table of values for each equation, then graph it and decide whether it is a linear relation.

How many points do you NEED to tell whether a relation is linear? \_\_\_\_\_

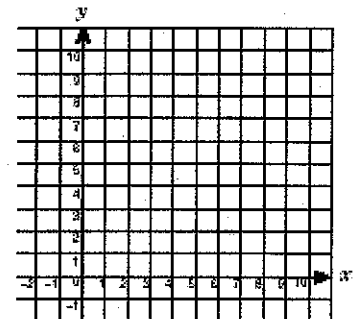
a)  $y = -2x + 8$



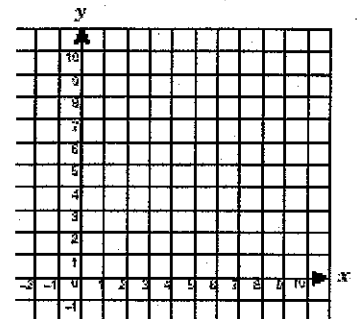
b)  $y = 3x^2 - 3$



c)  $y = 6$



d)  $x = 3$



Ex3)

Ex3) Sort the equations we have seen so far by crossing out all NON-linear relations. How can we recognize linear relations **without** graphing?

$$F = \frac{9}{5}C + 32$$

$$n = 6(2)^{\frac{t}{5}}$$

$$T = 0.12A + 0$$

$$y = -2x + 8$$

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

$$y = 6$$

$$x = 3$$

Ex4)

Ex4) A banquet hall costs \$80 to rent, and it costs \$30 per person for catering. Write an equation to represent the total cost of the banquet (C) in relation to the number of people who attend (n).

Ex5)

Ex5) Determine and explain the rate of change using the graph of the linear relation.

Step 1) Find the dependent and independent variables

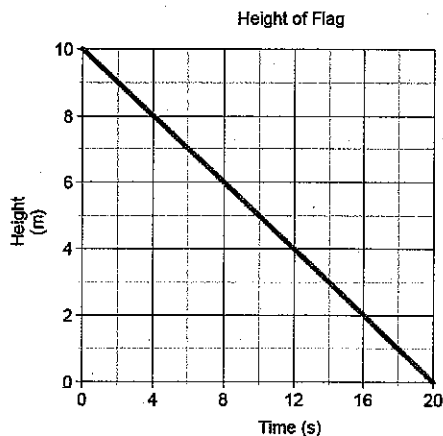
Step 2) Find two EASY TO READ points

Step 3)

Find the change in height (y, dep. var.) and the change in left/right (x, indep. var.)

$$\frac{\Delta \text{dep var}}{\Delta \text{indep var}} = \underline{\hspace{2cm}}$$

Step 4) Reduce the fraction and pay attention to units to help see what the rate represents.



**Reflection:** Compare (similarities and differences) how you find the rate of change for a table of values versus a graph.

# 5.7 – Interpreting Graphs of Linear Functions

Name:

Date:

**Goal:** to use intercepts, rate of change, domain, and range to describe the graph of a linear function.

**Toolkit:**

**Main Ideas:**

Warm-up

Warm-up: True or False? A linear relation is always a linear function.

What is a horizontal intercept?

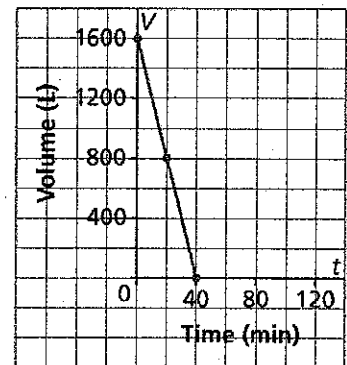
A vertical intercept?

Ex1) Determining features of a linear function's graph

Ex1) What are some of the key features of this graph?

- a) Write the coordinates of the points where the graph intersects the axes.
- b) Determine the vertical and horizontal intercepts.
- c) Describe what the points of intersection represent.
- d) What are the domain and range of this function?
- e) What is the rate of change for this function?

Emptying a Hot Tub



Ex2) Sketching a graph using function notation and intercepts

Ex2) Sketch a graph of the linear function  $f(x) = 2x - 4$

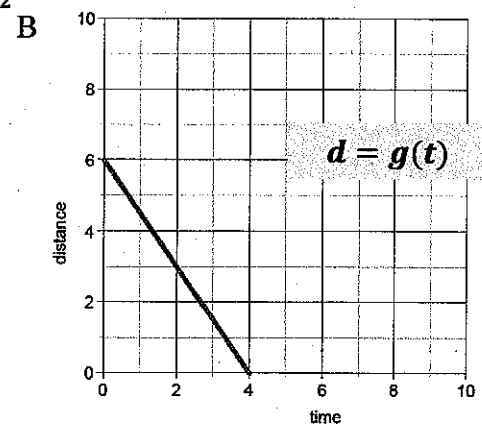
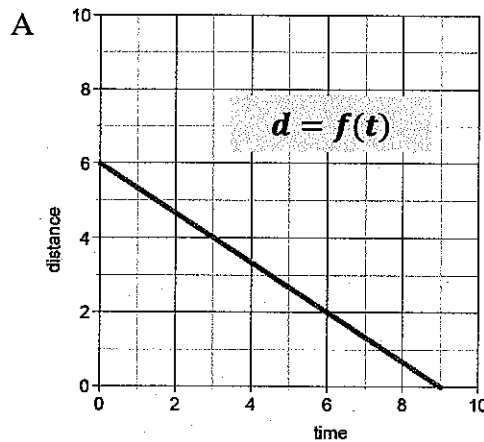
Step 1: Determine the y-intercept

Step 2: Determine the x-intercept

Step 3: Plot the intercepts and connect the dots!

*How else could we have graphed this line?*

Ex3) Which graph has a rate of change of  $\frac{-3}{2}$  and a vertical intercept of 6?



- a) Using the correct graph, what is the distance when time is 2?
- b) Using the correct graph, what is the time is it when the distance is 1?

**Reflection:** Describe how you can tell from a graph whether a linear function has a positive or negative rate of change.