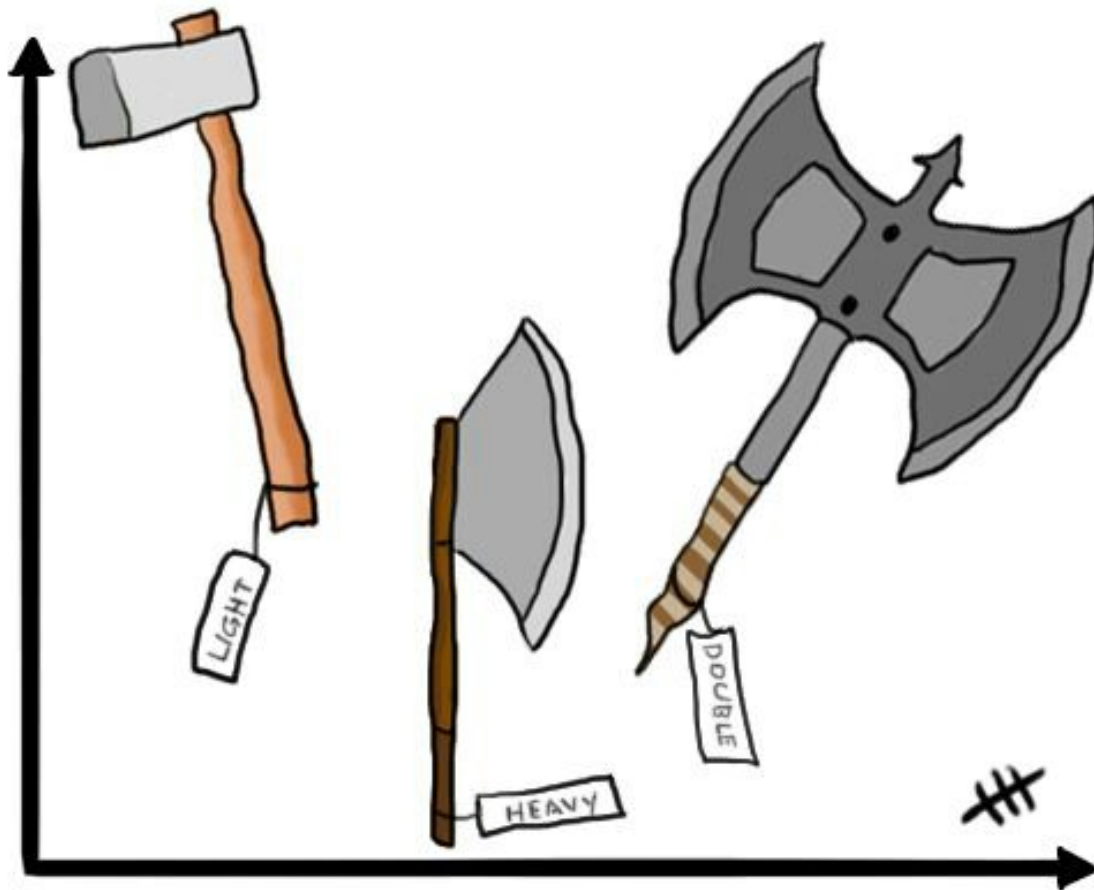# Chapter 6 Booklet
Linear Relations

Always label your axes

Name: _____

Due Date: _____

MATH 9 – LINEAR RELATIONS
REGULAR ASSESSMENT RECORD

Name: _____   Class: _____

Category	Topic	Due Date	Mark
6.1	**_Representing Patterns_**		
	Pg. 217/218 Q. 4, 6, 7, 9, 10, 12		
	Pg. 219 Q. 14, 15, 16, 17		
6.2	**_Interpreting Graphs_**		
	Pg. 226/227 Q. 2, 4, 6, 7, 8, 10		
	Pg. 228/229 Q. 12, 13, 15, 16, 18		
6.3	**_Graphing Linear Relations_**		
	Pg. 239/240 Q. 5, 6, 7, 9, 10, 11		
	Pg. 241/242 Q. 12, 14, 16, 17, 19, 20		
Review	Pg. 244 Q. 1 – 14		

At the end of this unit you will be assessed on the following:

☐ 1. I can generalize a pattern from a problem.

☐ 2. I can tell whether a pattern is linear or non linear.

☐ 3. I can write an expression for a linear equation
- Represented by an oral pattern
- Represented by a pictorial pattern
- Represented by a written pattern

☐ 4. I can verify a linear equation by substitution (plug in).

☐ 5. I can graph a linear equation
- For oblique (slanted) lines
- For horizontal lines
- For vertical lines

☐ 6. I can analyze a graph with respect to changes in the variables.

☐ 7. I can interpolate (inside) and extrapolate (extend) values of a variable from a graph.

☐ 8. I can match given equations with their corresponding graphs.

6.1 Representing Patterns

Linear Relation - a relation that appears as a straight line when graphed

Linear Equation - an equation whose graph is a straight line

Example 1: Describe a Pictorial Pattern Using a Linear Equation

Figure 1   Figure 2   Figure 3   Figure 4
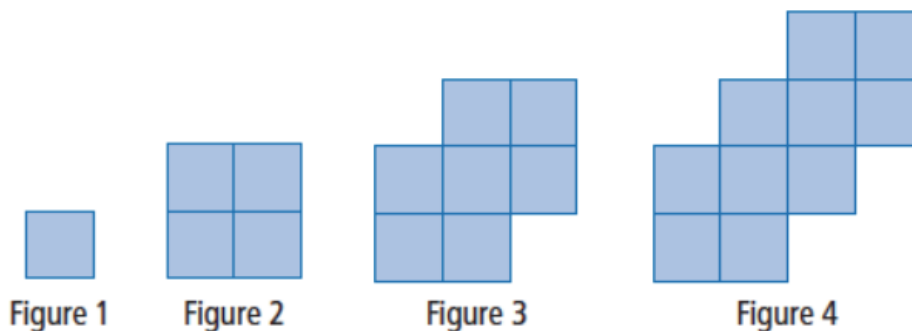
a) Describe the pattern.
b) Create a table of values to represent the linear relation between the number of squares and the figure number for the first four figures.
c) Write a linear equation to represent this pattern.
d) How many squares are in Figure 12?
e) Which figure number has 106 squares? Verify your answer.

Example 2: Describe a Written Pattern Using a Linear Equation

A bead design for a necklace has an arc shape:
• Row 1 has seven red beads.
• Row 2 has five additional beads and all the beads are green.
• Row 3 has five additional beads and all the beads are blue.
• The pattern repeats. Five beads are added to each successive row.

a) Draw the pattern for the first four rows.
b) Make a table of values showing the number of beads in relation to the row number.
c) What equation shows the pattern between the row number and the number of beads in the row?
d) How many beads are in Row 4? Explain how to check your answer.
e) How many beads are in Row 38?
f) If the bead pattern were continued, which row number would have 92 beads? How did you determine the answer?

Try Question:

a) Write an equation to represent the number of circles in relation to the figure number.

Figure 1   Figure 2   Figure 3   Figure 4
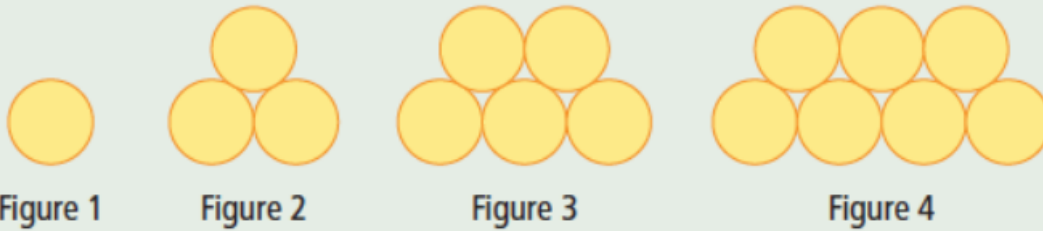
b) How many circles are in Figure 71? Explain how you determined the answer.

c) Which figure number has 83 circles? How did you arrive at your answer?

Key Ideas:
1) Many pictorial and written patterns can be represented using a table of
2) values or a linear equation.
3) Linear equations can be verified by substituting values.

6.1 Questions Page 216 - 219   DUE: _____

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Page 217 #7	Page 218 #9
Page 218 #10	Page 218 #12
Page 219 #14	Page 219 #15

6.2 Interpreting Graphs

Interpolate: Estimate a value between two given values (within the graph)
- used only when it makes sense to connect the dots

Extrapolate: Estimate a value beyond a given set of values
(past the end of the graph).
- used only when it makes sense to extend the graph

Example 1)

A weather balloon records the air temperature at different altitudes
The data approximately represents a linear relationship

Altitude (m)	Temperature (°C)
350	11.4
750	5.7
1000	2.1
1500	-5.0
1800	-10.0

Altitude (m)	Temperature (°C)
350	11.4
750	5.7
1000	2.1
1500	-5.0
1800	-10.0
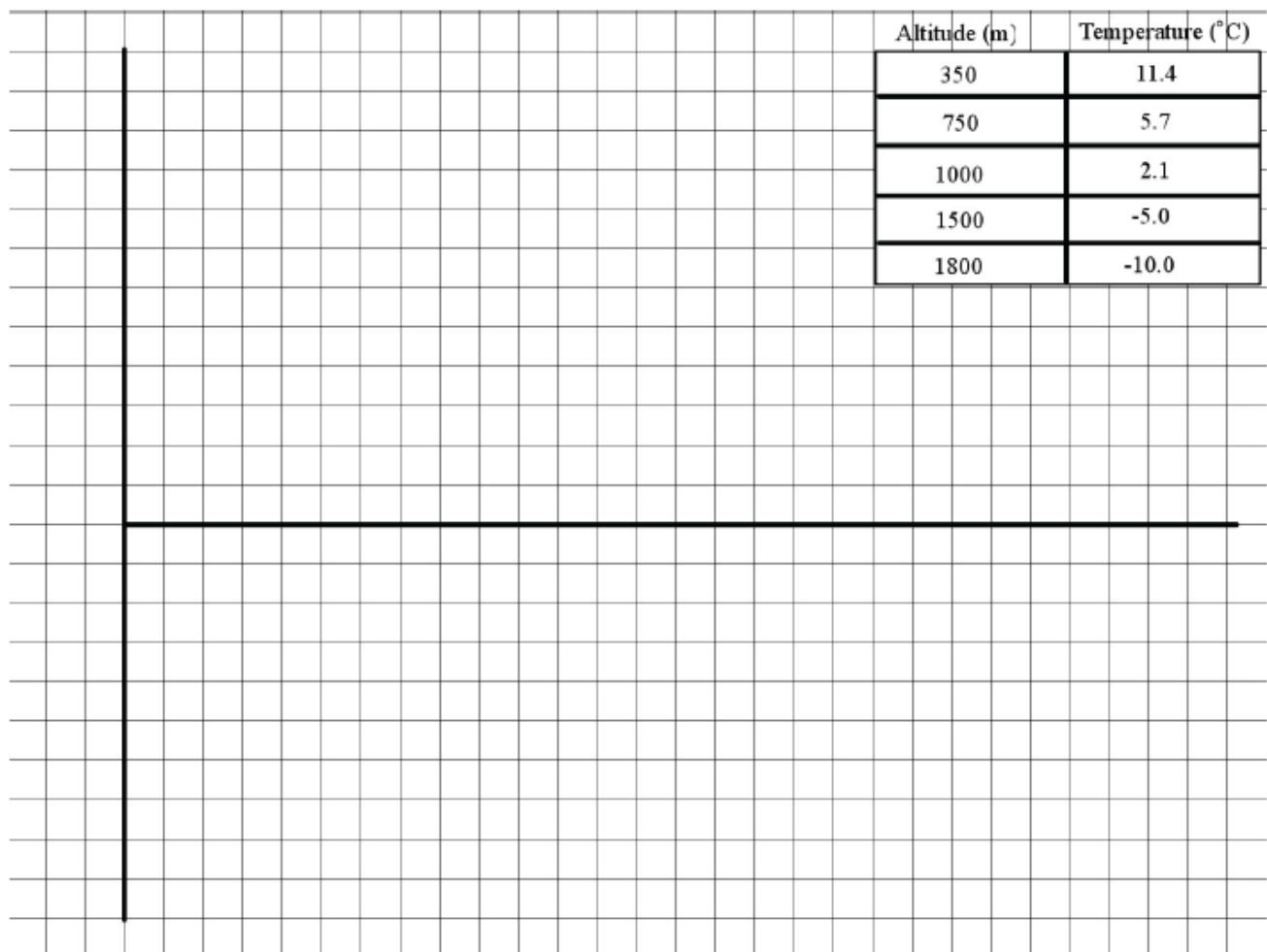
Can we interpolate this data?
- if the data is continuous, we may interpolate
- if the data is discrete, we cannot interpolate

e.g. predict the temperature when the altitude is 400 m

e.g. predict the altitude when the temperature is 0°C

Can we extrapolate this data?
- if we can logically extend the relationships, we may extrapolate
- if the relationship can't be extended, we cannot extrapolate

e.g. predict the temperature when the altitude is 100 m

e.g. predict the altitude when the temperature is -15°C

This graph shows a plane's altitude as it lands. The relationship between altitude and time is approximately linear.

a) What was the plane's approximate altitude at 50 s?

b) At what time was the plane's altitude approximately 11 km?

c) Is it appropriate to join the points with a straight line? Explain.

Airplane Altitude

Altitude (km) / Time (s)
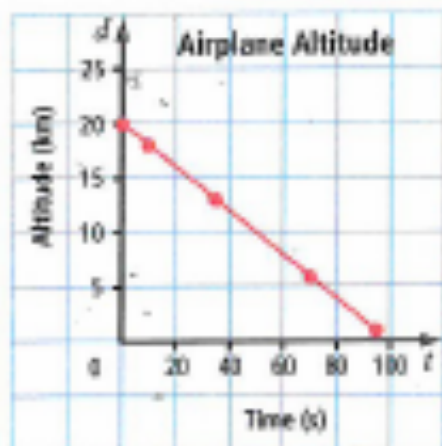
The value of a computer decreases over time. The graph shows the value of a computer after it was bought.

a) After what approximate period of time does the computer have no value?

b) When was the computer worth approximately $200?

c) Is it appropriate to join the points with a straight line? Explain.

Value of a Computer

Value ($) / Time (years)
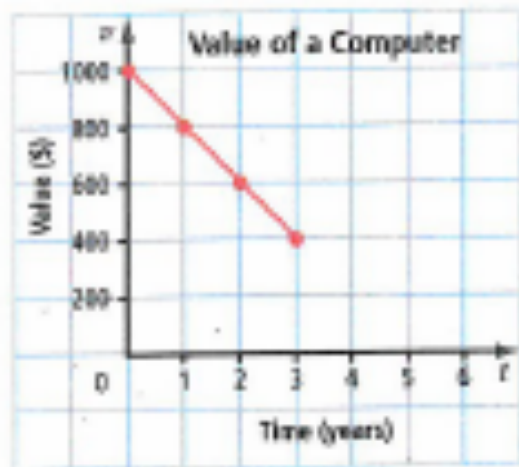
Key Ideas:

1) On a graph, you can use a line to interpolate values between known values.

2) On a graph you can extend a line to extrapolate values beyond known values. Use a dashed line to extend the line.

3) Interpolation and extrapolation should be used only when it is reasonable to have values between or beyond values on the graph. (ex: no decimal people).

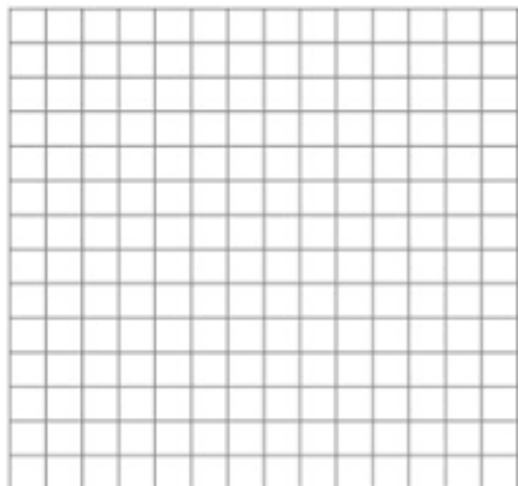| Page 226, #2	Page 226, #4
Page 227, #6	Page 227, #7
Page 227, #8	Page 227, #10

Page 228, #12
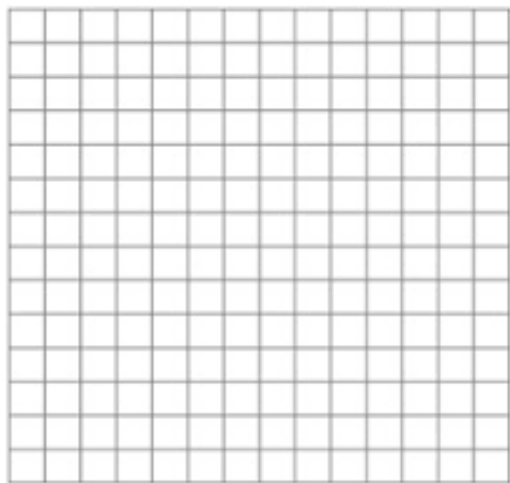
Page 228, #13

Page 228, #15

Page 229, #16

Page 229, #18

6.3 Graphing Linear Relations (Graph paper needed)

The picture of a linear equation is called a **linear relation**.

To graph a linear relation:

1) Make a table of values from the equation.
2) Plot the points from your table on the graph
3) Decide if it makes sense to join the points
4) Use your graph to interpolate or extrapolate. Verify with the linear equation.

Example 1: Graph a Linear Equation

The world's largest cruise ship, *Freedom of the Seas*, uses fuel at a rate of 12 800 kg/h. The fuel consumption, f, in kilograms, can be modelled using the equation $f = 12\ 800t$, where t is the number of hours travelled.
a) Create a graph to represent the linear relation for the first 7 h.
b) Approximately how much fuel is used in 11 h? Verify your solution.
c) How long can the ship travel if it has approximately 122 000 kg of fuel? Verify your solution.

a)

Time in hours	Fuel in kg

Graphing Skills:
1) All graphs need a title.
2) You must label both axes of the graph
3) Think carefully about what scale you should use on your graph.

Cruise Ship Fuel Consumption
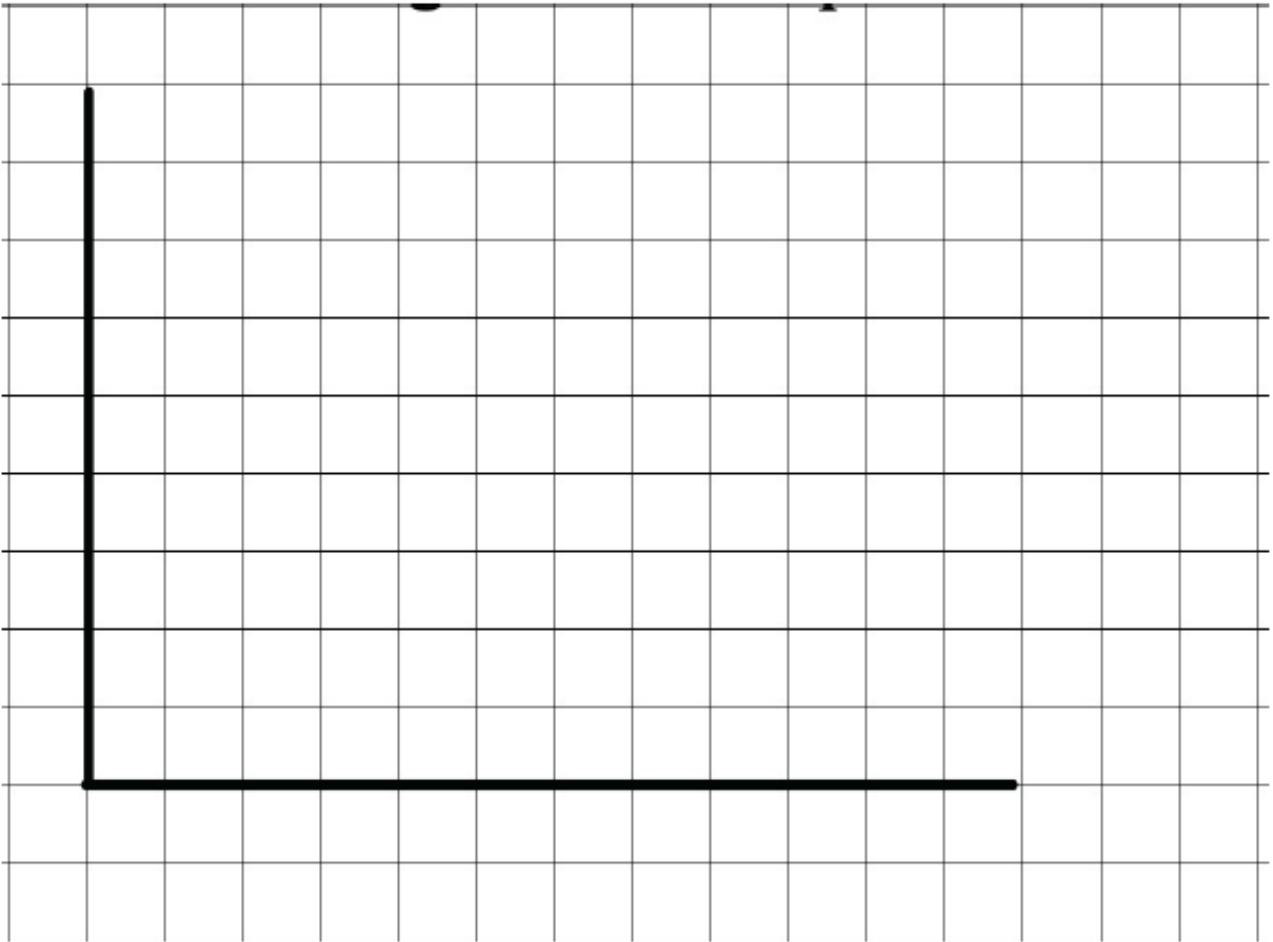
b)

c)

To determine the linear equation from the graph:
1) make a table of values
2) follow the same process as in 6.1
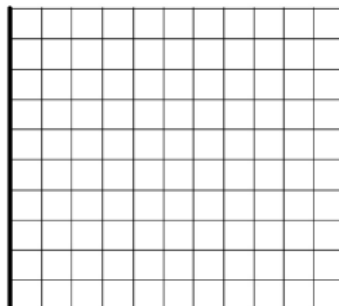
Example 2:

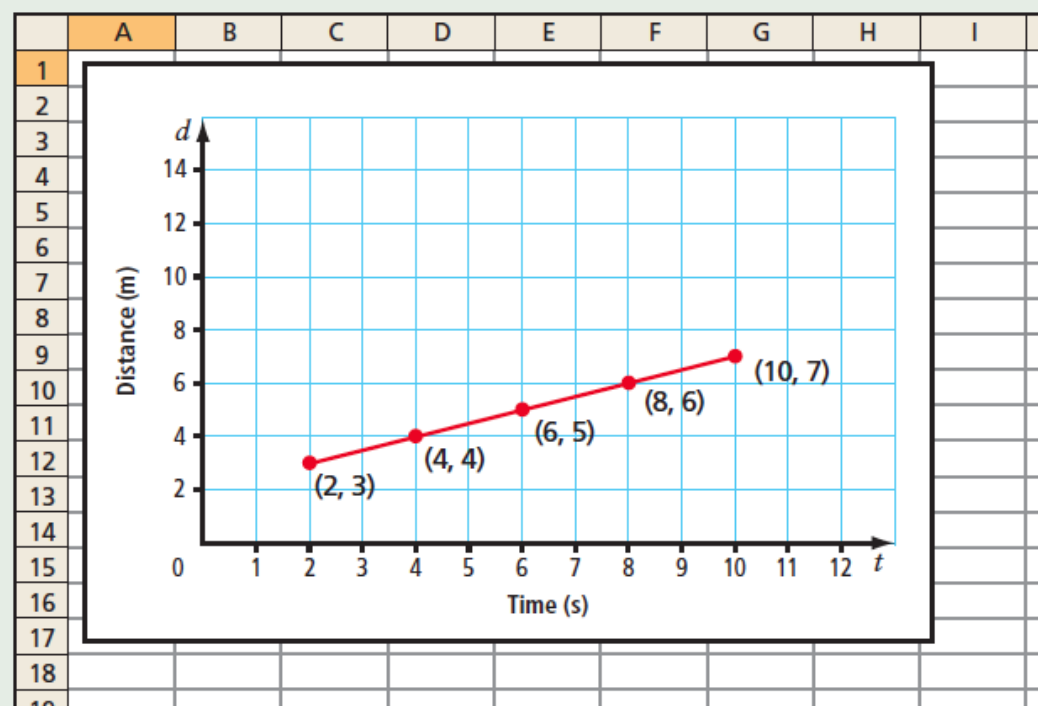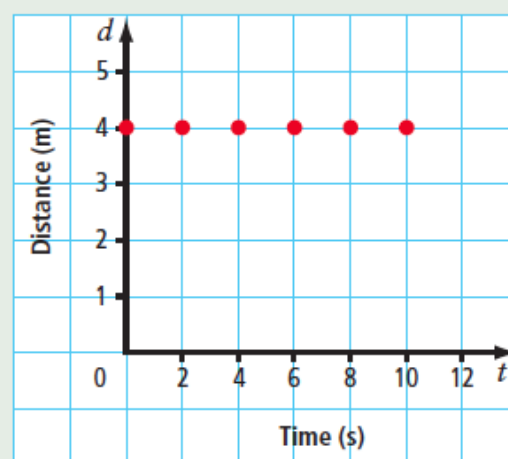Determining a linear equation from a grap
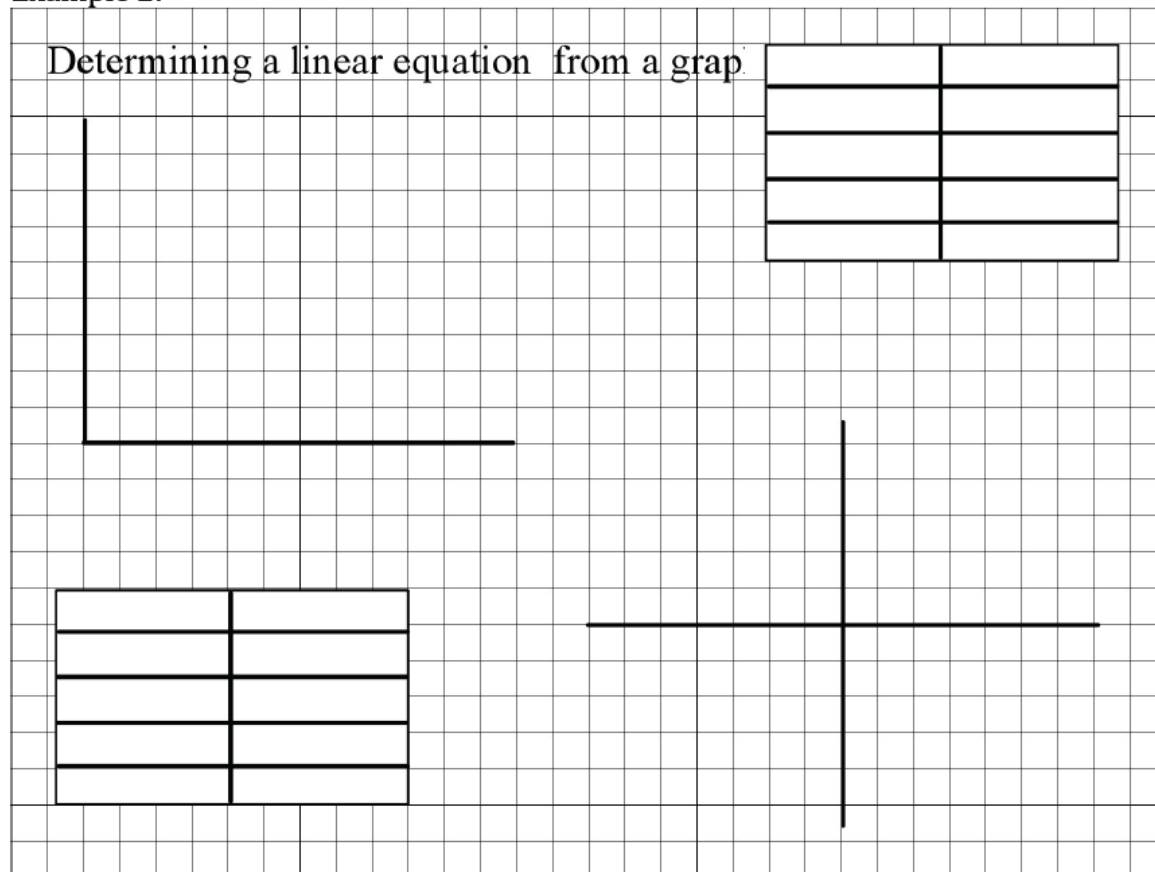
Horizontal Lines:
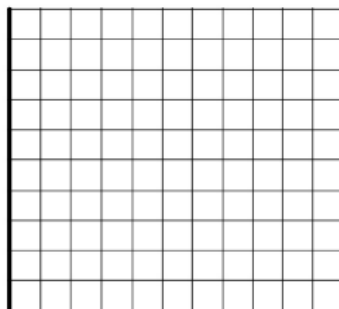
Vertical Lines:

Identify the linear equation that represents the graph.

a) Write the linear equation that represents the graph.
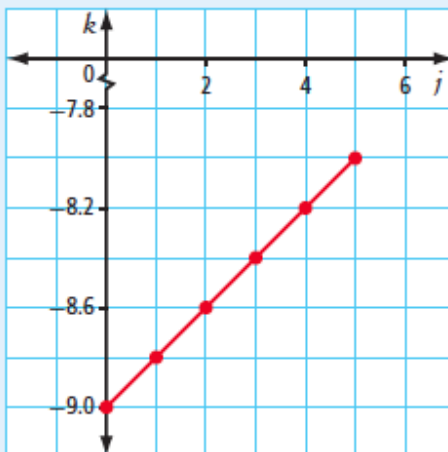
b) Explain how you know the graph matches the equation.

Key Ideas

- You can graph a linear relation represented by an equation.
  - Use the equation to make a table of values.
  - Graph using the coordinate pairs in the table. The graph of a linear relation forms a straight line.

$$k = \frac{j}{5} - 9$$

j	k
0	−9.0
1	−8.8
2	−8.6
3	−8.4
4	−8.2
5	−8.0

- The graph of a linear relation can form a horizontal or a vertical line.
- You can use graphs to solve problems by interpolating or extrapolating values.

Questions Page 238-243   DUE:_____

Page 239, #5	Page 239, #6
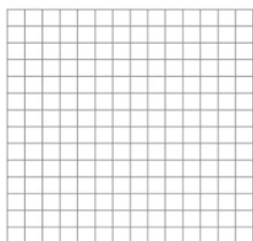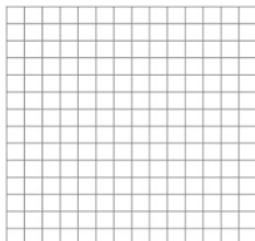
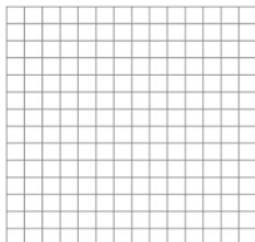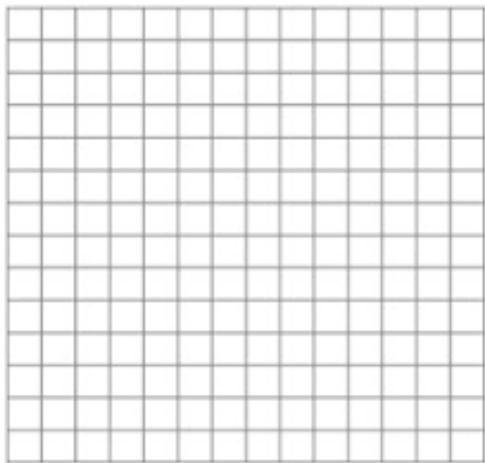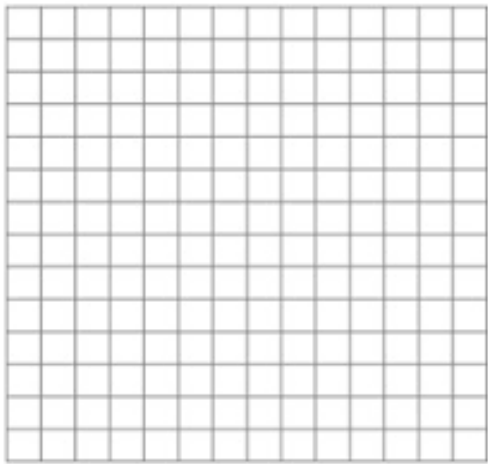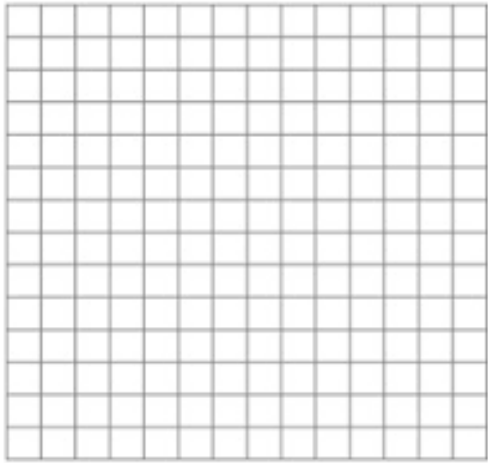|	
Page 240, #7 A b C	Page 240, #9
Page 240, #10	Page 240, #11
Page 241, #12 A b C d	Page 241, #14
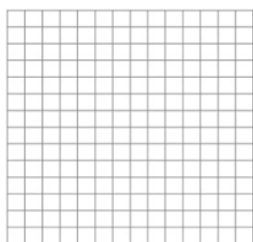
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Page 242, #17
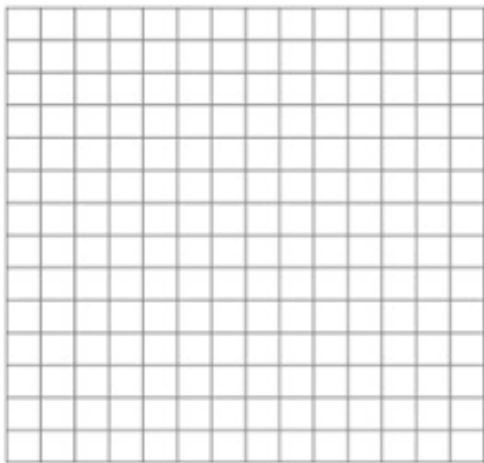
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Review Page 244-245   DUE:_____

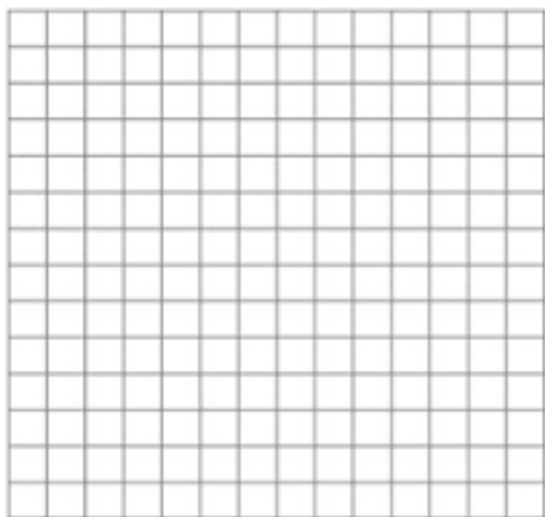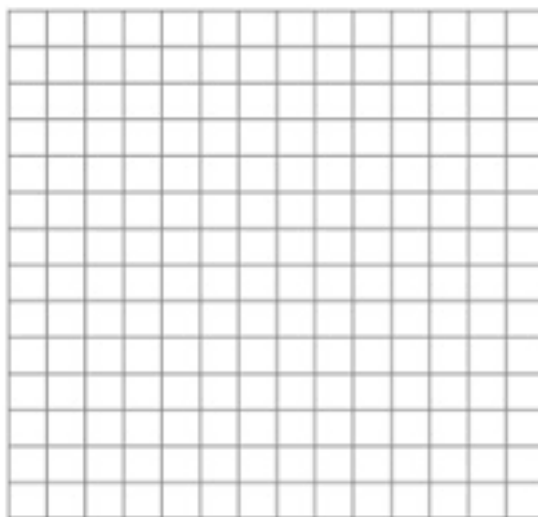| Page 244, #1-5	Page 244, #6
Page 244, #7	Page 244, #8
Page 244, #9	Page 245, #10

Page 245, #11

Page 245, #12

Page 245, #13

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