

Assignment: Modelling Relations

Name Key Date _____
Total: _____/50

Multiple Choice: Place the correct letter to the left of the question that best answers the question or completes the statement. [5 marks]

- d 1. The slope of a line can be described as...
- a) rise over run
 - b) rate of change
 - c) change in y compared to change in x
 - d) all the above

- b 2. Consider the relation $y = -2x + 6$. Which of the following statements about the graph of this relation is **not** true?
- a) The y-intercept is 6
 - b) The slope is 2
 - c) For a rise of 2, the run is -1.
 - d) The graph crosses the y-axis at (0,6)

- c 3. Consider the following equations. Which are non-linear relations?
- (i) $y = 4x$ (ii) $y = 5 - 8x$ (iii) $y = 2x^2 + 1$ (iv) $y = \frac{5}{4}x - 2$ (v) $5x^2 + 2y^2 = 10$
- a) (i) and (iii)
 - b. (ii) and (v)
 - c. (iii) and (v)
 - d. (iv) and (v)

- d 4. Charlotte orders an Uber car that charges a flat fee of \$20 and \$0.50 for each kilometer driven. Which equation best represents the cost of Charlotte's trip C , in dollars, where n is the number of kilometres?
- a) $C = 20.50n$
 - b. $C = 20(0.50n)$
 - c. $C = 20n + 0.50$
 - d. $C = 0.50n + 20$

- a 5. Alex's distance from home is represented by the equation $D = -0.5t + 300$, where D represents his distance from home, in kilometres, and t represents time, in minutes. How long will it take Alex to reach a distance of 182 km from home?
- 182 = -0.5t + 300
0.5t = 300 - 182
0.5t = 118
t = 236
- a) 236 min
 - b. 209 min
 - c. 64 min
 - d. 59 min

- 16 6. For each situation determine:
- a) Whether it is a partial or direct variation
 - b) Write an equation relating the two variables.

i) The cost to mow the lawn is a flat fee of \$10, plus \$5/h.

PARTIAL

$$C = 5t + 10$$

let C rep cost
let t rep time

ii) Volume of water drips from a tap at a rate of 0.3mL / min

DIRECT

$$V = 0.3t$$

let V rep volume
let t rep. time

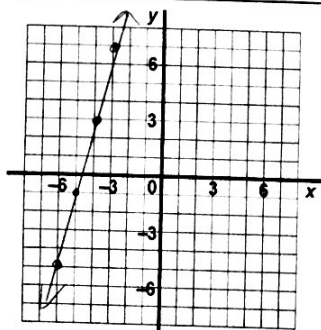
iii) The gas tank of a van holds 75 litres. The van uses 0.125L/km.

PARTIAL

$$V = 75 - 0.125d$$

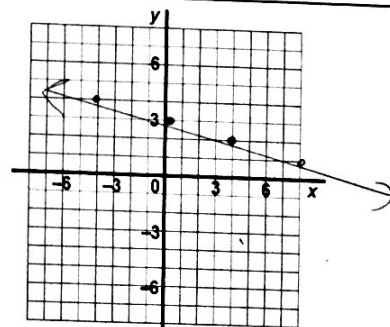
let V rep volume
let d rep. distance

- 14 7. Draw the lines described in each case. Show three coordinates on the line.



a) slope = 4 ; start at (-6,-5)

$$m = \frac{4}{1} \text{ so RISE} = 4 \\ \text{RUN} = 1$$

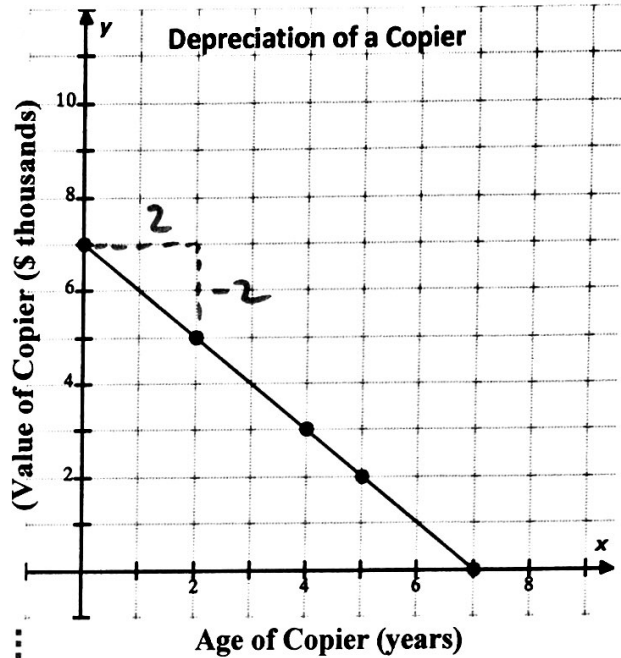
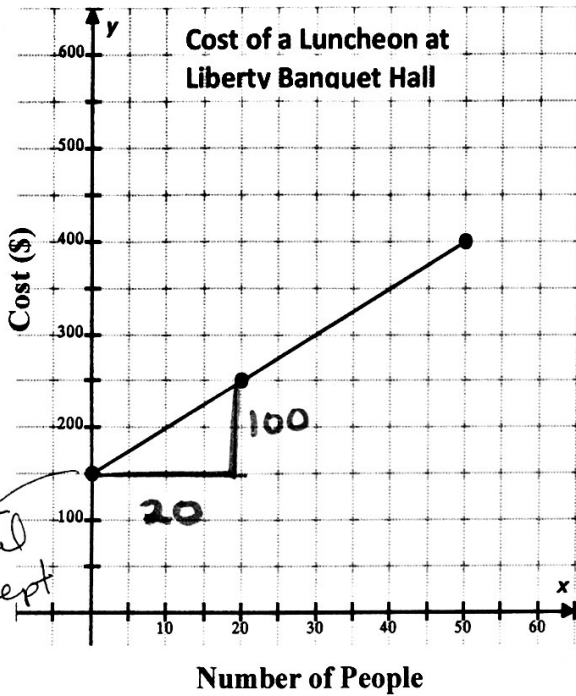


b) $y = -\frac{1}{4}x + 3$ $m = -\frac{1}{4}$, $b = 3$

$$\text{RISE} = -1 \\ \text{RUN} = 4$$

8. Consider the following two relations.

- For each graph determine the slope and y-intercept (initial value).
- Use the title and axes of each graph to tell you what the y-intercept and slope mean in each case.
- Write an equation that represents each relation. Remember to refer to the scale.



 /8 Slope: $m = \frac{100}{20} = 5$ vertical-intercept: 150 Slope: $m = -1$ y-intercept: 7

Equation: $y = 5x + 150$ Equation: $y = -x + 7$

Meaning of slope and vertical-intercept:

Meaning of slope and y-intercept:

For every additional person, it will cost \$5.

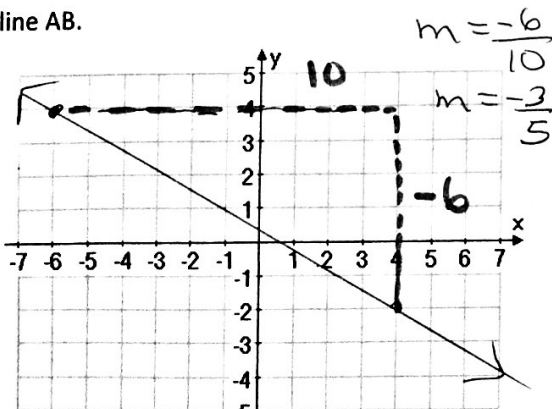
The value of the copier decreases by \$1000/YR.

Fixed cost of luncheon is \$150

The initial value of copier is \$7000.

9. Plot the following points A (-6, 4) and B (4, -2) on the coordinate plane. Determine the slope of line AB.

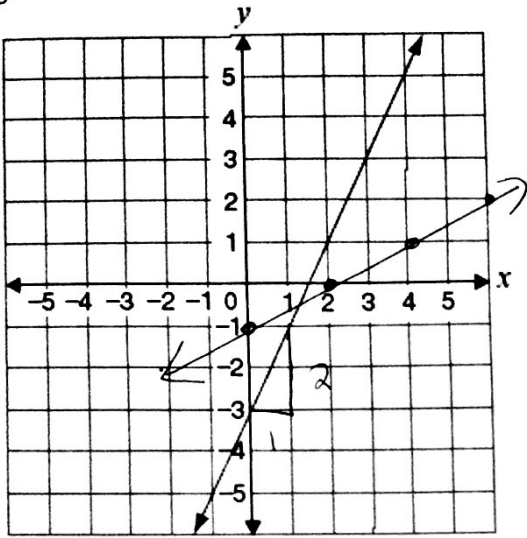
10. Determine the slope of the line that passes through the pair of points (29, -10) and (20, 26).



$$\begin{aligned}
 m &= \frac{y_2 - y_1}{x_2 - x_1} \\
 &= \frac{26 - (-10)}{20 - 29} \\
 &= \frac{36}{-9} \\
 &= -4
 \end{aligned}$$

11. Consider the graph below.

Miranda drew another line. The y-intercept of Miranda's line is two more than the y-intercept of the given line. The slope of the given line is four times the slope of Miranda's line. Construct her line on the same grid provided.



$$m = 2 \text{ (given line)}$$

$$\text{Miranda line : } m = 2 \div 4 = \frac{1}{2}$$

y-intercept is 2 more than -3
thus $b = -1$

12. Alvin Seville likes to take long hot showers that leave other chipmunks waiting. They decided to study the amount of water he is using. Consider the data they collected.

a) Is this a linear relation? Justify your reasoning.



T (min)	V (L)
0	0
2	45
8	180
12	270

Direct variation :
Ratio of volume to time produces a constant value.

b) What is the rate of water flow in the shower?

$$m = \frac{45}{2} = 22.5$$

Rate is 22.5 L / min

c) Write an algebraic model that describes this situation.

$$V = 22.5t$$

d) Use your algebraic model (equation) to determine the amount of water Alvin uses while singing in the shower for 27 minutes.

$$V = 22.5(27) = 607.5 \text{ L of water}$$

13. There are three steps from the ground to a front porch 72 cm above the ground, as shown.

a. What is the rise of each step?

$$\frac{72 \text{ cm}}{4 \text{ steps}} = 18 \text{ cm / step}$$

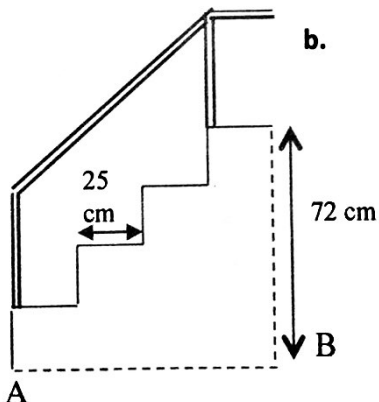
b. The horizontal distance across each step is 25 cm. Determine the length of AB.

$$AB = 25 \times 4 = 100 \text{ cm}$$

c. Determine the slope of the handrail.

$$m = \frac{54}{75}$$

$$m = \frac{18}{25}$$



14. Ollie, Ms. Barsby's Boxer pup, found a worksheet in her binder containing a table of values representing a linear relation. After drooling all over it two of the y values are hidden behind Ollie's drool. Determine the hidden y values. Show your work.


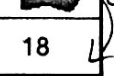
_ /4

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

$$= \frac{+18 - (-6)}{1 - (-2)}$$

$$= \frac{24}{3} = 8$$

Each y -value increases by 8 as x increases by 1
 At $x = -1$, $y = -6 + 8 = 2$
 At $x = 0$, $y = 2 + 8 = 10$

x	y
-2	-6
-1	
0	
1	18

+8
+8
+8

15. Rachel plants trees in Northern Ontario. She is paid \$55 a day plus 15¢ for each tree she plants.

- a. On the grid provided, draw the graph of the relationship between Rachael's total earnings for a single day, E , in dollars, and the number of trees she plants that day, n . Include a scale on the vertical axis.

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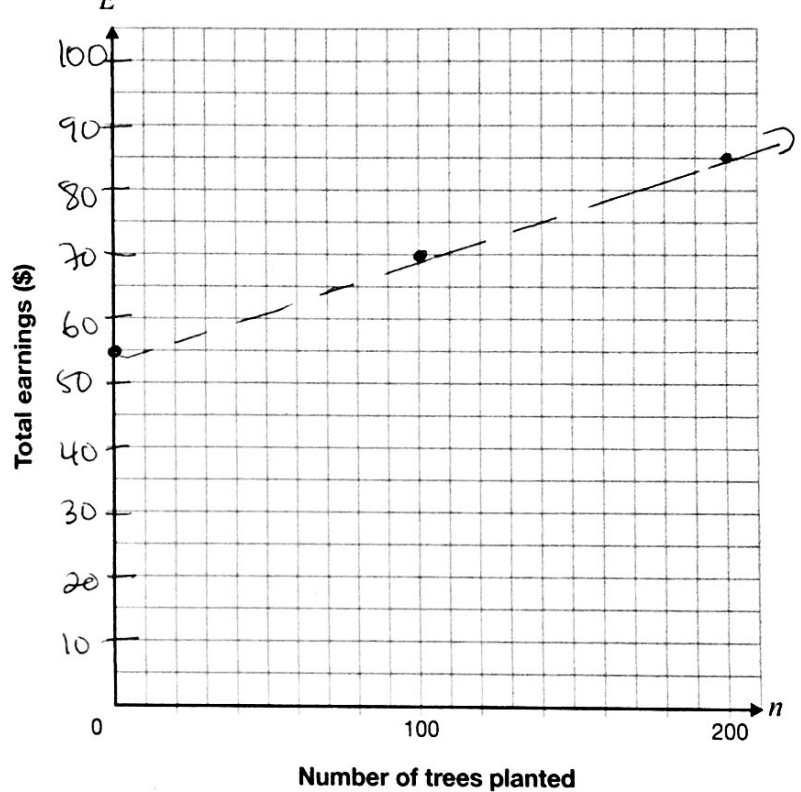
n	E
0	55
100	70
200	85



- b. Write an equation to represent the relationship between Rachel's earnings.

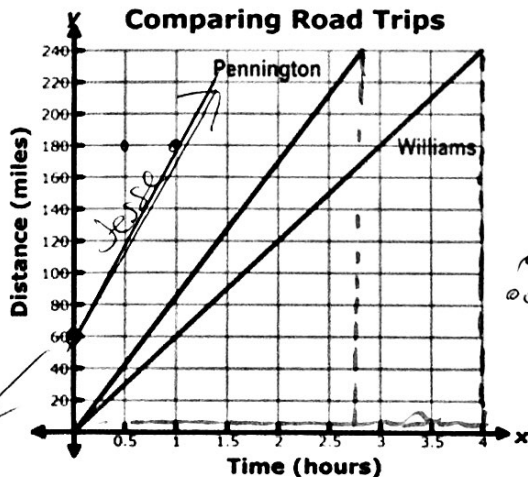
$$E = 0.15n + 55$$

Total Earnings vs. Number of Trees Planted



16. Williams and Pennington are both travelling to the same place. A graph comparing the distance travelled and the time it took is shown below.

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Starts at 60 miles

- a) Which friend is travelling faster? How can you tell? Justify your answer.

Pennington: $m = \frac{240}{2.75} \approx 87 \text{ miles/hr}$

Williams: $m = \frac{240}{4} = 60 \text{ miles/hr}$

Pennington's speed was faster

- b) A third friend named Jesse is also taking this trip. If Jesse travels twice as fast as Williams and started 60 miles ahead of the other two travellers add a line representing Jesse's trip to the graph. Label it.

Jesse: $m = 60 \times 2 = 120$
 speed is 120 miles/hr