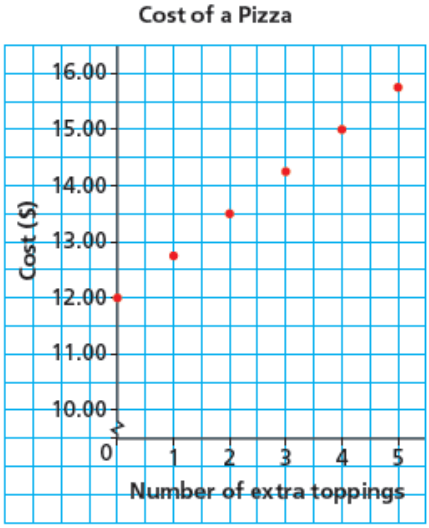
5.6 Properties of Linear Relations

LESSON FOCUS Identify and represent linear relations in different ways.

Make Connections

The table of values and graph show the cost of a pizza with up to 5 extra toppings.

Number of Extra Toppings	Cost ($)
0	12.00
1	12.75
2	13.50
3	14.25
4	15.00
5	15.75



12 A B C D E

B

2. b) D: $-4 < x \leq 0$

R: $-1 < y \leq 8$

4. a) 35

b) $x = 4$

c) 1)

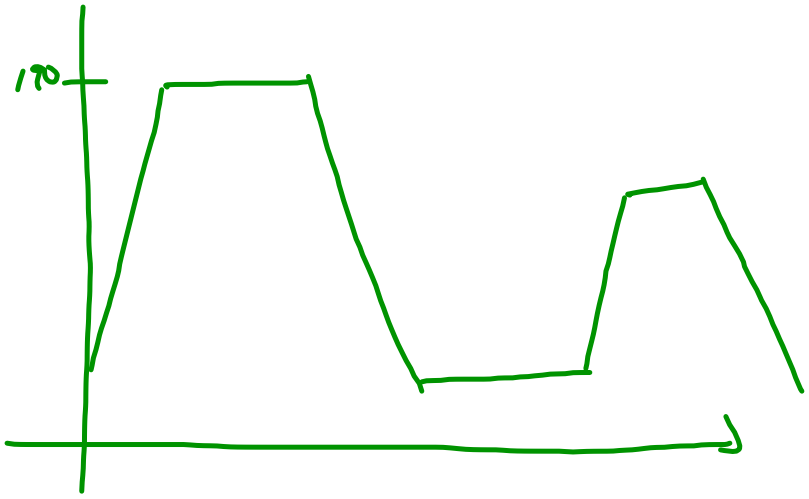
BEDMAS?

$g(5) = 2(5)^2 - (5 \times 3)$

$= 50 - 5 \times 3$

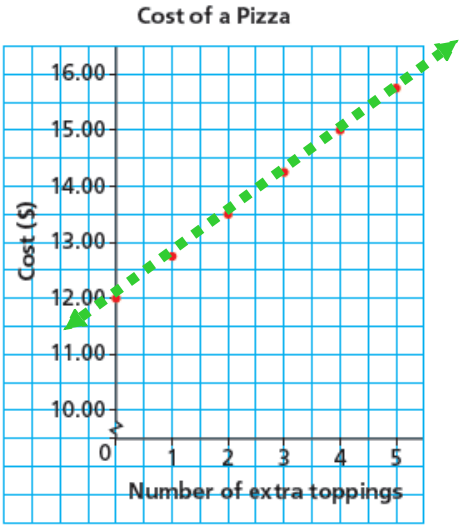
$= 40$

5.



Number of Extra Toppings	Cost ($)
0	12.00
1	12.75
2	13.50
3	14.25
4	15.00
5	15.75

+1, +0.75 for each row



What patterns do you see in the table?

Write a rule for the pattern that relates the cost of a pizza to the number of its toppings.

How are the patterns in the table shown in the graph?

How can you tell from the table that the graph represents a linear relation?

5.6 Properties of Linear Relations

Equations

$y = 7 - x^2$

$y = 3x + 7$

Linear

$F(x) = 7 - x^2$

Non-Linear

$g(x) = 2x + 4$

$y = 2x + 4$

Linear

$w = \frac{7}{x} + 8$

$w = 7x^{-1} + 8$

Non-linear

EXERCISE...

Which table of values represents a linear relation? Justify your answer.

a) The relation between the number of bacteria in a culture, n, and time, t minutes.

t	n
0	1
20	2
40	4
60	8
80	16
100	32

Non-Linear

b) The relation between the amount of goods and services tax charged, T dollars, and the amount of the purchase, A dollars

A	T	
60	3	3
120	6	3
180	9	3
240	12	3
300	15	

Linear

Here is another example of a linear relation...

The cost for a car rental is $60, plus $20 for every 100 km driven.
The independent variable is the distance driven and the dependent variable is the cost.
We can identify that this is a linear relation in different ways.

- a table of values

Independent variable →

Distance (km)	Cost ($)
0	60
100	80
200	100
300	120
400	140

← Dependent variable

+100, +100, +100, +100 (Distance)
+20, +20, +20, +20 (Cost)

For a linear relation, a constant change in the independent variable results in a constant change in the dependent variable.

5.6 Properties of Linear Relations

How to identify a linear relation...

- a set of ordered pairs

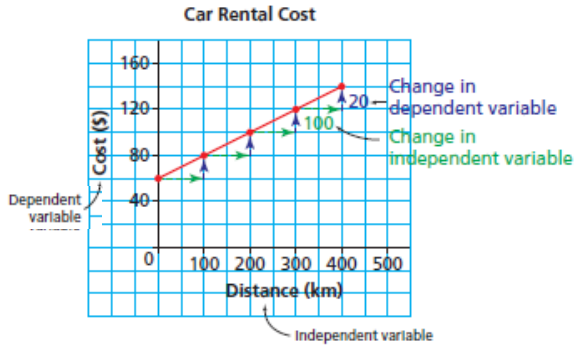
+100 +100 +100 +100

{(0, 60), (100, 80), (200, 100), (300, 120), (400, 140)}

+20 +20 +20 +20

Why is it important that the ordered pairs are listed so their first elements are in numerical order?

- a graph



The graph of a linear relation is a straight line.

We can use each representation to calculate the **rate of change**.

The rate of change can be expressed as a fraction:

$$\frac{\text{change in dependent variable}}{\text{change in independent variable}} = \frac{\$20}{100 \text{ km}}$$

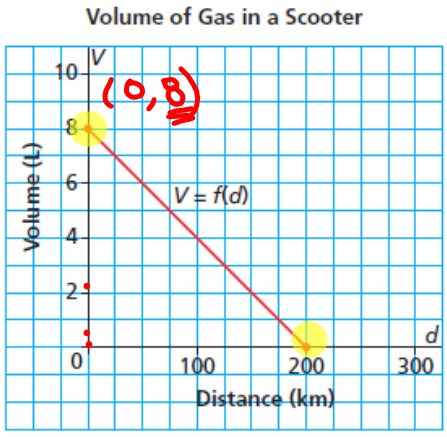
$$= \$0.20/\text{km}$$

5.6 Properties of Linear Relations

$$\text{Rate of Change (ROC)} = \frac{\text{change in dependent variable}}{\text{change in independent variable}}$$

EXERCISE...

This graph shows the fuel consumption of a scooter with a full tank of gas at the beginning of a journey.



Vert. Int = 8
=> Amount of fuel the tank will hold

Hor. Int: = 200
(200, 0) How far he could go before running out of gas.

a) Write the coordinates of the points where the graph intersects the axes. Determine the vertical and horizontal intercepts. Describe what the points of intersection represent.

b) What are the domain and range of this function?

c) Determine the rate of change

(b) D: $0 \leq x \leq 200$

R: $0 \leq y \leq 8$

c) $ROC = \frac{\Delta Ind.}{\Delta Dep.} = \frac{-8\,L}{200\,km} = -0.04\,L/km$

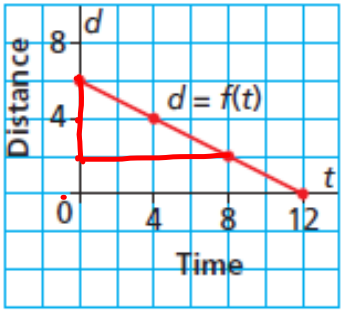
26 L/100 km

7.5 L/100 km

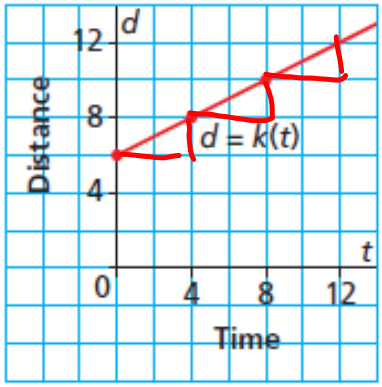
YOUR TURN...

Which graph has a rate of change of $\frac{1}{2}$ and a vertical intercept of 6? Justify the answer.

a)



b)



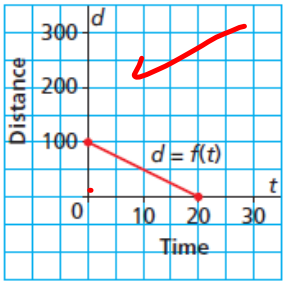
ROC = $\frac{1}{2}$

ROC = $\frac{-1}{2} = \frac{-2}{4} = \frac{-1}{2} = \frac{-6}{12}$

ONE MORE...

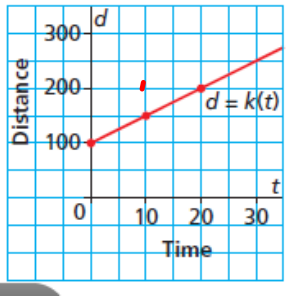
Which graph has a rate of change of −5 and a vertical intercept of 100? Justify your answer.

a)



ROC = −100/20 = −5

b)



PRACTICE PROBLEMS...

p. 308: #3 - 8, 12, 14, 16