

## 5.7 Properties of Linear Functions

↗ fixed
↘ rate

**Example 1:** The cost for a car rental is \$60, plus \$20 for every 100km driven.

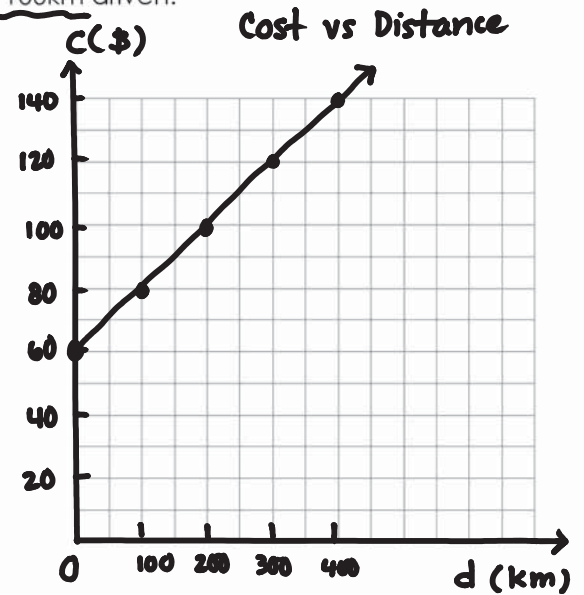
Show this linear relation as a table and a graph:

indep. ("x") Distance (km) (d)	dependent ("y") Cost (\$) (C)
0	60
100	60 + 20 = 80
200	80 + 20 = 100
300	100 + 20 = 120
400	120 + 20 = 140

+100
+100
+100
+100

+20
+20
+20
+20

constant variation for indep. variable produces constant variation for dependent variable



Linear (straight line) Graph

Rate of Change (Slope)

constant for linear functions

$$\text{rate of change} = \frac{\text{constant variation of dep. variable}}{\text{constant variation of indep. variable}}$$

$$= \frac{\$20}{100\text{km}}$$

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

It costs \$0.20 (or 20¢) for every km driven.

Equation to represent the linear function

$$C = 0.20d + 60$$

↑ dependent variable
↑ independent variable
→ initial value (or y-intercept)

rate of change (or slope)

**Example 2:** Which table of values represents a linear relation? Justify your answer.

a) The relation between temperature in degrees Celsius,  $C$ , and temperature in degrees Fahrenheit,  $F$ .

	$C$	$F$
+5 ↙	0	32
+5 ↙	5	41
+5 ↙	10	50
+5 ↙	15	59
+5 ↙	20	68

constant                      constant

since both indep. & dep. variable change at constant amounts, this relation is linear.

b) The relationship between the current,  $I$  amps, and power,  $P$  watts, in an electrical circuit.

	$I$	$P$
+5 ↙	0	0
+5 ↙	5	75
+5 ↙	10	300
+5 ↙	15	675
+5 ↙	20	1200

constant                      not constant

Since " $I$ " does not change by a constant amount, this relation is not linear.

**Example 3:** Graph each equation and explain which ones are linear relations.

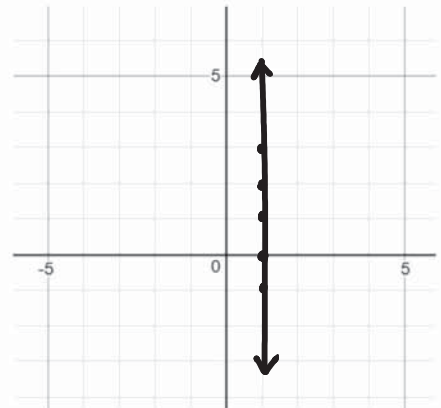
a)  $y = -3x + 4$



linear

$x$	$y$
-1	$y = -3(-1) + 4 = 7$
0	$y = -3(0) + 4 = 4$
1	$y = -3(1) + 4 = 1$

b)  $x = 1$  }  $x$  must be 1 but  $y$  can be any value.

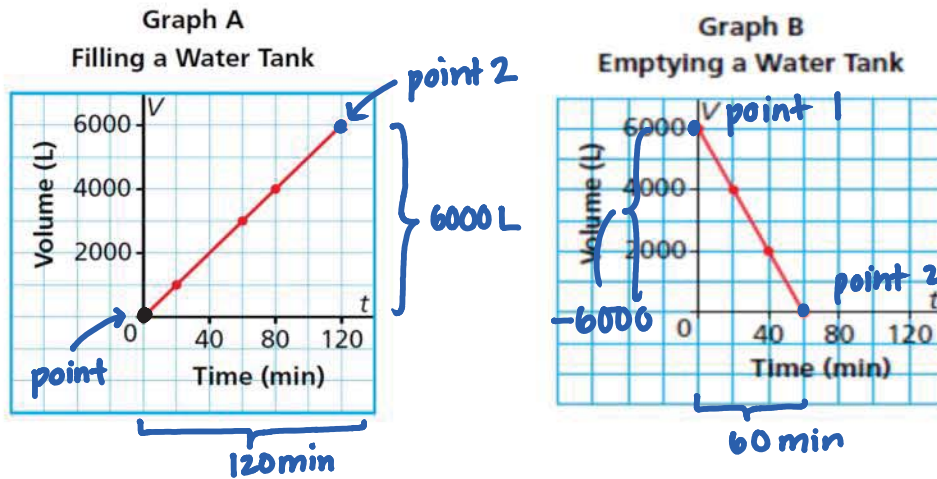


linear

(but not a function)

**Example 4:** A water tank on a farm near Swift Current holds 6000 L.

- Graph A represents the tank being filled at a constant rate.
- Graph B represents the tank being emptied at a constant rate.



a) Identify the independent and dependent variables.

time (look at "x" axis) → volume (look at "y" axis)

b) Determine the rate of change for each relation, then describe what it represents.

- choose 2 points on each graph
- calculate change in variable from one point to the other

Graph A : rate of change =  $\frac{\text{constant variation of dep. var.}}{\text{constant variation of indep. var.}}$

+ rate → volume increased over time

$$= \frac{6000 \text{ L}}{120 \text{ min}} = 50 \text{ L/min}$$

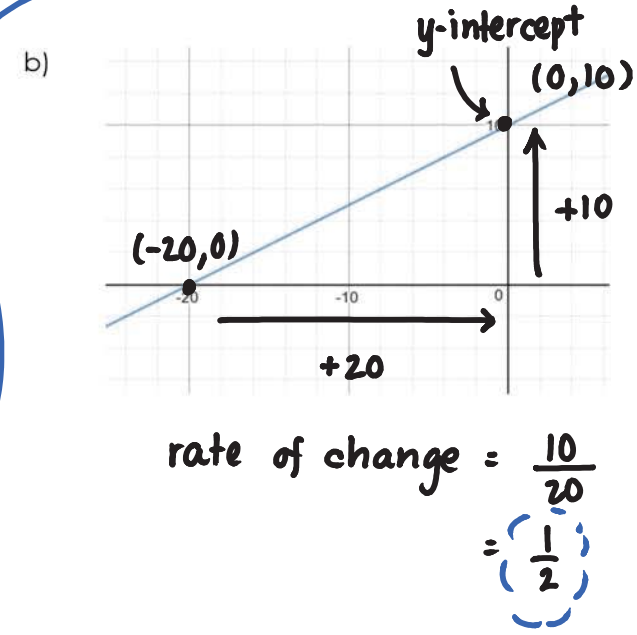
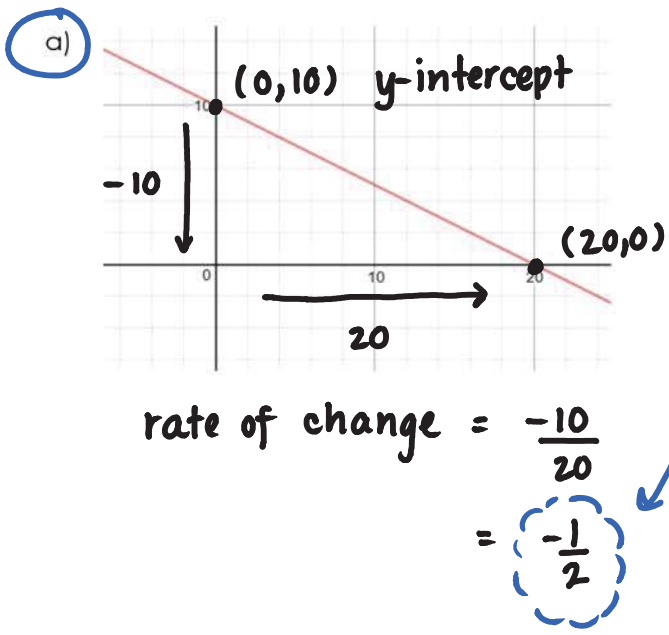
The tank filled at a rate of 50 L per minute.

Graph B : rate of change =  $\frac{-6000 \text{ L}}{60 \text{ min}} = -100 \text{ L/min}$

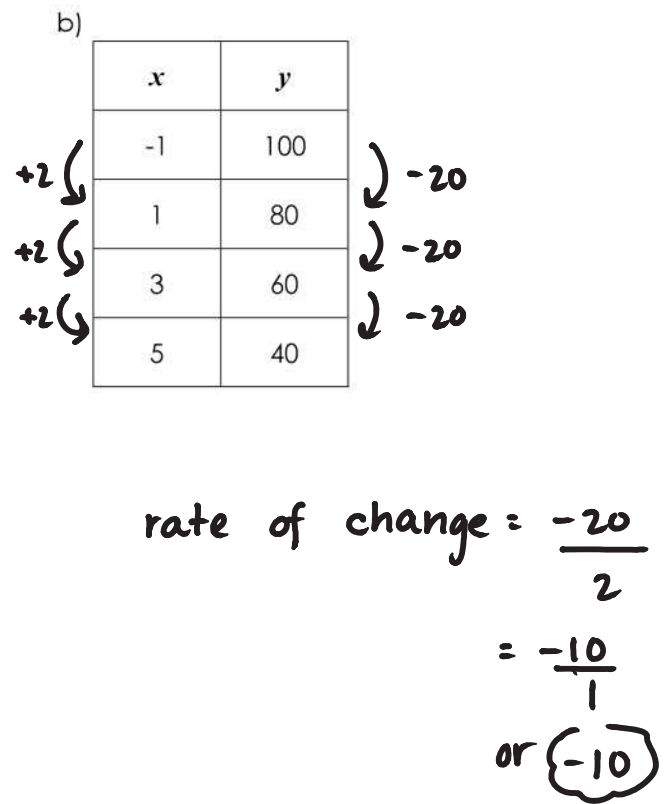
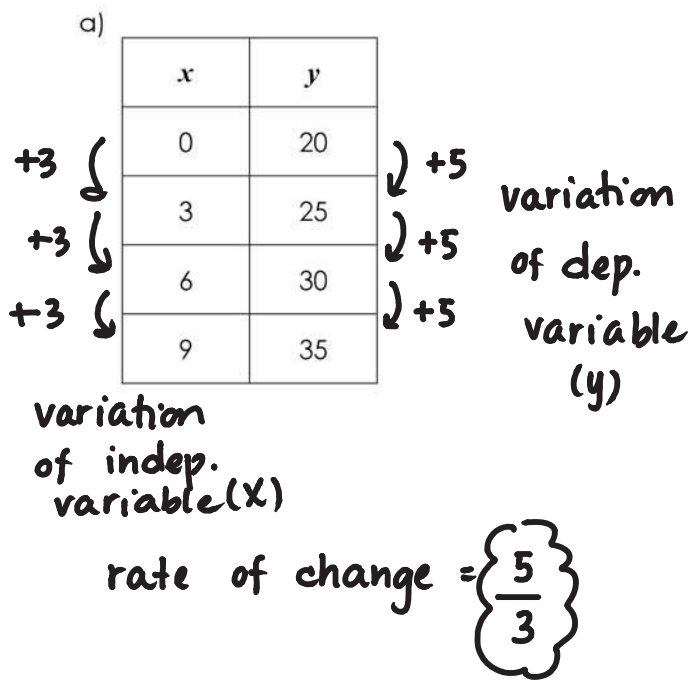
- rate → volume decreased over time

The tank emptied at a rate of 100 L per minute.

**Example 5:** Which of the following graphs has a rate of change of  $-\frac{1}{2}$  and a y-intercept of 10? Justify your answer.



**Example 6:** Find the rate of change for the following linear functions.



**Practice:** p.308 #3 – 7, 12, 14; p.319 #4, 5, 7, 8

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F & PC 10