Vision 4.1

Recall, a relation is a connection between two variables, an independent variable and a dependent variable.

slope

In a relation the **rate of change** is the comparison between the change in the dependent variable and the corresponding change in the independent variable.

pool A empties at a rate of 1 L/min

L

t

$$\text{Rate of change} = \frac{\text{change in the dependent variable}}{\text{change in the independent variable}}$$

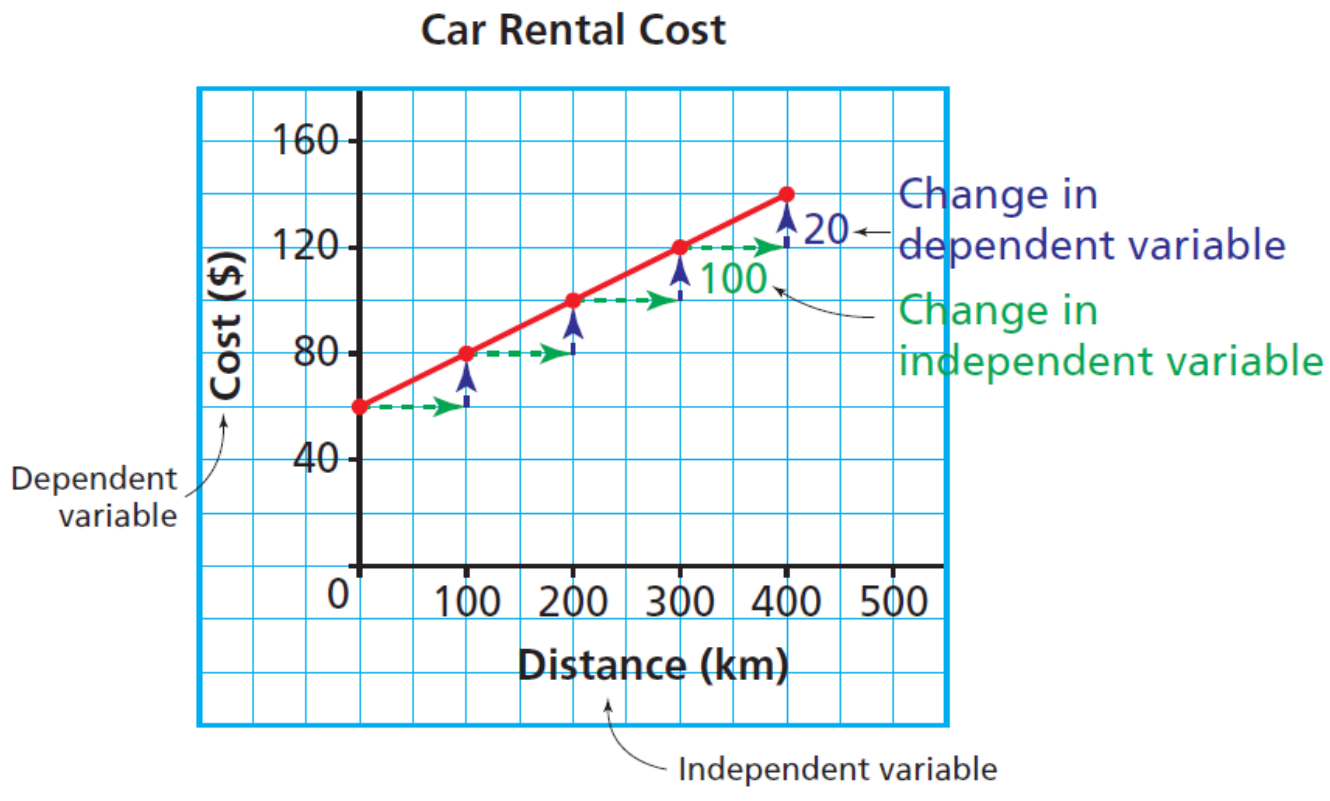
pool B empties at a rate of 7 L/min

L

t

Symbolically, the rate of change between the ordered pairs (x_1, y_1) and (x_2, y_2) is $\frac{y_2 - y_1}{x_2 - x_1}$

When a constant change in the independent variable results in a constant change in the dependent variable, the relation is linear. A linear relation is represented graphically by a line.



Independent variable → | Dependent variable ←

	Distance (km)	Cost ($)	
	0	60	
+100	100	80	+20
+100	200	100	+20
+100	300	120	+20
+100	400	140	+20

Example: Which table of values represents a linear relation? Justify the answer.

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

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

+5 +5 +5 +5 | +9 +9 +9 +9

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

I	P
0	0
5	75
10	300
15	675
20	1200

+5 +5 +5 +5 | +75 +225 +375 +525

Not linear

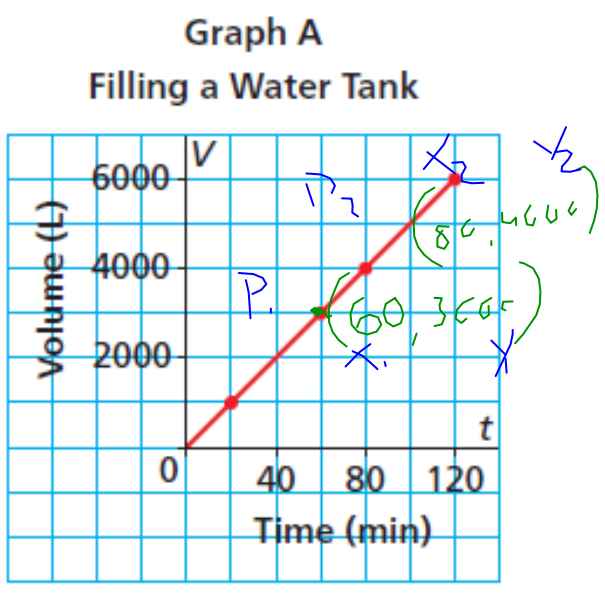
a constant inc in Amps does not create a constant inc in power

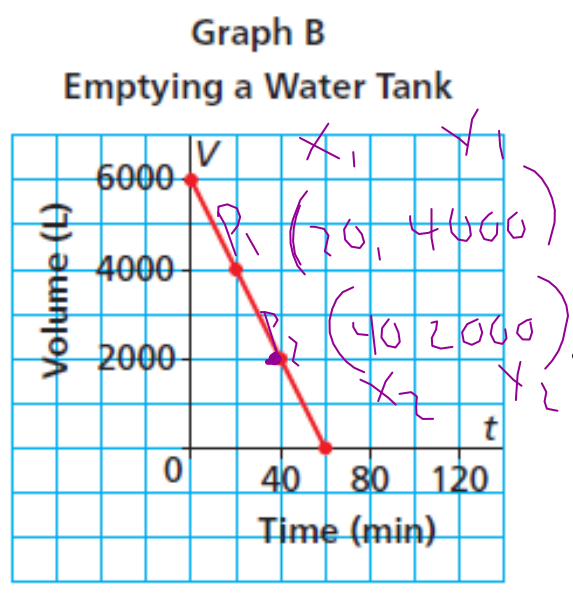
Linear

constant inc in C

creates a constant inc in F

Example: A water tank on a farm near Swift Current, Saskatchewan, 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.





independent = time (min)

dependent = volume (L)

a) Identify the independent and dependent variables.

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

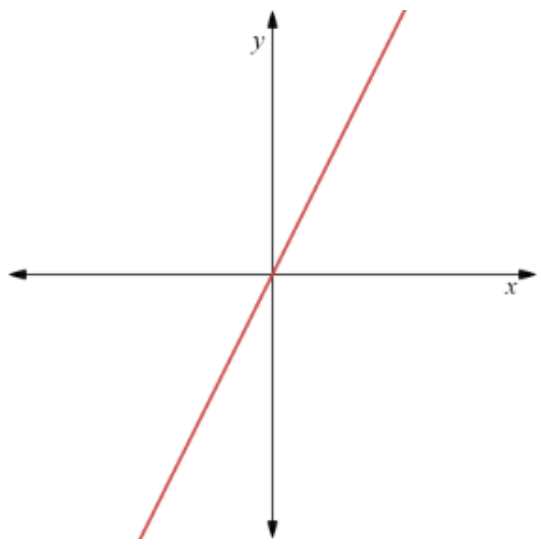
rate of change = $\frac{\text{change dep}}{\text{change ind}}$

= $\frac{\text{change in volume}}{\text{change in time}}$

(A) $roc = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4000 - 3000}{80 - 60} = 50\ L/min$

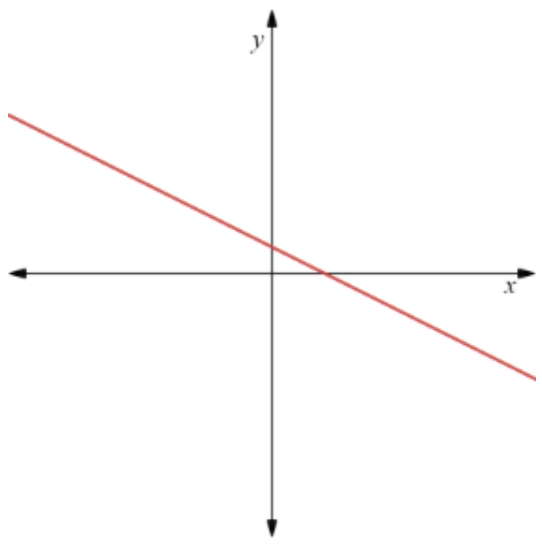
(B) $roc = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2000 - 4000}{40 - 20}$

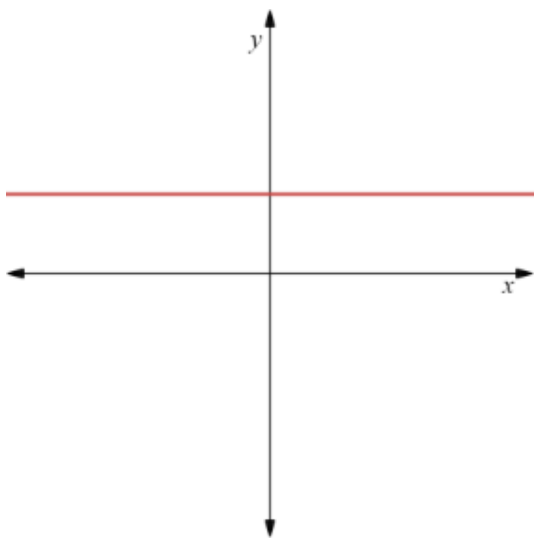
$= -100\ L/min$



If a positive increase in the independent variable results in a positive increase in the dependent variable, the rate of change is positive and the function is increasing.

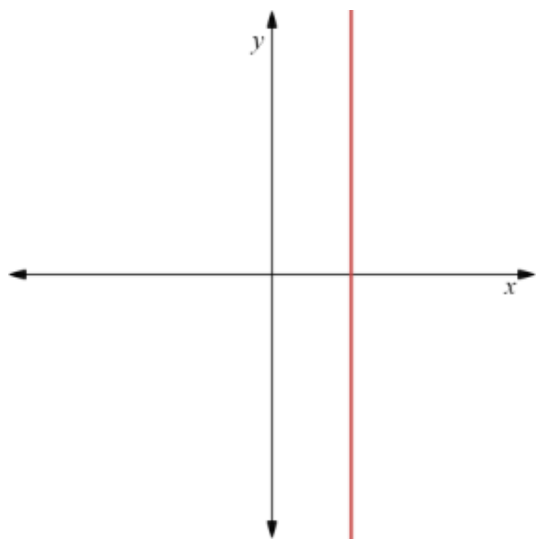
If a positive increase in the independent variable results in a negative decrease in the dependent variable, the rate of change is negative and the function is decreasing.





If a positive increase in the independent variable results in no change in the dependent variable, the rate of change is zero (or null) and the function is constant.

If there is no change in the independent variable, the rate of change is undefined.



Check Your Understanding

Textbook Volume 1 pg. 189

Questions 1, 4, 8 and 9