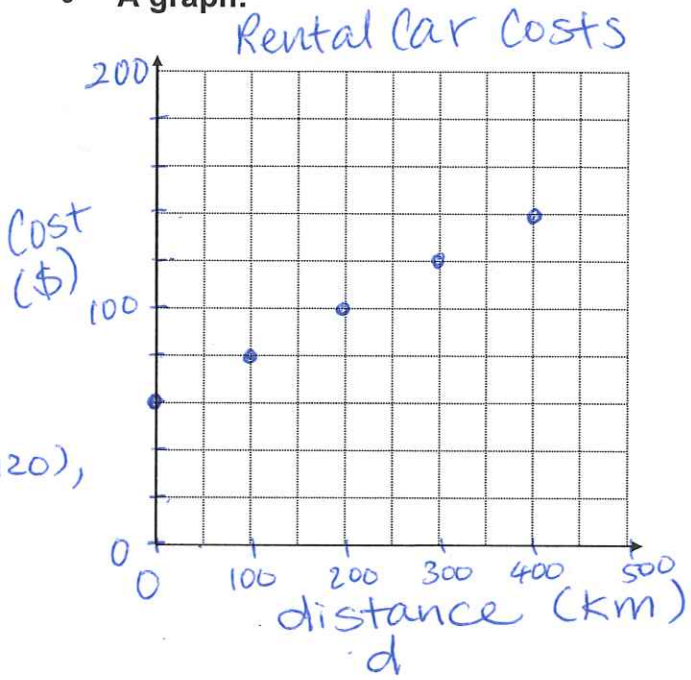
5.6 Properties of Linear Relations

Example: The cost of renting a car is $60, plus $20 for every 100 km driven. We can show this linear relation in the following ways:

- **A table of values:**

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

- **A graph:**



- **A set of ordered pairs:**

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

- **An equation:**

$C = 60 + 20d$

Determine the **rate of change:**

$$\frac{\$20}{100\text{ km}} = \$0.2/\text{km}$$

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

a)

x	y
0	1
20	2
40	4
60	8
80	16
100	32

+20; +1, +2, +4

No, the y-values don't increase at the same rate.

b)

x	y
60	3
120	6
180	9
240	12
300	15

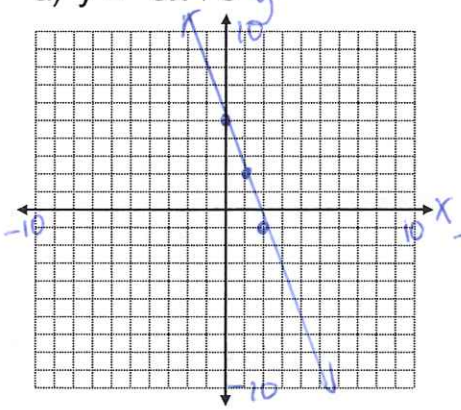
+60; +3

Yes, the y-values increase by 3 each time x increases by 60

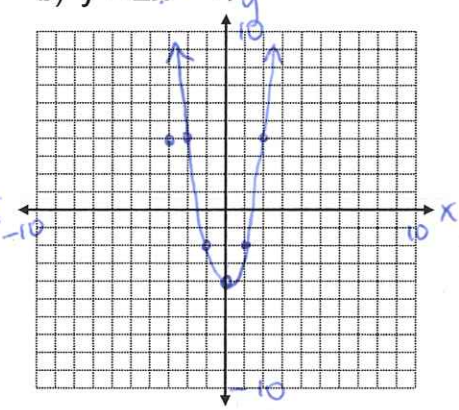
a) and c) are linear because they are straight. (Their rates of change are constant)

Example: Graph each equation. Which equations represent linear functions? Why?

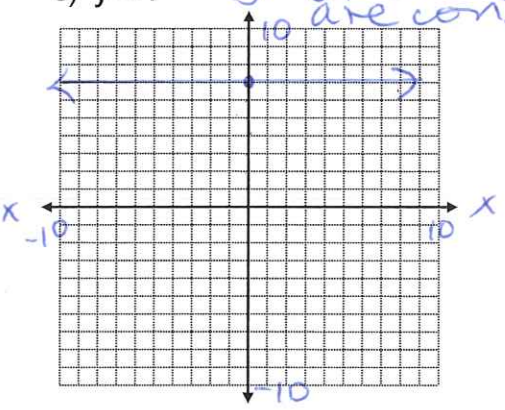
a) $y = -3x + 5$



b) $y = 2x^2 - 4$



c) $y = 7$



Example: Which of the following relations is linear? Justify the answer.

a) A new car is purchased for $36 000. Every year, the value of the car decreases by 15%. The value is related to time.

Not linear because the value doesn't change by the same amount each time.

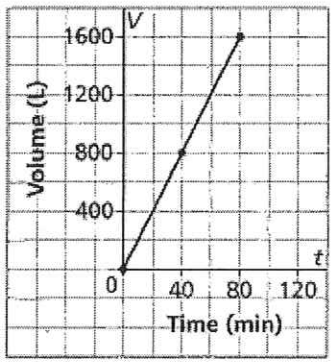
b) For a service call, a plumber charges a $75 flat rate, plus $50 for each hour he works. The total cost for service is related to time.

Linear, the constant rate of change is $50/hour.

Example: A hot tub contains 1600L of water. Graph A represents the hot tub being filled at a constant rate. Graph B represents the hot tub being emptied at a constant rate.

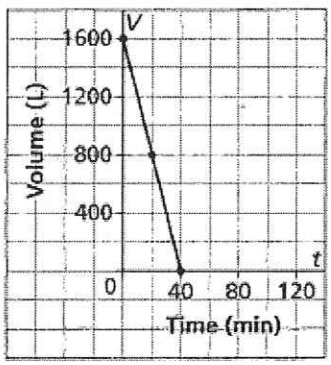
Graph A

Filling a Hot Tub



Graph B

Emptying a Hot Tub



a) Identify the dependent and independent variables.

Dependent: Volume Independent: Time.

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

A: $\frac{800L}{40min} = 20L/min$ B: $\frac{-800L}{20min} = -40L/min$