b. What does the slope represent?

6. The fuel consumption of a vehicle is often measured in units of L/100 km. Determine the fuel consumption represented in the graph in part 4, in units of L/100 km.

7. The slope of a graph is also referred to as the "rate of change". Explain why.

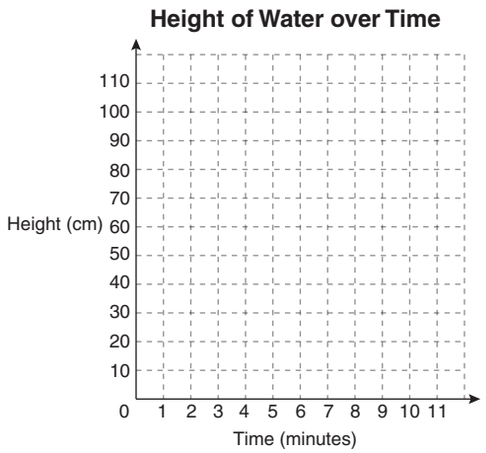
The slope of a linear relation represents a **rate of change**. It tells you how much the vertical unit changes for each change of 1 in the horizontal unit.

Rate of Change
how one quantity changes relative to another quantity

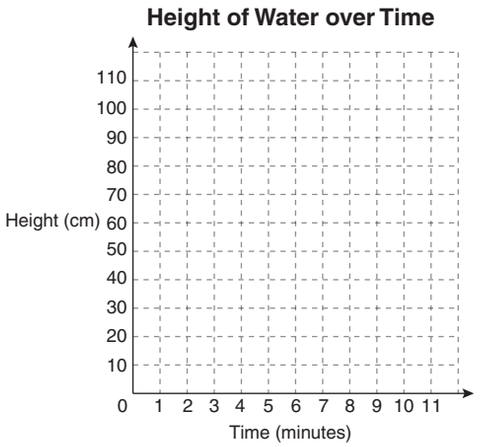
Check Up

1. The height of the water level in a rain barrel decreases as plants are watered. Sketch a graph to represent each of the following scenarios if the height of water in the barrel was initially 100 cm.

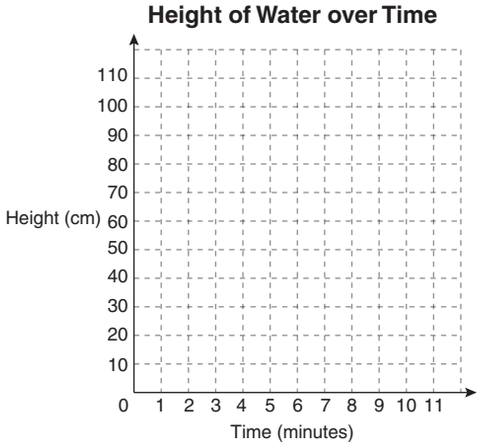
   a. a rate of change of –2 cm/min



b. a rate of change of –10 cm/min



c. a rate of change of –25 cm/min



2. Pick one scenario from part 1 and answer the following questions.

a. State two points on the graph of the chosen relation.

b. Use those points to determine the slope of the relation.

c. What are the units for the rise of the graph?

d. What are the units for the run of the graph?

e. Describe, in words, the rate of change of the relation.

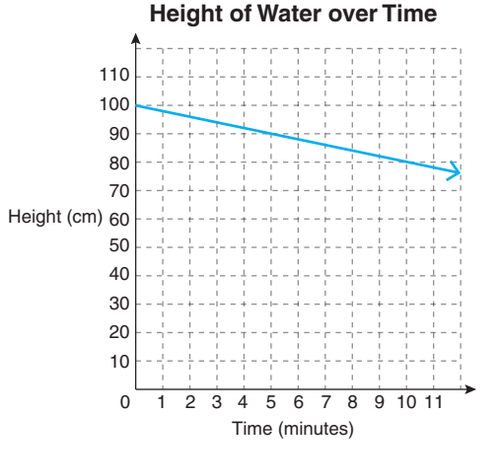
f. Would this data be considered continuous or discrete? Explain.

g. State the domain and range of the relation.

☑ Compare your answers.

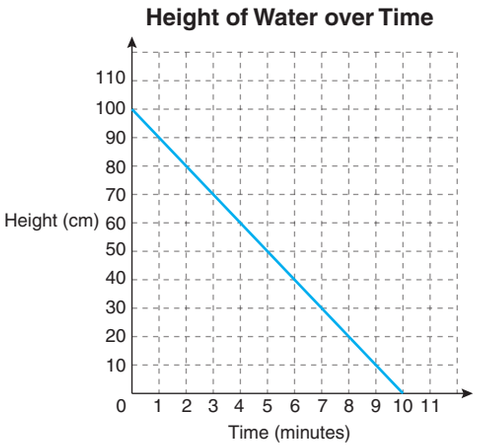
1. The height of the water level in a rain barrel decreases as plants are watered. Sketch a graph to represent each of the following scenarios if the height of water in the barrel was initially 100 cm.

   a. a rate of change of –2 cm/min



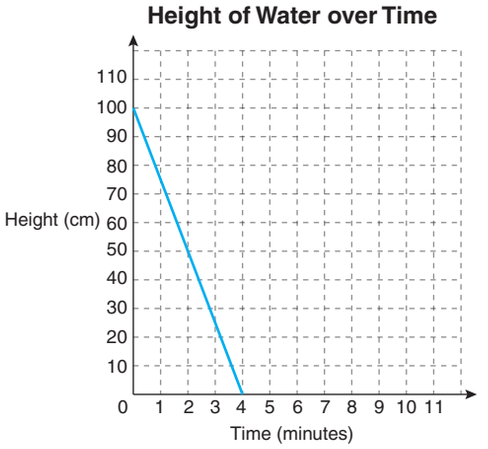
This graph has a rate of change of –2 cm/min. That means that for every minute that passes, the water height decreases by 2 cm.

b. a rate of change of –10 cm/min



This graph has a rate of change of –10 cm/min. That means that for every minute that passes, the water height decreases by 10 cm.

c. a rate of change of –25 cm/min



This graph has a rate of change of –25 cm/min. That means that for every minute that passes, the water height decreases by 25 cm.

2. Pick one scenario from part 1 and answer the following questions.

a. State two points on the graph of the chosen relation.

Points will vary.

Points from a: $\{(0,100),(5,90)\}$

Points from b: $\{(0,100),(4,60)\}$

Points from c: $\{(0,100),(2,50)\}$

b. Use those points to determine the slope of the relation.

Points will vary, however slopes should be consistent.

Slope of graph a.

$$m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{90 - 100}{5 - 0} = \frac{-10}{5} = -2$$

Slope of graph b.

$$m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{60 - 100}{4 - 0} = \frac{-40}{4} = -10$$

Slope of graph c.

$$m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{50 - 100}{2 - 0} = \frac{-50}{2} = -25$$

c. What are the units for the rise of the graph?

The units for the rise are centimetres.

d. What are the units for the run of the graph?

The units for the run are minutes.

e. Describe, in words, the rate of change of the relation.

For every minute that passes, the water height decreases by 2 cm.

For every minute that passes, the water height decreases by 10 cm.

For every minute that passes, the water height decreases by 25 cm.

f. Would this data be considered continuous or discrete? Explain.

The data is continuous because height and time are both measurements and thus decimal values are permitted.

g. State the domain and range of the relation.

There cannot be values above 100 cm for the height of the water level.

Height and time cannot have negative values.

For graph a.:

$\{x \mid 0 \le x \le 50, x \in \mathrm{R}\}$

$\{y \mid 0 \le y \le 100, y \in \mathrm{R}\}$

For graph b.:

$\{x \mid 0 \le x \le 10, x \in \mathrm{R}\}$

$\{y \mid 0 \le y \le 100, y \in \mathrm{R}\}$

For graph c.:

$\{x \mid 0 \le x \le 4, x \in \mathrm{R}\}$

$\{y \mid 0 \le y \le 100, y \in \mathrm{R}\}$

Linear relations are easily recognizable because they always have a straight-line graph. Linear relations are also fairly straight-forward to interpret because as one value changes, the other value changes proportionately. The next lesson will focus on a specific type of linear relation – the linear function.