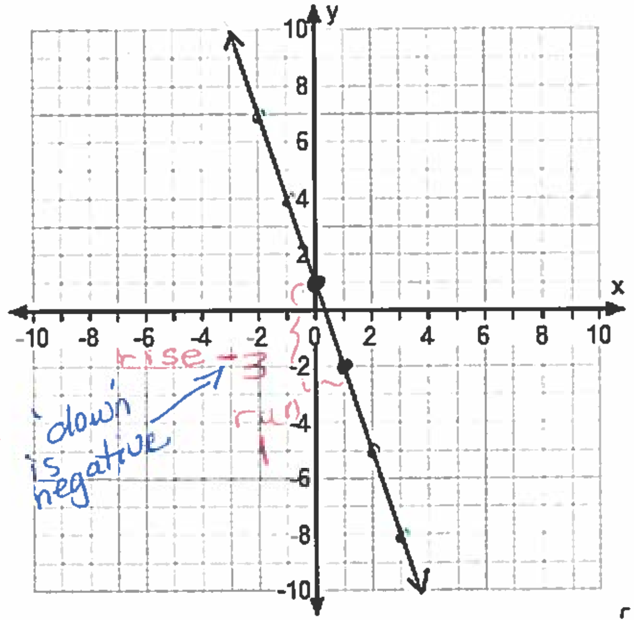
Unit 5 Lesson 3

Warm Up:
Determine the slope of the line given in the graph to the right.



* pick any two 'nice' points on the line ('nice' points are points with integer values for the x & y co-ordinates.)

* count the 'rise' and 'run' to get from one point to the next

$m = \frac{rise}{run}$

$= \frac{-3}{1}$ simplify the fraction by reducing to lowest terms.

$= -3$

Unit 5 – Linear Relations I
Day 3 - Slope as a Rate of Change (5.4)

Recap: Slope formula – $m = \frac{rise}{run}$

OR $m = \frac{\text{change in } y\text{'s}}{\text{change in } x\text{'s}}$ "y's rhymes with rise"

$= \frac{\Delta y}{\Delta x}$ "Δ" is greek letter 'delta', means 'the change in'

$= \frac{y_2 - y_1}{x_2 - x_1}$ subscripts are used to number the points e.g., given (x_1, y_1), x_1 means the x-value from the first point

Ex. 1 Sue drove 325 km in 3.5 hours. What is the rate of change of distance from Sue's starting point?

recall: rates always have two units. For example, 10 km/h, \$2/scoop, 1.3 litres/h are all examples of rates of change. In fact, they are all "unit rates".

The 'rate of change' in this example means, "How is distance changing over time?"

rate of change $= \frac{\text{change in distance}}{\text{change in time}}$

$= \frac{325\text{ km}}{3.5\text{ h}}$ ← this is a rate

$\doteq 92.9$ km/h } simplify to a unit rate

Ex. 2 A 5 year old sleeps an average of 11 hours a night, whereas a 25 year old sleeps an average of 8 hours a night. What is the rate of change of sleep?

means "How do total hours of sleep change as an individual gets older".

rate of change $= \frac{\text{change in hours}}{\text{change in age}}$

$= \frac{8\text{ hours} - 11\text{ hours}}{25\text{ years} - 5\text{ years}}$

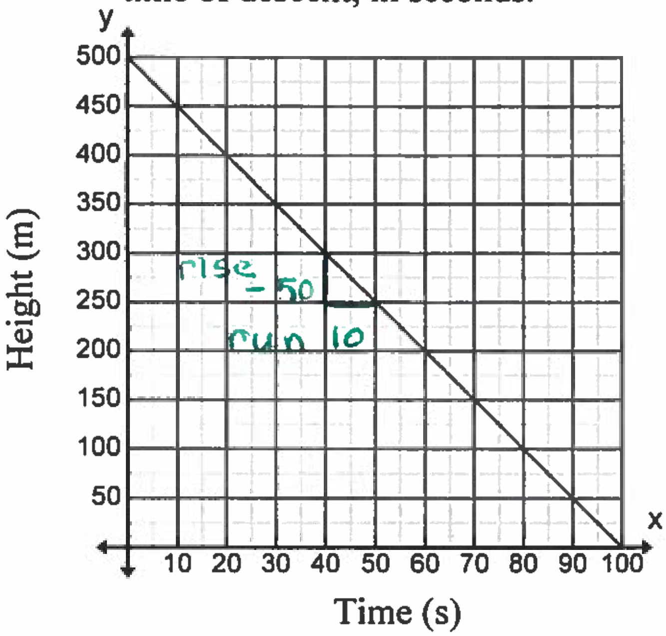
$= \frac{-3\text{ hours}}{20\text{ years}}$

$= \frac{-180\text{ minutes}}{20\text{ years}}$

$= -9$ minutes/year

∴ on average a person's nightly sleep is 9 minutes less each year.

Ex. 3 The graph shows the relationship between the height of a parachutist, in metres, and the time of descent, in seconds.



a) Calculate the slope. (watch the scale)

$$m = \frac{rise}{run}$$
$$= \frac{-50}{10}$$
$$= -5$$

b) Interpret the slope as a rate of change.

−5 m/s

'y' units 'x' units

negative slope ∴ distance is decreasing

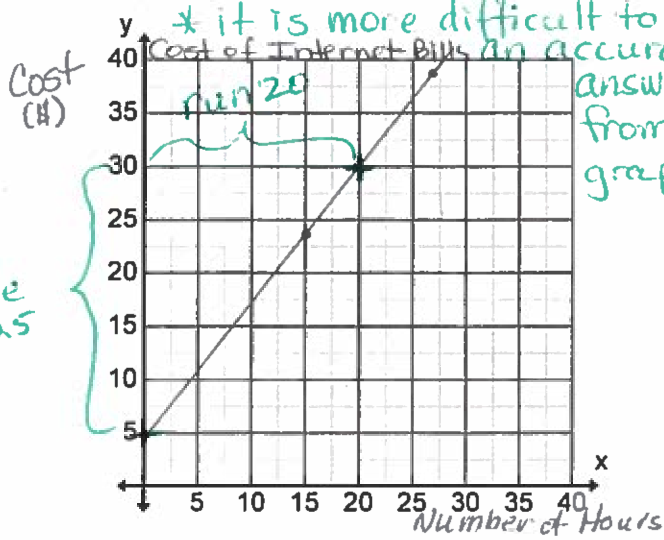
The parachutist is falling 5 metres every second.

Ex. 4 Christina pays her internet bill based on hours of use. For one month, Christina was on-line for 15 hours and was billed for $23.75. The next month, she was on for 27 hours and her bill was $38.75. Assume this is a linear relationship. Determine the rate of change and interpret its meaning in the context of the question. Recall: Rate of change = slope of the line!

Given two 'ordered pairs' (15, 23.75), (27, 38.75)

Method 1:

a) Graph the cost per hour



* it is more difficult to get an accurate answer from a graph.

b) Determine the slope of the line.

$$m = \frac{rise}{run}$$
$$= \frac{25}{20}$$
$$m = \frac{5}{4}$$

∴ the rate of change is $1.25/hour.

Method 2:

Determine the slope of the line using the two given points

$(15, 23.75)$ $(27, 38.75)$

x_1 y_1 x_2 y_2

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{38.75 - 23.75}{27 - 15}$$
$$= \frac{15}{12}$$
$$= \frac{5}{4}$$

∴ the rate of change is $1.25/h

Christina pays $1.25 for every hour she uses the internet.

Exit Cards

It cost a video game company $1575 to produce 125 copies of their top selling video game in November. In December they produced 300 copies and it cost the company $3500. Assuming this is a linear relationship, determine the company's cost of producing one copy of the game.

* rate of change will be in #/copy

$(125, 1575)$ $(300, 3500)$
x_1 y_1 x_2 y_2

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{3500 - 1575}{300 - 125}$$
$$= \frac{1925}{175}$$
$$= 11$$

∴ the cost is $11/copy.