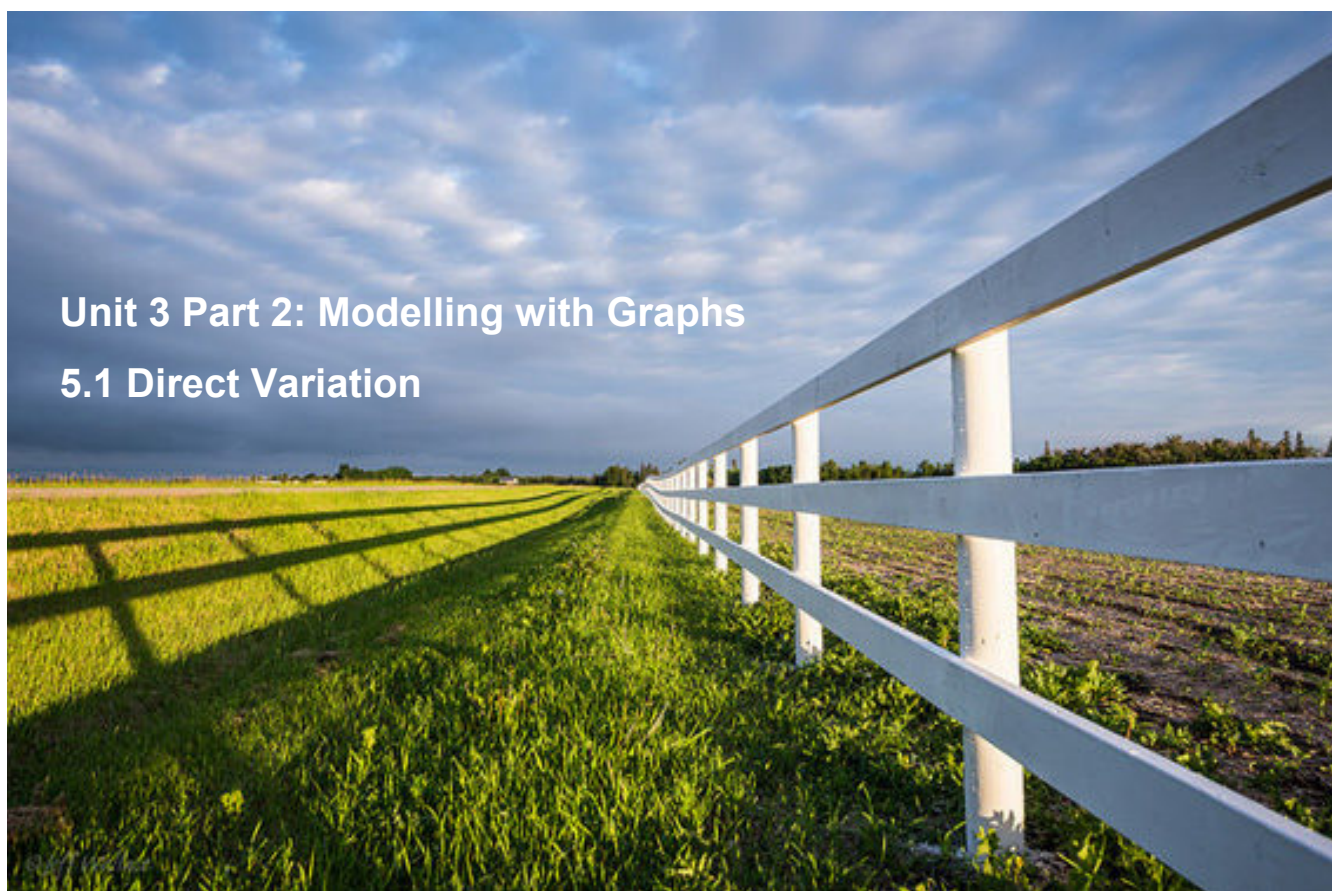


Unit 3 Part 2: Modelling with Graphs

5.1 Direct Variation



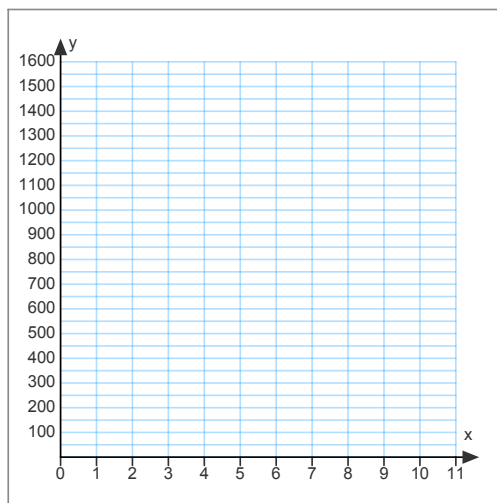
5.1 Direct Variation

Consider the relationship between the distance a person can run, and the time it takes:

Susan can jog at a steady pace of 150 m/min for the first hour.

- Create a table showing the distance she jogs in 0 min, 1 min, 2 min and so on up to 10 min.
- Graph the relationship.
- Where does the graph intersect the y - axis?
- Write an equation to show the distance, d , that Susan jogs in t minutes.
- Use the equation to determine how far she can jog in 40 min.

Time (minutes)	Distance (m)
0	
1	
2	



The relationship between distance and time is an example of **direct variation: a relationship in which one variable is a constant multiple of the other.**

In a direct variation, the ratio of the variables doesn't change. For example, consider our distance and time example:

$$\frac{d}{t} = k \quad \mathbf{k \text{ is the constant of variation.}}$$

$$\frac{150}{1} = 150 \quad \frac{300}{2} = 150 \quad \frac{1350}{9} = 150$$

The constant of variation is 150. It represents the average speed of the runner.

We can rearrange $\frac{d}{t} = k$ into $d = kt$

In our example: $\frac{d}{t} = 150$ is $d = 150t$

This is the relation relating distance to time.

Example 1:

A family travels 250 km on a trip. The distance, d , in kilometers varies directly with the time, t , in hours.

- a) find the equation relating distance and time if $d = 43$ when $t = 0.5$
b) use the equation to find how long it will take them to reach their destination.

a) since it's direct variation,

$$k = \frac{d}{t}$$
$$= \frac{43}{0.5}$$
$$= 86$$

the equation is $d = kt$ or $d = 86t$

b)

$$d = 86t$$
$$250 = 86t$$
$$\frac{250}{86} = t$$
$$2.9 = t$$

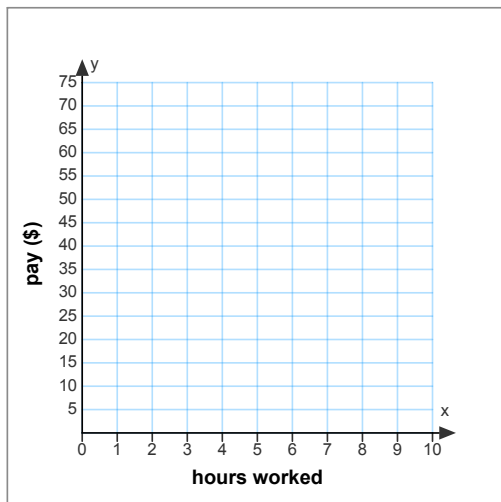
It will take 2.9 hours to reach their destination.

Example 2:

Amir works part time at a bookstore and earns \$7.50 per hour.

Write an equation to relate Amir's pay (P) in dollars to the time (t) in hours that he works, then use the equation to find how much he earns if he works 9 hours.

Graph the relationship between the number of hours Amir works and his pay:

**Key Concepts:**

Direct variation occurs when one variable is a constant multiple of the other.

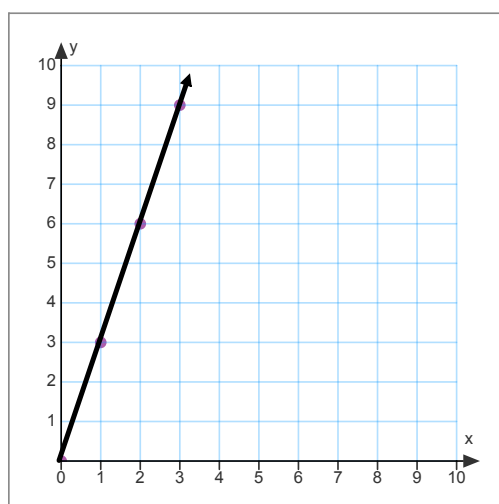
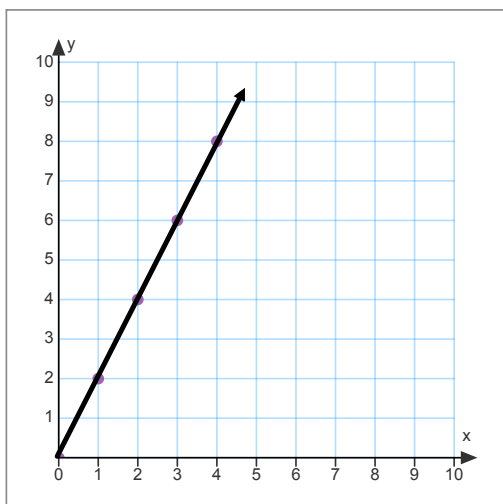
k is the constant of variation:

$$\frac{y}{x} = k \quad \text{and} \quad y = kx$$

The graph of a direct variation is a straight line that passes through the origin $(0, 0)$.

Practice pg 242 #1, 3, 7, 8, 12, 13

Ex. Consider the graphs of $d=2t$ and $d=3t$. Describe the similarities and differences. Why do these differences occur?



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Slope of a Line

$f(x) = x$

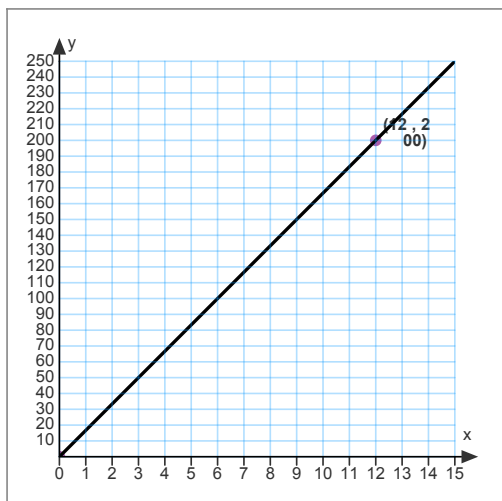
m + 1 -

c + 0 -

Compute Slope

ZOOM IN ZOOM OUT

Ex. On New Year's Eve, Sally baby-sat for 12 hours and made \$200, what was her rate of pay?



$$200 = m(12)$$

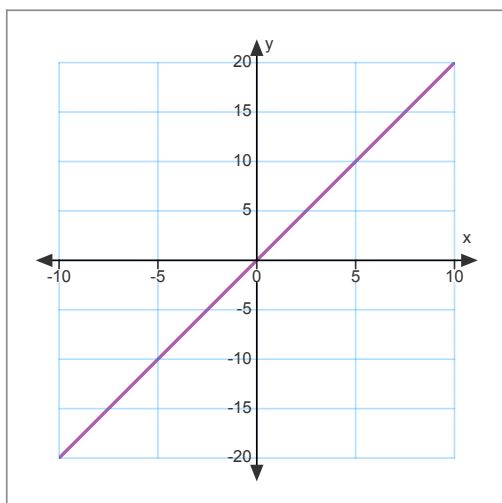
$$\frac{200}{12} = m$$

$$16.67 = m$$

Therefore, Sally charged \$16.67 an hour.

Ex. Consider the two equations, $y=2x+5$ and $y=2x$. Which is an example of a direct variation? Explain.

$$y = 2x$$



$$y = 2x + 5$$

