

## Solutions to Exercises Set 1

1. **i** When  $a = 10$ ,  $n = f(10) = 60(10) - 900 = -300$ . This represents a negative number of words for a 10 month old baby so the formula does not make sense for  $a = 10$ .
- ii** You would not expect an adult to learn new words at the same rate as that of a very young child.
- iii** You can calculate the rate at which the size of the child's vocabulary is changing by looking at the graph drawn on page 4. If you take two points on the graph say when  $x = 30$  and  $x = 40$ , the corresponding values for  $f(x)$  are 900 and 1500 respectively. We can determine the rate the child's vocabulary is changing by calculating,

$$\text{rate} = \frac{\text{change in } f(x)}{\text{change in } x} = \frac{1500 - 900}{40 - 30} = \frac{600}{10} = 60 \text{ words per month.}$$

2. **i** When  $t = 3$ ,

$$d = f(3) = 4.9(3)^2 = 44.1.$$

Therefore the object falls 44.1 metres in the first three seconds.

When  $t = 6$ ,

$$d = f(6) = 4.9(6)^2 = 176.4.$$

The object falls 176.4 metres in the first six seconds.

Therefore the object falls  $176.4 - 44.1 = 132.3$  metres in the second three seconds.

- ii** The speed of the falling object is increasing, as it falls 44.1 metres in the first three seconds compared with 132.3 metres in the next three seconds.
- iii** We can calculate the average speed of the object as:

$$\text{average speed} = \frac{\text{distance fallen}}{\text{time taken}}.$$

Therefore the average speed of the object over the first 3 seconds is  $\frac{44.1}{3} = 14.7$  m/sec while the average speed is  $\frac{132.3}{3} = 44.1$  m/sec over the next 3 seconds.

3. **i** If  $f(x) = 5(x - 3)$ ,

$$f(-6) = 5((-6) - 3) = 5(-6 - 3) = 5(-9) = -45.$$

(Substitute  $-6$  everywhere there is an  $x$ .)

$$f(a) = 5((a) - 3) = 5(a - 3).$$

- ii** If  $f(x) = t^3 - 5t^2$ ,

$$f(-2) = (-2)^3 - 5(-2)^2 = -8 - 5(4) = -28.$$

$$f\left(\frac{1}{2}\right) = \left(\frac{1}{2}\right)^3 - 5\left(\frac{1}{2}\right)^2 = \frac{1}{8} - 5\left(\frac{1}{4}\right) = \frac{1}{8} - \frac{5}{4} = -\frac{9}{8}.$$

**iii** If  $f(x) = 4x - 2$ ,  $f(x) = 7$  when

$$4x - 2 = 7$$

$$4x = 9$$

$$x = \frac{9}{4}$$