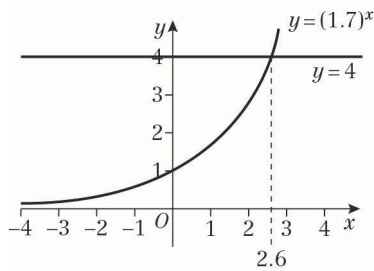
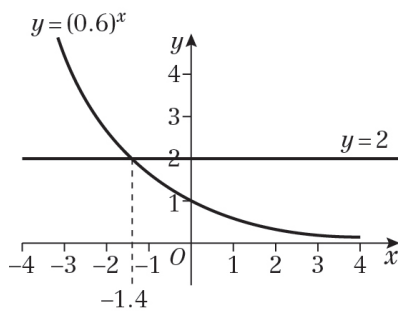


Exercise 3A

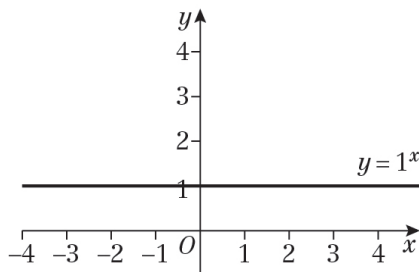
1 a

b Where $y = 4$, $x \approx 2.6$

2 a

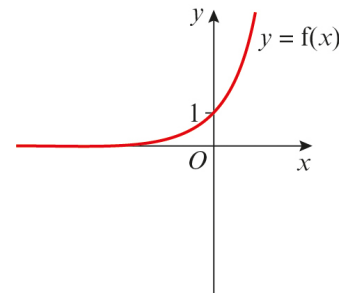
b Where $y = 2$, $x \approx -1.4$

3

4 a True because, when $x = 0$, $a^0 = 1$ when a is positiveb False. For example, when $a = \frac{1}{2}$, the function $f(x) = a^x$ is not an increasing function.c True because, when a is positive, $a^x > 0$ for all values of x .5 a The graph crosses the y -axis when $x = 0$.

$$y = 3^0$$

$$\text{So } y = 1$$

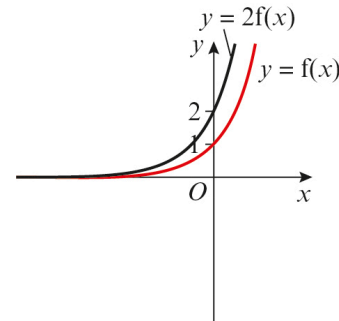
The graph crosses the y -axis at $(0, 1)$.Asymptote is at $y = 0$.

b The graph is a vertical stretch by scale factor 2.

The graph crosses the y -axis when $x = 0$.

$$y = 2 \times 3^0$$

$$\text{So } y = 2$$

The graph crosses the y -axis at $(0, 2)$.Asymptote is at $y = 0$.

- 5 c The graph is a translation by the vector $\begin{pmatrix} 0 \\ -4 \end{pmatrix}$.

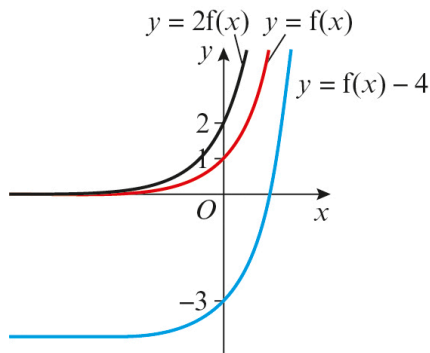
The graph crosses the y -axis when $x = 0$.

$$y = 3^0 - 4$$

$$\text{So } y = -3$$

The graph crosses the y -axis at $(0, -3)$.

Asymptote is at $y = -4$.



- d The graph is a horizontal stretch by scale factor 2.

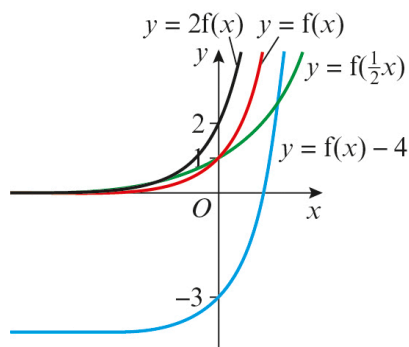
The graph crosses the y -axis when $x = 0$.

$$y = 3^{\frac{1}{2} \times 0}$$

$$\text{So } y = 1$$

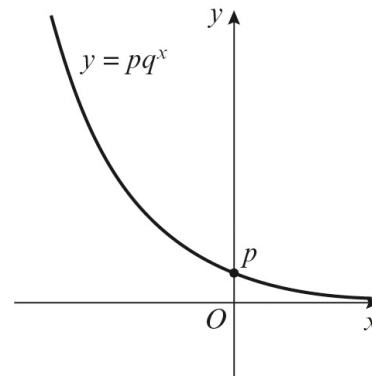
The graph crosses the y -axis at $(0, 1)$.

Asymptote is at $y = 0$.



- 6 Substitute the coordinates into $y = ka^x$.
- $$6 = ka^1 \text{ (equation 1)}$$
- $$48 = ka^4 \text{ (equation 2)}$$
- Solve simultaneously: divide equation 2 by equation 1,
- $$48 \div 6 = \frac{ka^4}{ka}$$
- $$a^3 = 8$$
- $$a = 2, k = 3$$

- 7 a As x increases, y decreases



- b Substitute the coordinates into $y = pq^x$.
- $$150 = pq^{-3} \text{ (equation 1)}$$
- $$0.048 = pq^2 \text{ (equation 2)}$$
- Solve simultaneously, divide equation 2 by equation 1.

$$0.048 \div 150 = \frac{pq^2}{pq^{-3}}$$

$$q^5 = 0.00032$$

$$q = 0.2$$

$$p = 0.048 \div 0.2^2 = 1.2$$

$$p = 1.2, q = 0.2$$

Challenge

To draw the graph, note that it is a translation of the graph $y = 2^x$ by the vector $\begin{pmatrix} 2 \\ 5 \end{pmatrix}$.

The graph crosses the y -axis when $x = 0$,
so $y = 2^{0-2} + 5$

$$y = 5.25$$

The graph crosses the y -axis at $(0, 5.25)$.

Asymptote is at $y = 5$.

