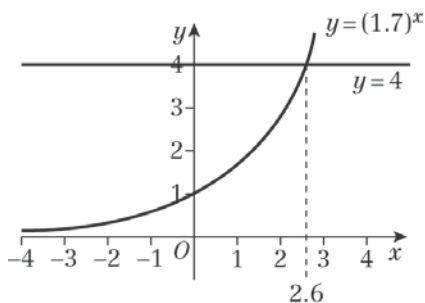


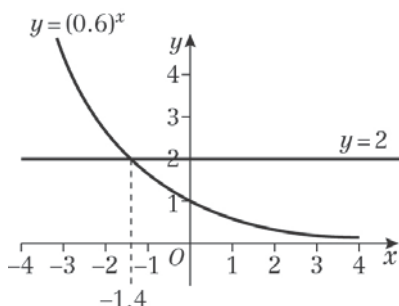
Exponentials and logarithms 14A

1 a



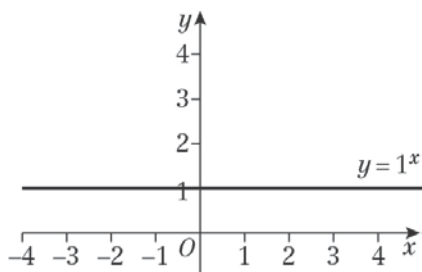
b Where $y = 4$, $x \approx 2.6$

2 a



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

3



4 a True because, when $x = 0$, $a^0 = 1$ when a is positive

b 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 .

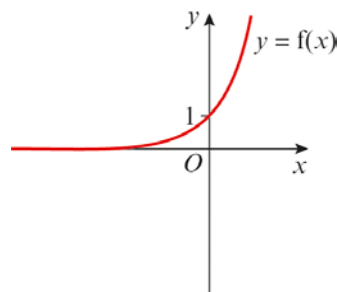
5 a The graph crosses the y-axis when $x = 0$.

$$y = 3^0$$

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

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.

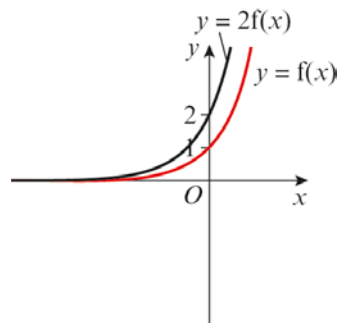
The graph crosses the y-axis when $x = 0$.

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

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

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

Asymptote is at $y = 0$.



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

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

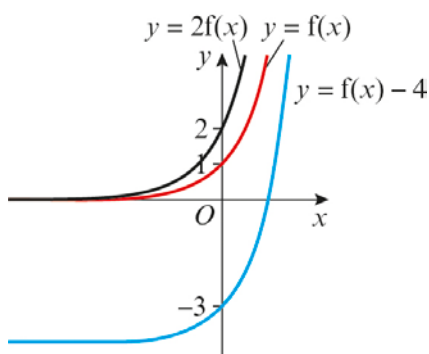
$$y = 3^0 - 4$$

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

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

Asymptote is at $y = -4$.

5 c



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

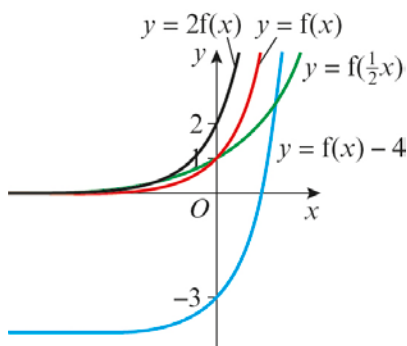
The graph crosses the y-axis when $x = 0$.

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

So $y = 1$

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

Asymptote is at $y = 0$.



6 Substitute the coordinates into $y = ka^x$.

$$6 = ka^1 \text{ (equation 1)}$$

$$48 = ka^4 \text{ (equation 2)}$$

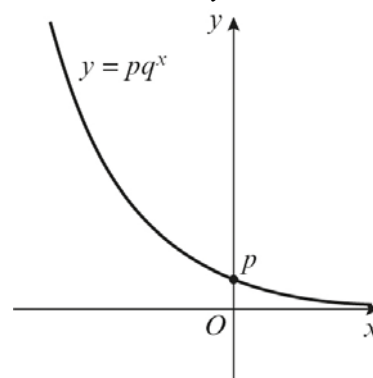
Solve simultaneously: divide equation 2 by equation 1,

$$48 \div 6 = \frac{ka^4}{ka}$$

$$a^3 = 8$$

$$a = 2, k = 3$$

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 $y = 5$.

