iii $y = \tan 3x$

2 a translation through $\begin{pmatrix} 1 \\ 2 \end{pmatrix}$ **b** reflection in x-axis

**c** horizontal stretch, factor $\frac{1}{2}$ and vertical stretch with factor 2

3 a π **b** $\frac{\pi}{3}$ **c** $\frac{\pi}{n}$

EXERCISE 10F

1 a 1   **b** undefined   **c** 1

2 a π **b** 6π **c** π

3 a $b = 1$ **b** $b = 3$ **c** $b = 2$ **d** $b = \frac{\pi}{2}$

4 a

b

c

d

e

f

5
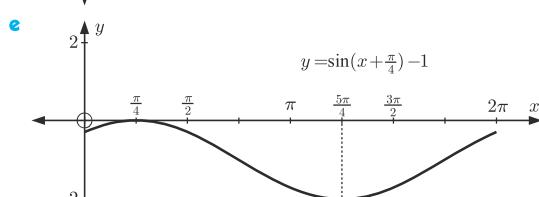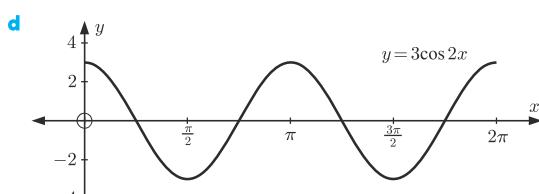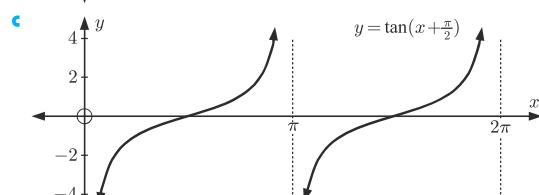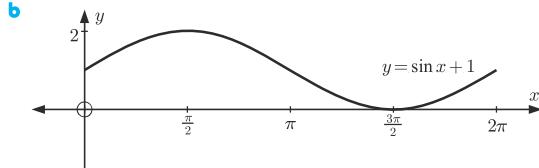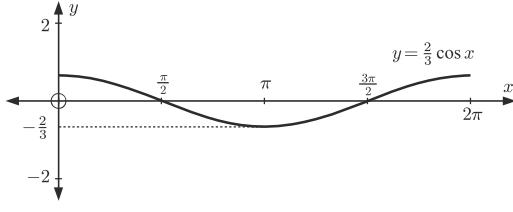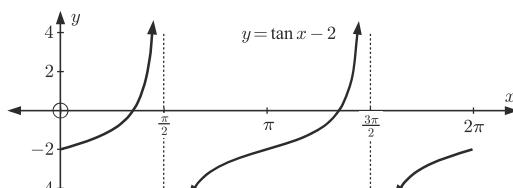
	a	b	c	d	e	f
maximum value	1	3	undef.	4	3	-2
minimum value	-1	-3	undef.	2	-1	-4

6 a vertical stretch, factor $\frac{1}{2}$ **b** horizontal stretch, factor 4

c reflection in the x-axis

d vertical translation down 2 units

e horizontally translate $\frac{\pi}{4}$ units to the left

f reflection in the y-axis

7 $m = 2$, $n = -3$ **8** $p = \frac{1}{2}$, $q = 1$

REVIEW SET 10A

1 a no   **b** yes

2
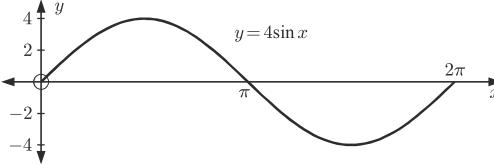
3 a minimum $= 0$,   maximum $= 2$

b minimum $= -2$,   maximum $= 2$

4 a 10π **b** $\frac{\pi}{2}$ **c** 4π **d** $\frac{\pi}{3}$

5

Function	Period	Amplitude
$y = -3\sin(\frac{x}{4}) + 1$	8π	3
$y = \tan 2x$	$\frac{\pi}{2}$	undefined
$y = 3\cos \pi x$	2	3

Function	Domain	Range
$y = -3\sin(\frac{x}{4}) + 1$	$x \in \mathbb{R}$	$-2 \leqslant y \leqslant 4$
$y = \tan 2x$	$x \neq \pm\frac{\pi}{4}, \pm\frac{3\pi}{4}, ...$	$y \in \mathbb{R}$
$y = 3\cos \pi x$	$x \in \mathbb{R}$	$-3 \leqslant y \leqslant 3$

6 a $y = -4\cos 2x$ **b** $y = \cos \frac{\pi}{4} x + 2$

REVIEW SET 10B

1 a
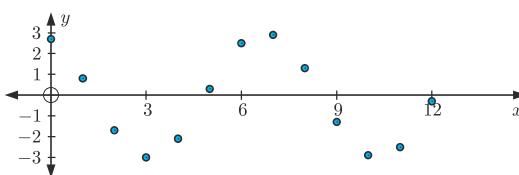
approximately periodic

b

not periodic

2

$y = \sin 3x$

3 a 6π **b** $\frac{\pi}{4}$

4

$y = 0.6 \cos 2.3\,x$
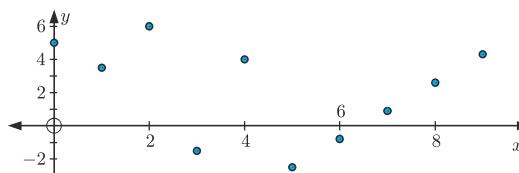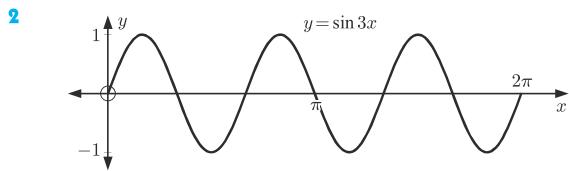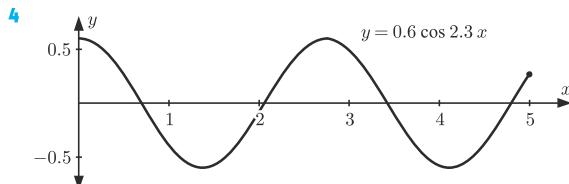
5 a maximum: $-5°$C, minimum: $-79°$C
  b $T \approx 37 \sin(0.008\,98n) - 42$ **c** ≈ 700 Mars days

6 a maximum $= 2$,   minimum $= -8$
  b maximum $= 1\frac{1}{3}$,   minimum $= \frac{2}{3}$

REVIEW SET 10C

1 a The function repeats itself over and over in a horizontal direction, in intervals of length 8 units.
  b i 8   **ii** 5   **iii** -1

2 a $\frac{1}{3}$ **b** 24   **c** $\frac{2\pi}{9}$

3 a

$y = \sin\left(x - \frac{\pi}{3}\right) + 2$

  b $1 \leqslant k \leqslant 3$

4 a

$y = \cos x$

$y = \cos x - 3$

  b

$y = \cos x$

$y = \cos\left(x - \frac{\pi}{3}\right)$

  c

$y = 3\cos 2x$

$y = \cos x$

d

$y = 2 \cos\left(x - \frac{\pi}{3}\right) + 3$

$y = \cos x$
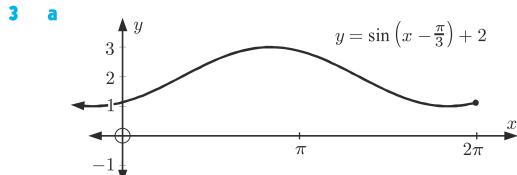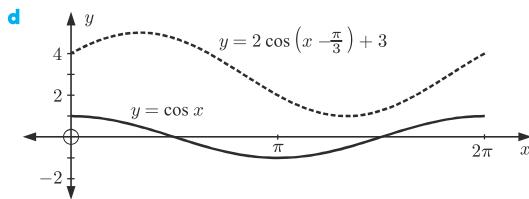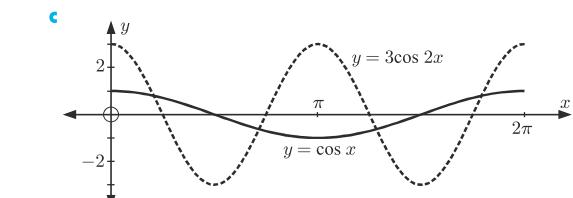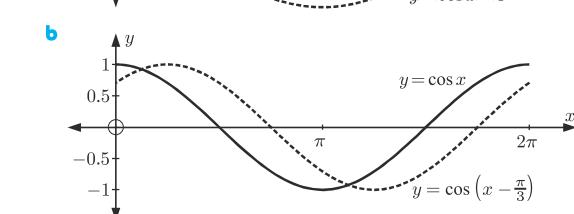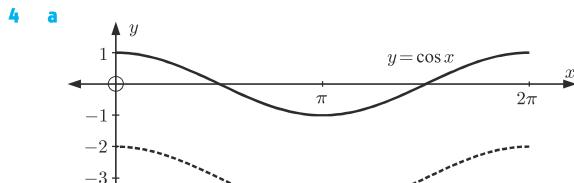
5 a $T \approx 7.05 \sin \frac{\pi}{6}(t - 10.5) + 24.75$

6 a translation through $\begin{pmatrix} \frac{\pi}{3} \\ 1 \end{pmatrix}$

  b a vertical stretch of factor 2 followed by a reflection in the x-axis
  c a horizontal stretch, factor $\frac{1}{3}$

EXERCISE 11A.1

1 a $x \approx 0.3, 2.8, 6.6, 9.1, 12.9$ **b** $x \approx 5.9, 9.8, 12.2$
2 a $x \approx 1.2, 5.1, 7.4$ **b** $x \approx 4.4, 8.2, 10.7$
3 a $x \approx 0.4, 1.2, 3.5, 4.3, 6.7, 7.5, 9.8, 10.6, 13.0, 13.7$
  b $x \approx 1.7, 3.0, 4.9, 6.1, 8.0, 9.3, 11.1, 12.4, 14.3, 15.6$
4 a i ≈ 1.6 **ii** ≈ -1.1
  b i $x \approx 1.1, 4.2, 7.4$ **ii** $x \approx 2.2, 5.3$

EXERCISE 11A.2

1 a $x \approx 0.446, 2.70, 6.73, 8.98$
  b $x \approx 2.52, 3.76, 8.80, 10.0$
  c $x \approx 0.588, 3.73, 6.87, 10.0$
2 a $x \approx -0.644, 0.644$ **b** $x \approx -4.56, -1.42, 1.72, 4.87$
  c $x \approx -2.76, -0.384, 3.53$
3 a $x \approx 1.08, 4.35$ **b** $x \approx 0.666, 2.48$
  c $x \approx 0.171, 4.92$ **d** $x \approx 1.31, 2.03, 2.85$
4 $x \approx -0.951, 0.234, 5.98$

EXERCISE 11A.3

1 a $x = \frac{\pi}{3}, \frac{5\pi}{3}, \frac{7\pi}{3}, \frac{11\pi}{3}$ **b** $x = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{9\pi}{4}, \frac{11\pi}{4}$
  c $x = \frac{\pi}{4}, \frac{5\pi}{4}, \frac{9\pi}{4}, \frac{13\pi}{4}$
2 a $x = -\frac{5\pi}{3}, -\frac{4\pi}{3}, \frac{\pi}{3}, \frac{2\pi}{3}$ **b** $x = -\frac{5\pi}{4}, -\frac{3\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}$
  c $x = -\frac{5\pi}{4}, -\frac{\pi}{4}, \frac{3\pi}{4}, \frac{7\pi}{4}$
3 a $0 \leqslant 2x \leqslant 4\pi$ **b** $0 \leqslant \frac{x}{3} \leqslant \frac{2\pi}{3}$
  c $\frac{\pi}{2} \leqslant x + \frac{\pi}{2} \leqslant \frac{5\pi}{2}$ **d** $-\frac{\pi}{6} \leqslant x - \frac{\pi}{6} \leqslant \frac{11\pi}{6}$
  e $-\frac{\pi}{2} \leqslant 2(x - \frac{\pi}{4}) \leqslant \frac{7\pi}{2}$ **f** $-2\pi \leqslant x \leqslant 0$
4 a $-3\pi \leqslant 3x \leqslant 3\pi$ **b** $-\frac{\pi}{4} \leqslant \frac{x}{4} \leqslant \frac{\pi}{4}$
  c $-\frac{3\pi}{2} \leqslant x - \frac{\pi}{2} \leqslant \frac{\pi}{2}$ **d** $-\frac{3\pi}{2} \leqslant 2x + \frac{\pi}{2} \leqslant \frac{5\pi}{2}$
  e $-2\pi \leqslant -2x \leqslant 2\pi$ **f** $0 \leqslant \pi - x \leqslant 2\pi$
5 a $x = \frac{\pi}{3}, \frac{5\pi}{3}, \frac{7\pi}{3}$ **b** $x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}, \frac{13\pi}{6}, \frac{17\pi}{6}$
  c $x = 0, \frac{4\pi}{3}, 2\pi$
6 a $x = \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{8\pi}{3}, \frac{10\pi}{3}, \frac{14\pi}{3}$
  b $x = -330°, -210°, 30°, 150°$
  c $x = \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{17\pi}{6}$ **d** $x = -\frac{5\pi}{3}, -\pi, \frac{\pi}{3}, \pi$
  e $x = -\frac{13\pi}{6}, -\frac{3\pi}{2}, -\frac{\pi}{6}, \frac{\pi}{2}, \frac{11\pi}{6}, \frac{5\pi}{2}$ **f** $x = 0, \frac{3\pi}{2}, 2\pi$
  g $x = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}$
  h $x = -\frac{8\pi}{9}, -\frac{4\pi}{9}, -\frac{2\pi}{9}, \frac{2\pi}{9}, \frac{4\pi}{9}, \frac{8\pi}{9}$
  i $x = 0, \frac{\pi}{4}, \frac{\pi}{2}, \frac{3\pi}{4}, \pi$ **j** $x = 0, \frac{\pi}{6}, \pi, \frac{7\pi}{6}, 2\pi$