1   **a** 0.755   **b** −0.354   **c** 0.530   **d** −0.255

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

   e $= 1$ **f** $= \frac{1}{\sqrt{3}}$ **g** $= -\cos 60° = -\frac{1}{2}$ **h** $= \sin 45° = \frac{1}{\sqrt{2}}$

   i $= \tan 30° = \frac{1}{\sqrt{3}}$ **j** $= -\cos 45° = -\frac{1}{\sqrt{2}}$ **k** $= -\sin 60° = -\frac{\sqrt{3}}{2}$ **l** $= -\tan 60° = -\sqrt{3}$

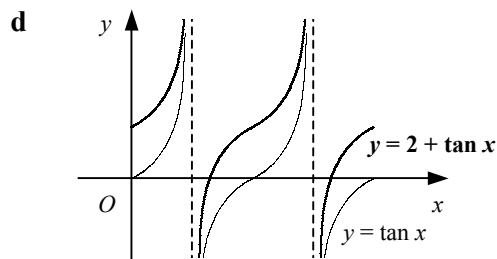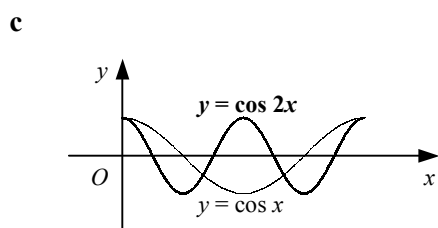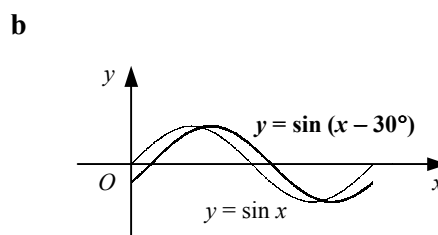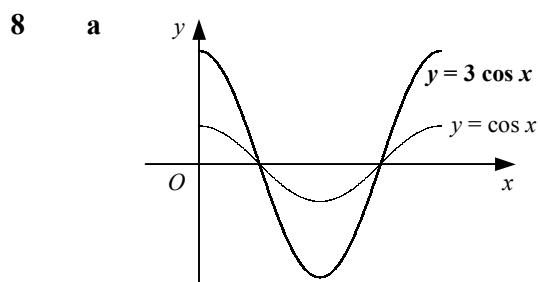   **m** $= \cos 30° = \frac{\sqrt{3}}{2}$ **n** $= -\tan 30° = -\frac{1}{\sqrt{3}}$ **o** $= \cos 60° = \frac{1}{2}$ **p** $= \sin 45° = \frac{1}{\sqrt{2}}$

   q $= -\tan 45° = -1$ **r** $= \sin 60° = \frac{\sqrt{3}}{2}$ **s** $= \tan 30° = \frac{1}{\sqrt{3}}$ **t** $= -\cos 30° = -\frac{\sqrt{3}}{2}$

3   **a** 0.913   **b** −0.851   **c** 0.042   **d** 0.252

4   **a** $= \frac{1}{2}$ **b** $= 0$ **c** $= \frac{1}{\sqrt{2}}$ **d** $= \sqrt{3}$

   e $= \frac{1}{2}$ **f** $= \sin \frac{\pi}{3} = \frac{\sqrt{3}}{2}$ **g** $= -\tan \frac{\pi}{4} = -1$ **h** $= -\cos \frac{\pi}{6} = -\frac{\sqrt{3}}{2}$

   i $= -\tan \frac{\pi}{3} = -\sqrt{3}$ **j** $= -\cos \frac{\pi}{4} = -\frac{1}{\sqrt{2}}$ **k** $= -\sin \frac{\pi}{6} = -\frac{1}{2}$ **l** $= \tan \frac{\pi}{6} = \frac{1}{\sqrt{3}}$

   m $= \sin 0 = 0$ **n** $= -\tan \frac{\pi}{4} = -1$ **o** $= -\cos \frac{\pi}{3} = -\frac{1}{2}$ **p** $= -\sin \frac{\pi}{3} = -\frac{\sqrt{3}}{2}$

5   **a** (0, 0), (180, 0), (360, 0), (540, 0), (720, 0)

   b (90, 1), (270, −1), (450, 1), (630, −1)

6   **a** (0, 0), (180, 0), (360, 0), (540, 0), (720, 0)

   b $x = 90$, $x = 270$, $x = 450$, $x = 630$

7   **a** stretch by a factor of 3 in the *y*-direction about the *x*-axis

   b stretch by a factor of $\frac{1}{4}$ in the *x*-direction about the *y*-axis

   c translation by 60 units in the negative *x*-direction

   d reflection in the *y*-axis

8 **a**

$y = 3 \cos x$

$y = \cos x$

b

$y = \sin (x - 30°)$

$y = \sin x$

c

$y = \cos 2x$

$y = \cos x$

d

$y = 2 + \tan x$

$y = \tan x$

e

$y = -\sin x$

$y = \sin x$

f

$y = \cos (x + 60°)$

$y = \cos x$

g

$y = \tan \frac{1}{2} x$

$y = \tan x$

h

$y = 1 + \sin x$

$y = \sin x$
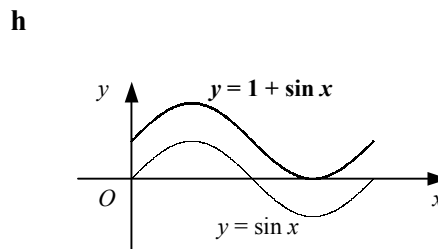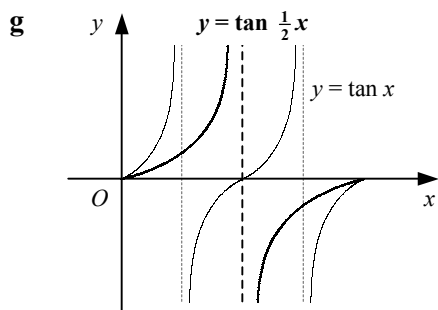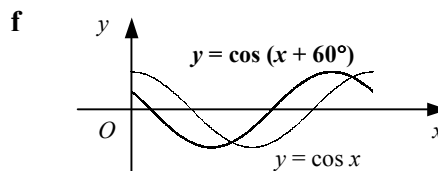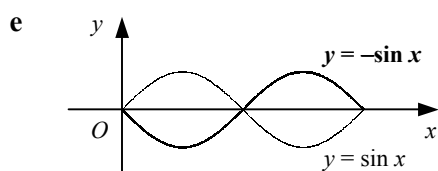
9 **a** (−90°, −2), (90°, 2)

b (−180°, 1), (0, 3), (180°, 1)

c (−150°, −1), (−90°, 1), (−30°, −1),
(30°, 1), (90°, −1), (150°, 1)

d (−135°, −1), (45°, 1)

10 **a** 360° **b** 180° **c** 360°

d 180° **e** 180° **f** 1080°

11 **a**

$x = 90$ $x = 270$

$(360, 0)$

O $(0, 0)$ $(180, 0)$ x

b

$(0, \frac{\sqrt{3}}{2})$ $(60, 0)$

O $(240, 0)$ x

c

$(0, 0)$ $(180, 0)$ $(360, 0)$

O $(90, 0)$ $(270, 0)$ x

d

$(0, 2)$

O $(180, 0)$ x

e

O $(0, 0)$ $(360, 0)$ x

f

$x = 0$ $x = 180$ $x = 360$

O $(90, 0)$ $(270, 0)$ x

g

$(225, 0)$

O $(45, 0)$ x

$(0, -\frac{1}{\sqrt{2}})$

h

$(0, 0)$

O $(180, 0)$ $(360, 0)$ x

$x = 90$ $x = 270$

i

$(210, 0)$

O $(30, 0)$ x

$(0, -\frac{1}{2})$

12 **a**

$(0, 1)$ $(2\pi, 1)$

O x

$(\pi, -1)$

b

$(\frac{\pi}{2}, 3)$

O x

$(\frac{3\pi}{2}, -3)$

c

$x = \frac{3\pi}{4}$ $x = \frac{7\pi}{4}$

O x

$x = \frac{\pi}{4}$ $x = \frac{5\pi}{4}$

d

$(\frac{5\pi}{6}, 1)$

O x

$(\frac{11\pi}{6}, -1)$

e

$(0, 1)$

O x

f

O $(\frac{\pi}{2}, -1)$ x

$(\frac{3\pi}{2}, -3)$

g

$x = \frac{\pi}{4}$ $x = \frac{5\pi}{4}$

O x

h

$(\frac{2\pi}{3}, 1)$

O x

$(2\pi, -1)$

i

$(\frac{\pi}{6}, 1)$

O x

$(\frac{7\pi}{6}, -1)$