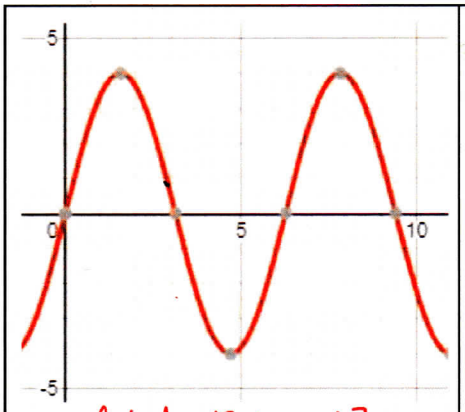
TRANSFORMATIONS OF GRAPHS OF TRIGONOMETRIC FUNCTIONS

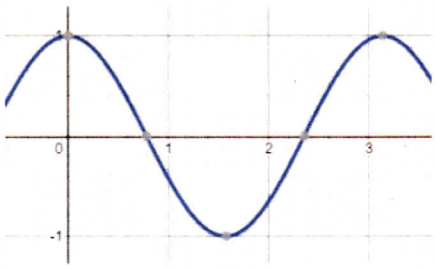
1 Sketch the graph of each of the following, stating the period and amplitude of the function:

(a) $y = 4\sin x,\ 0 \le x \le 2\pi$ **(b)** $y = \cos 2x,\ 0 \le x \le 2\pi$ **(c)** $y = 3\tan x,\ -\frac{\pi}{2} \le x \le \frac{\pi}{2}$

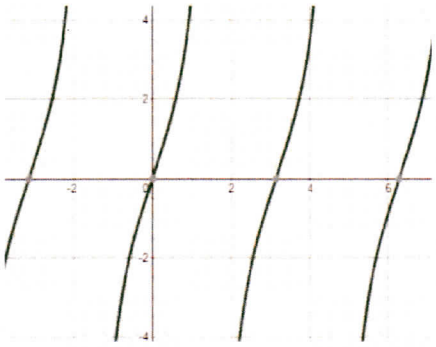
(d) $y = 4\sin 3x,\ 0 \le x \le 2\pi$ **(e)** $y = 3\cos 2x,\ 0 \le x \le 2\pi$ **(f)** $y = 3\tan 2x,\ -\frac{\pi}{2} \le x \le \frac{\pi}{2}$



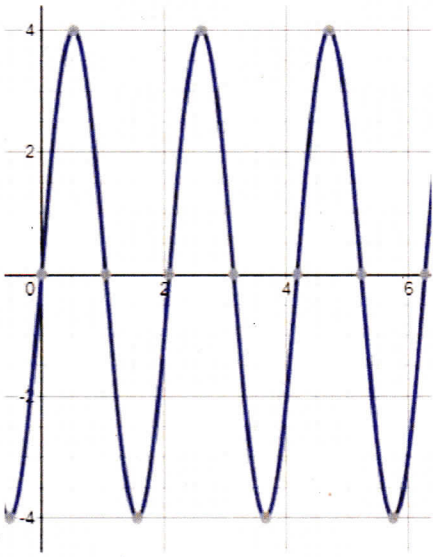
amplitude $[-4, +4]$
period 2π



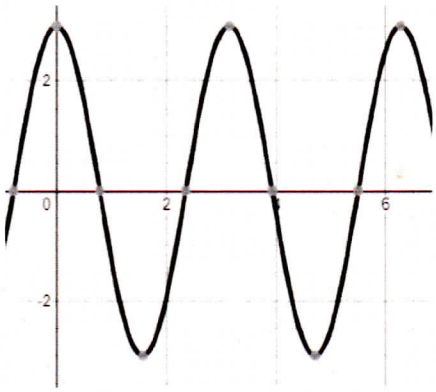
period π
amplitude $[-1, +1]$



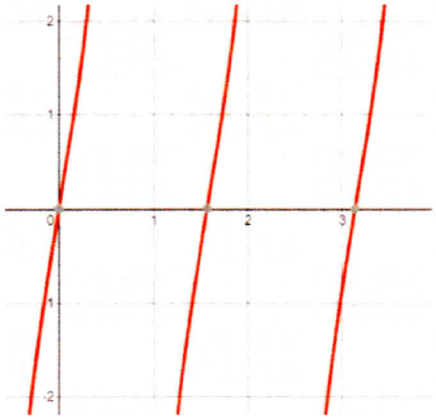
period π
amplitude $(-\infty, +\infty)$



period $2\pi/3$
amplitude $[-4, +4]$



period π
amplitude $[-3, +3]$

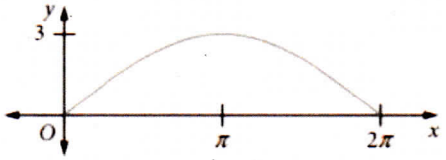


period $\pi/2$
amplitude $(-\infty, +\infty)$

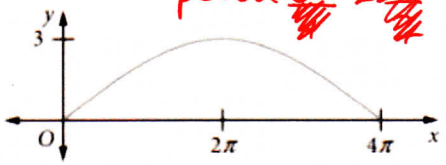
2 Which diagram shows the graph of $y = 3\sin\frac{x}{4}$ for $0 \le x \le 4\pi$?

amplitude $[-3, +3]$
period 8π

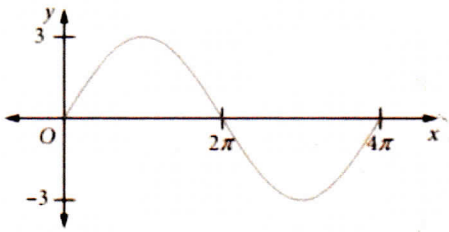
A



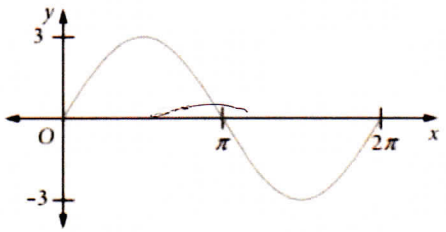
B



C



D



3 Sketch the graph of each of the following, stating the period and amplitude of each function:

(a) $y = 3\sin\frac{x}{2}, -\pi \le x \le \pi$ **(b)** $y = 2\cos\frac{x}{2}, 0 \le x \le 2\pi$ **(c)** $y = 3\tan\frac{x}{2}, 0 \le x \le 2\pi$

See DESMOS

4 Sketch the graph of $y = \cos x, 0 \le x \le \pi$. On the same axes, sketch the graph of:

(a) $y = -\cos x$ **(b)** $y = 1 - \cos x$

DESMOS

5 Sketch the graph of $y = \sin x, -\pi \le x \le \pi$. On the same axes, sketch the graph of:

(a) $y = 2\sin x$ **(b)** $y = -2\sin x$ **(c)** $y = 3 - 2\sin x$

DESMOS

9 Sketch the graph of each of the following.

(a) $y = 2\sin\left(\theta - \frac{\pi}{2}\right)$ **(b)** $y = 3\cos\left(\theta + \frac{\pi}{4}\right)$ **(c)** $y = 2\sin(\theta - \pi)$

DESMOS

(d) $y = 5\cos 3\left(\theta + \frac{\pi}{3}\right)$ **(e)** $y = \frac{1}{2}\tan 2(\theta + \pi)$ **(f)** $y = \sqrt{2}\sin\left(2\theta - \frac{\pi}{2}\right)$

DESMOS

10 Sketch the graph of each:

(a) $y = \sin 2\theta + 1$ **(b)** $y = 3\cos\theta - 2$ **(c)** $y = \frac{1}{2}\sin\left(\theta - \frac{\pi}{2}\right) + 3$

DESMOS

(d) $y = 2\cos 2\left(\theta - \frac{\pi}{4}\right) + 1$ **(e)** $y = 4\sin 3\left(\theta - \frac{\pi}{6}\right) - 2$ **(f)** $y = 3 - \sin\left(\theta - \frac{\pi}{2}\right)$

DESMOS

11 By adding ordinates, sketch the graphs of:

(a) $y = \sin\theta + \cos\theta$ **(b)** $y = 3\sin 2\theta + 4\sin\theta$ **(c)** $y = 2\cos 3\theta + 3\sin 2\theta$

DESMOS

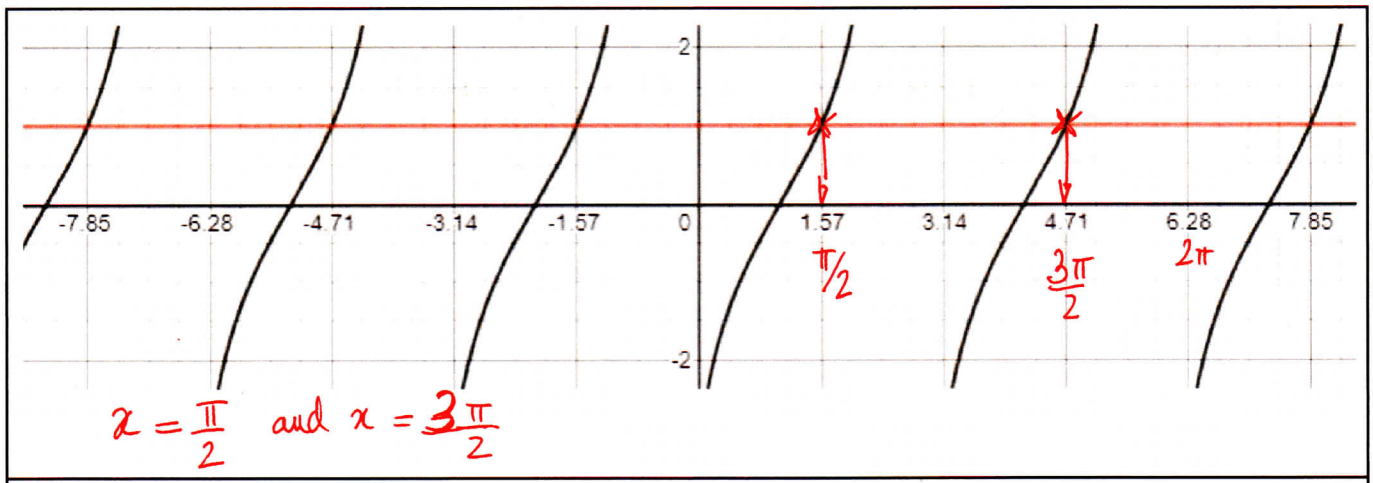
(d) $y = \sin 2\theta - \cos\theta$ **(e)** $y = \frac{1}{2}\cos 2\theta - \sin\theta$ **(f)** $y = \sin\theta + \sin 2\theta$

DESMOS

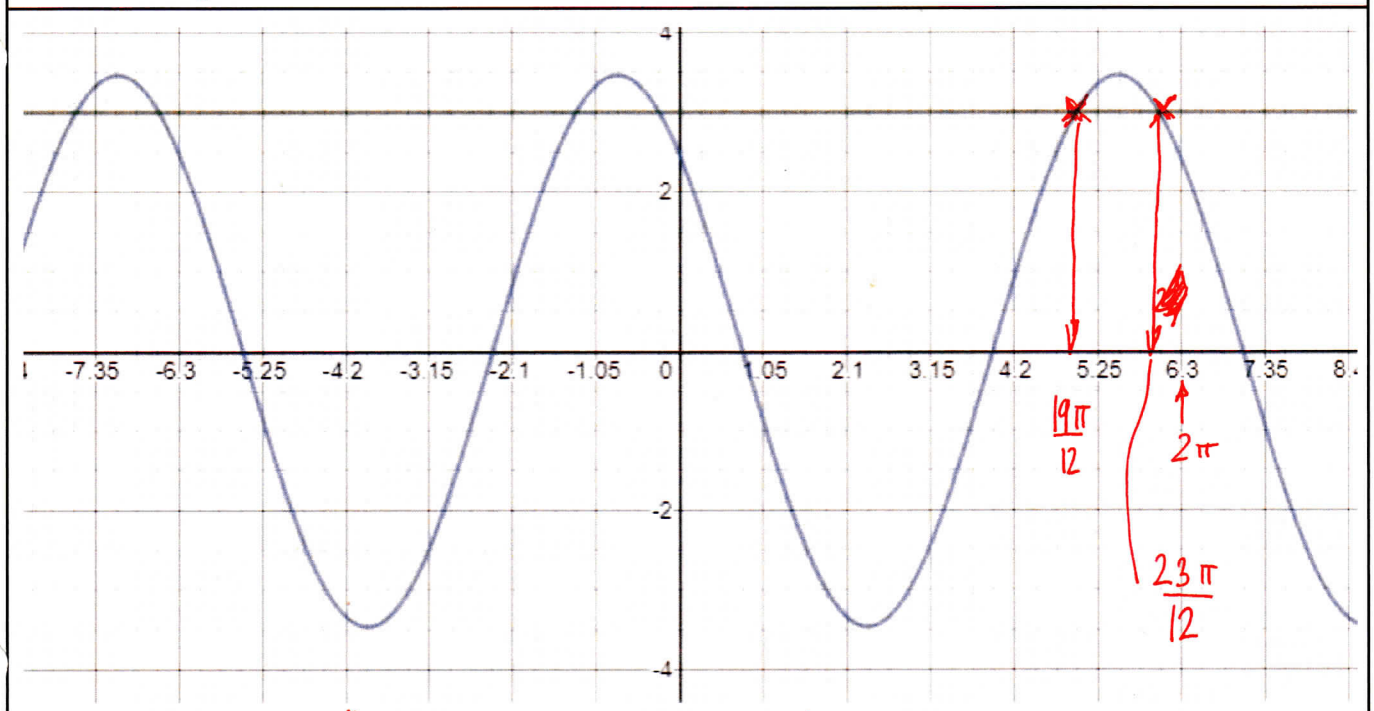
TRANSFORMATIONS OF GRAPHS OF TRIGONOMETRIC FUNCTIONS

13 By drawing appropriate graphs, solve each equation for $0 \le x \le 2\pi$.

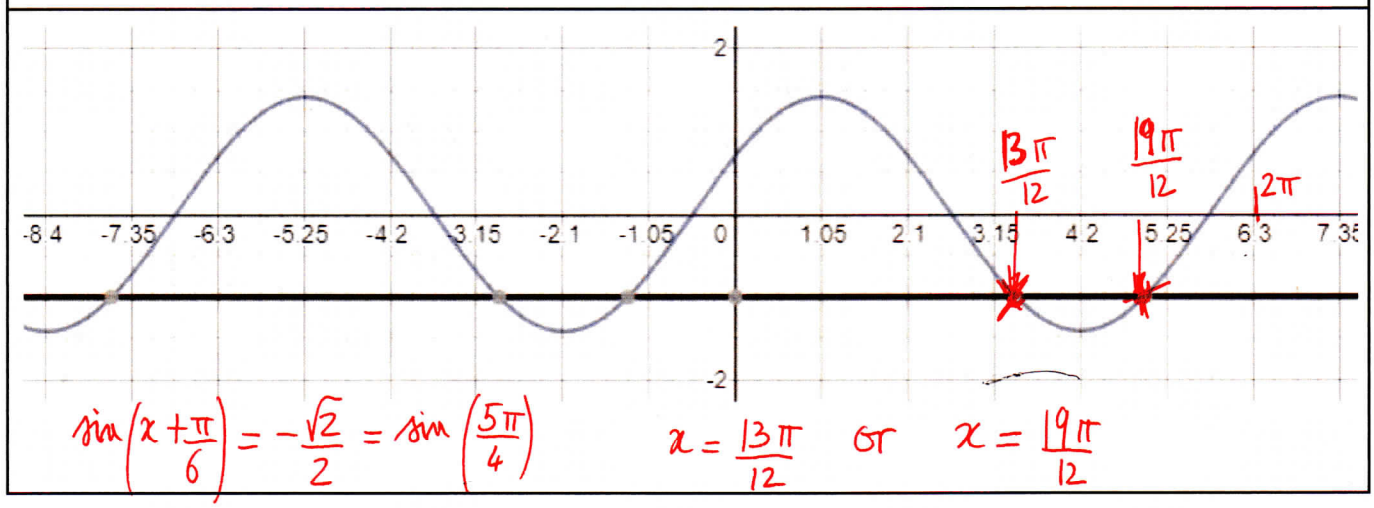
(a) $\sqrt{3}\tan\left(x-\frac{\pi}{3}\right)-1=0$ **(b)** $2\sqrt{3}\cos\left(x+\frac{\pi}{4}\right)-3=0$ **(c)** $\sqrt{2}\sin\left(x+\frac{\pi}{6}\right)+1=0$



$x = \frac{\pi}{2}$ and $x = \frac{3\pi}{2}$



so $x = \frac{23}{12}\pi$ and $x = \frac{19}{12}\pi$



$\sin\left(x+\frac{\pi}{6}\right) = -\frac{\sqrt{2}}{2} = \sin\left(\frac{5\pi}{4}\right)$ $x = \frac{13\pi}{12}$ or $x = \frac{19\pi}{12}$