MCR 3UI – *Transformations of Trig Functions*

PART A – *Amplitude*

1. Graph and state the *amplitude* for each of the following:

a) $y = \sin x$ — a = 1

b) $y = 2\sin x$ — a = 2

c) $y = 3\cos x$ — a = 3

2. How can the amplitude be determined from the equation?

- the number in front of the trig function gives the amplitude

3. State the equation of a sine curve with:

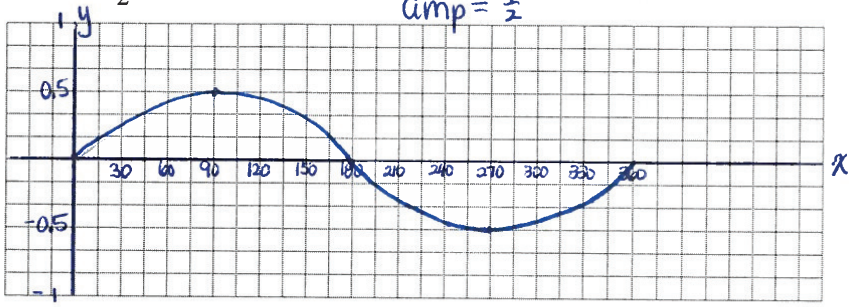
a) amplitude $\frac{1}{2}$ — $y = \frac{1}{2}\sin x$

b) amplitude $\frac{3}{4}$ — $y = \frac{3}{4}\sin x$

c) amplitude $\frac{5}{2}$ — $y = \frac{5}{2}\sin x$

Eg. 1 Graph $y = \frac{1}{2}\sin x$. State the *amplitude*.

amp = $\frac{1}{2}$



PART B – *Period*

1. Graph and state the *period* for each of the following:

a) $y = \sin x$ — period = 360°

b) $y = \sin 2x$ — period = 180°

c) $y = \sin 3x$ — period = 120°

d) $y = \cos\frac{x}{2}$ — period = 720°

e) $y = \cos\frac{x}{4}$ — period = 1440°

f) $y = \cos\frac{2x}{3}$ — period = 540°

2. How can the period be determined from the equation?

Given an equation of form $y = \sin(kx)$ or $y = \cos(kx)$

$\text{period} = \frac{360}{k}$

3. State the equation of a sine curve with:

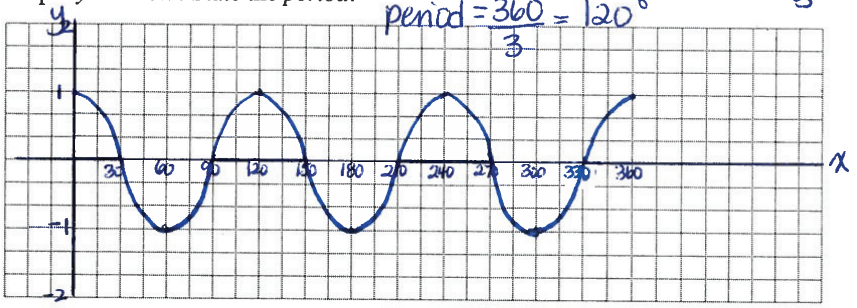
a) period 90° — $90 = \frac{360}{k}$ $\therefore y = \sin 4x$, $k = 4$

b) period 45° — $45 = \frac{360}{k}$ $\therefore y = \sin 8x$, $k = 8$

c) period 1080° — $1080 = \frac{360}{k}$ $\therefore y = \sin\frac{1}{3}x$, $k = \frac{1}{3}$ or $y = \sin\frac{x}{3}$

Eg. 2 Graph $y = \cos 3x$. State the *period*.

period = $\frac{360}{3} = 120°$



PART C – *Phase Shift (ie. horizontal shift)*

1. Graph and describe the transformation for each of the following:

   a) $y = \sin x$ — no shift

   b) $y = \sin(x - 90°)$ — shift right 90°

   c) $y = \sin(x + 90°)$ — shift left 90°

   d) $y = \cos(x - 180°)$ — shift right 180°

   e) $y = \cos(x + 270°)$ — shift left 270°

2. What happens to the graph of the function $f(x) = \sin(x - p)$ or $f(x) = \cos(x - p)$ when

   a) $p > 0$? — shift right p units

   b) $p < 0$? — shift left p units

3. State the equation of a sine curve with the following *phase shifts*:

   a) 45° to the *left* — $y = \sin(x + 45°)$

   b) 30° to the *right* — $y = \sin(x - 30°)$

   c) 180° to the *right* — $y = \sin(x - 180°)$

4. Verify your answers to #3 by graphing.

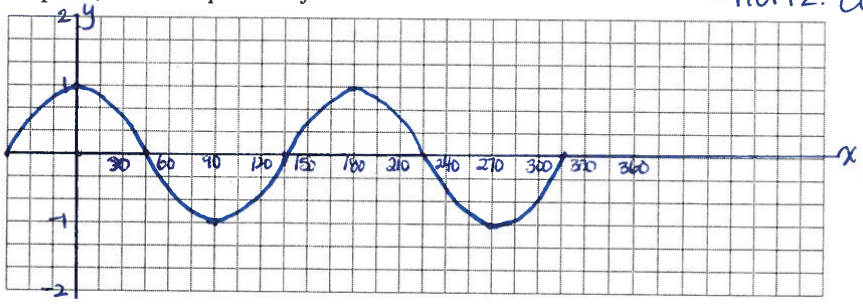
5. Predict the phase shift for each of the following and verify by graphing:

   a) $y = \sin(x - 270°)$ — - shift right 270°

   b) $y = \sin 2(x - 60°)$ — - shift left 60°
   - horiz. comp of 2

   c) $y = \sin(2x + 90°)$ — $= \sin[2(x + 45°)]$
   - shift left 45°
   - horiz. comp. of 2

Eg. 3 Graph **5c)**. State the *phase shift*.



PART D – *Vertical Shift*

1. Graph and describe the transformation for each of the following:

   a) $y = \sin x$ — no shift

   b) $y = \sin x + 2$ — shift up 2

   c) $y = \cos x - 3$ — shift down 3

2. What happens to the graph of the function $f(x) = \sin x + q$ when

   a) $q > 0$? — shift up q units

   b) $q < 0$? — shift down q units

Eg. 4 Graph $y = \cos x - 2$. State the *vertical shift*.