

5.4 Graphing Trigonometric Functions

$$y = a \sin b(x - c) + d$$

or

$$y = a \cos b(x - c) + d$$

Graphs

Amplitude: a

Max: $d + |a|$

Period: $\frac{2\pi}{|b|}$

Min: $d - |a|$

Phase shift: c

Domain: $x \in \mathbb{R}$

Vertical displacement: d

range: $d - |a| \leq y \leq d + |a|$

key

Graph ¹ ~~two~~ cycles of each function. Label 5 key points per cycle and indicate the scale on the x-axis.

1) $y = -3 \cos 3(x - \pi) + 1$

$$T = \frac{2\pi}{3}$$

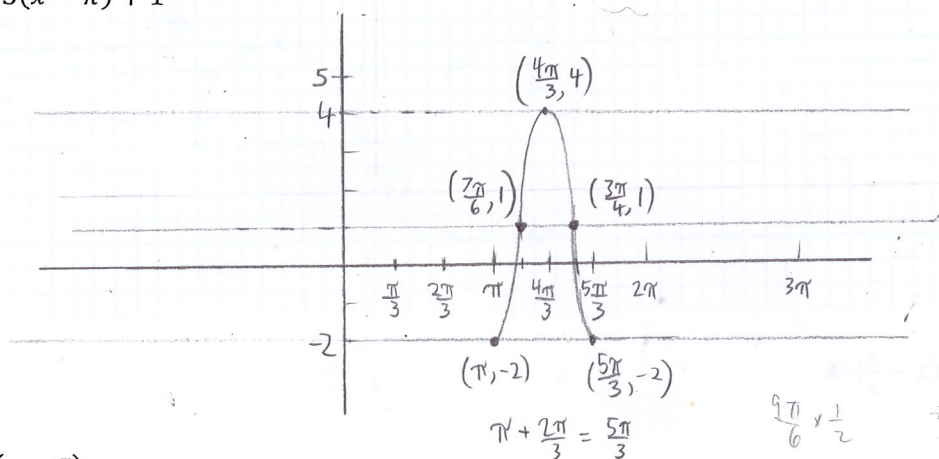
$$A = 3$$

$$p.s. = \pi$$

$$v.d. = 1$$

$$\max = 4$$

$$\min = -2$$



2) $y = 2 \sin \frac{1}{2}(x + \frac{\pi}{4}) - 2$

$$T = 2\pi / \frac{1}{2} = 4\pi$$

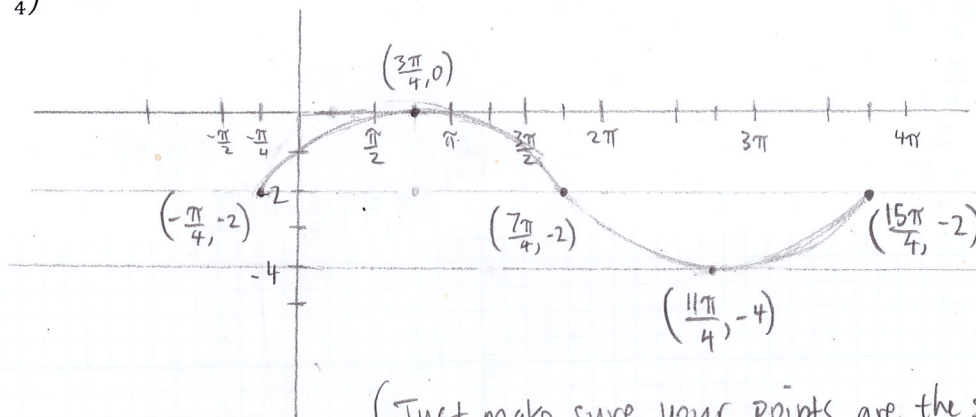
$$A = 2$$

$$p.s. = -\frac{\pi}{4}$$

$$v.d. = -2$$

$$\max = 0$$

$$\min = -4$$



(Just make sure your points are the same.)

3) $y = -\sin(\frac{3}{2}x - \frac{\pi}{6}) + 4$

$$= -\sin[\frac{3}{2}(x - \frac{\pi}{6})] + 4$$

$$A = 1$$

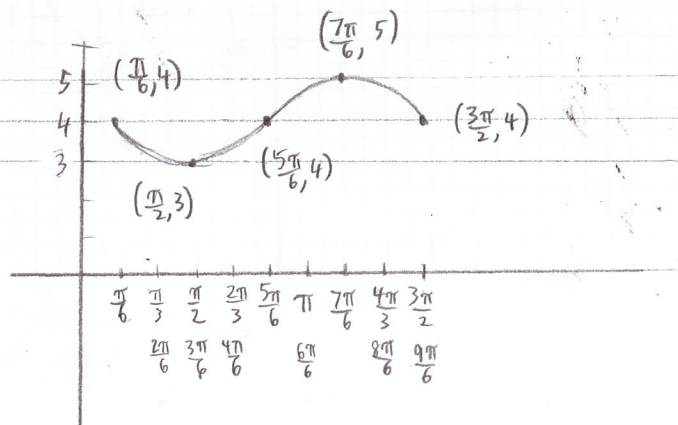
$$T = 2\pi / (\frac{3}{2}) = \frac{4\pi}{3}$$

$$p.s. = \pi/6$$

$$v.d. = 4$$

$$\max = 5$$

$$\min = 3$$



4) $y = -4\sin(2x) - 3$

$A = 4$

$T = \frac{2\pi}{2} = \pi$

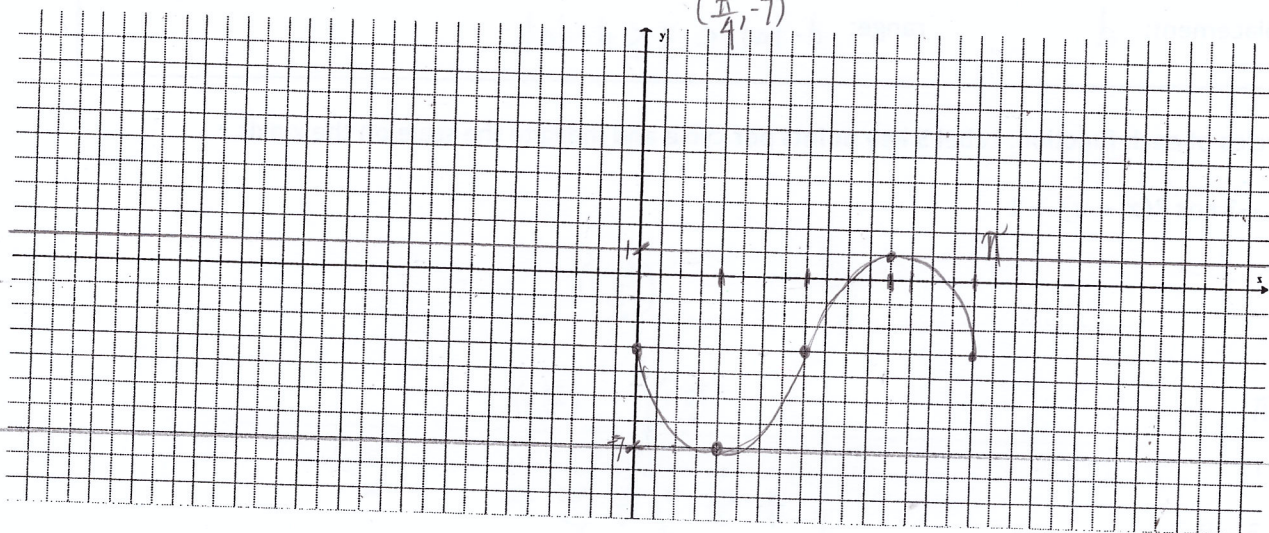
P.S. = 0

V.d = -3

max = 1

min = -7

$(0, -3)$ $(\frac{\pi}{4}, -7)$ $(\frac{\pi}{2}, -3)$ $(\frac{3\pi}{4}, 1)$ $(\pi, -3)$



5) $y = 3\cos 2(x - \frac{\pi}{6}) + 2$

$A = 3$

$T = \frac{2\pi}{2} = \pi$

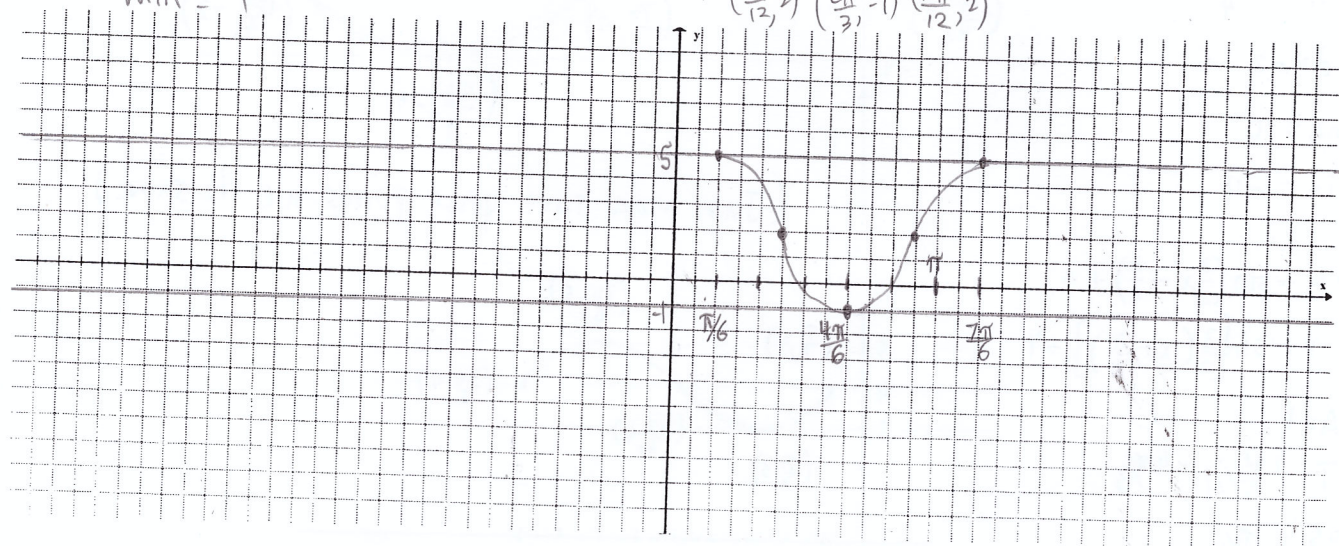
P.S. = $\frac{\pi}{6}$

V.d = 2

max = 5

min = -1

$(\frac{\pi}{6}, 5)$ $(\frac{5\pi}{12}, 2)$ $(\frac{2\pi}{3}, -1)$ $(\frac{11\pi}{12}, 2)$ $(\frac{7\pi}{6}, 5)$



6) $y = -4 \cos \frac{2}{3} \left(x + \frac{2\pi}{3} \right)$

$A = 4$ $\max = 4$
 $T = \frac{2\pi}{(\frac{2}{3})} = 3\pi$ $\min = -4$
 $PS = -\frac{2\pi}{3}$
 $vd = 0$

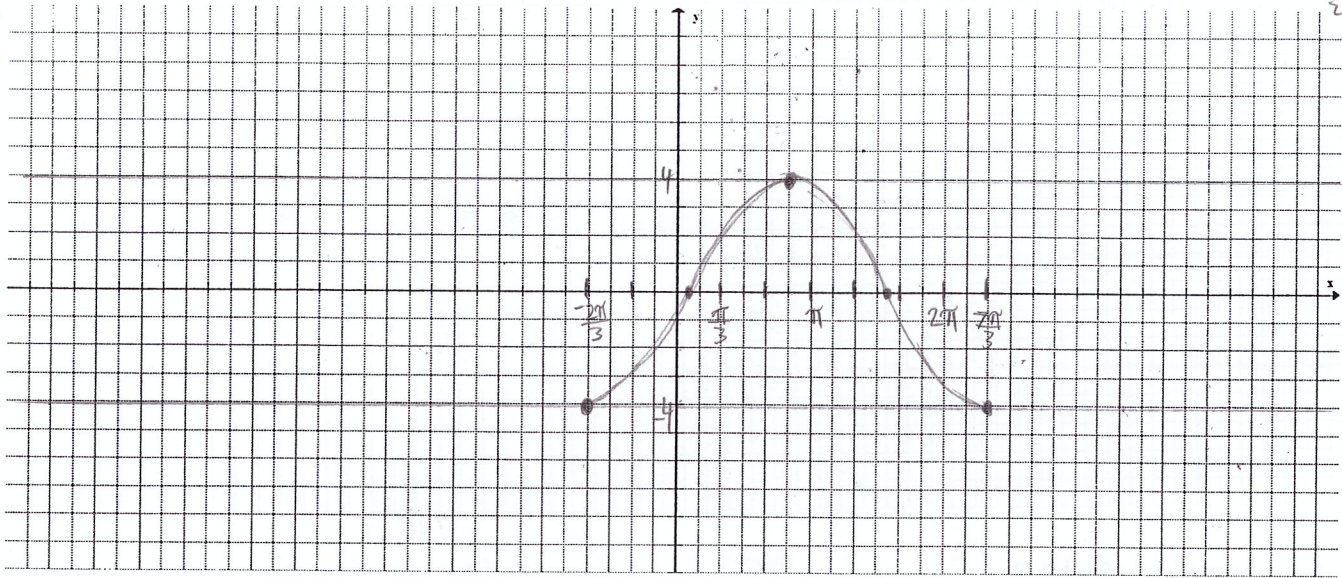
$-\frac{2\pi}{3} + 3\pi = \frac{+7\pi}{3}$ $\frac{1}{2} \left(\frac{7\pi}{3} + \frac{-2\pi}{3} \right) = \frac{5\pi}{6}$

$\frac{1}{2} \left(\frac{5\pi}{6} + \frac{-2\pi}{3} \right)$

$= \frac{\pi}{12}$

$\frac{1}{2} \left(\frac{5\pi}{6} + \frac{7\pi}{3} \right)$

$= \frac{19\pi}{12}$



$\left(-\frac{2\pi}{3}, -4 \right) \left(\frac{\pi}{12}, 0 \right) \left(\frac{5\pi}{6}, 4 \right) \left(\frac{19\pi}{12}, 0 \right) \left(\frac{7\pi}{3}, -4 \right)$

7) $y = 3 \sin \frac{3}{4} \left(x - \frac{\pi}{6} \right) + 1$

$A = 3$

$T = \frac{2\pi}{(3/4)} = \frac{8\pi}{3}$

$PS = \pi/6$

$vd = 1$

$\max = 4$

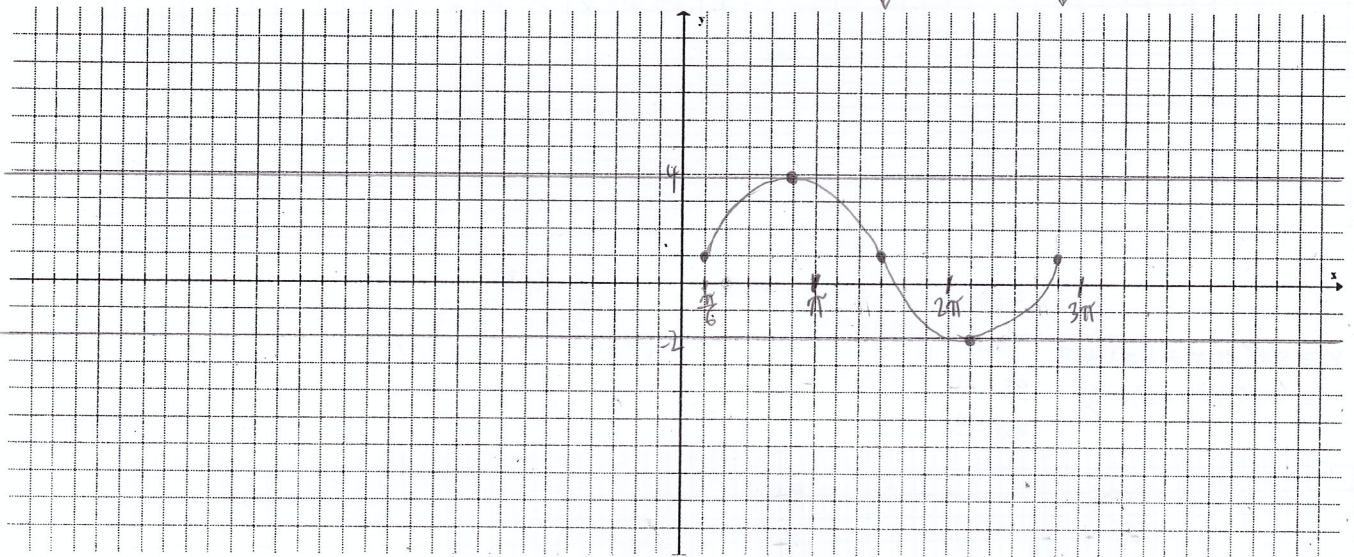
$\min = -2$

$\frac{\pi}{6} + \frac{8\pi}{3} = \frac{17\pi}{6}$

$\frac{3\pi}{2}$

$\frac{17\pi}{6}$

$\frac{1}{2} \left(\frac{17\pi}{6} + \frac{\pi}{6} \right) = \frac{3\pi}{2}$

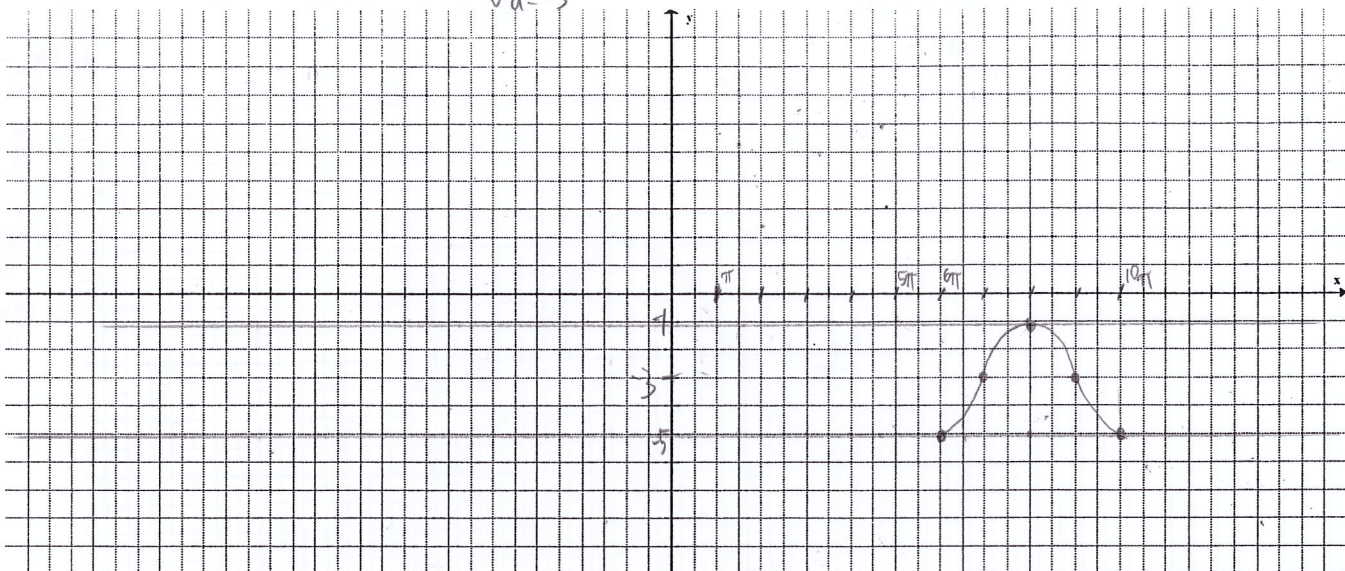


$\left(\frac{\pi}{6}, 1 \right) \left(\frac{5\pi}{6}, 4 \right) \left(\frac{3\pi}{2}, 1 \right) \left(\frac{17\pi}{6}, 1 \right) \left(\frac{13\pi}{6}, -2 \right)$

$$= -2 \cos\left[\frac{1}{2}(x - 6\pi)\right] - 3$$

8) $y = -2 \cos\left(\frac{1}{2}x - 3\pi\right) - 3$

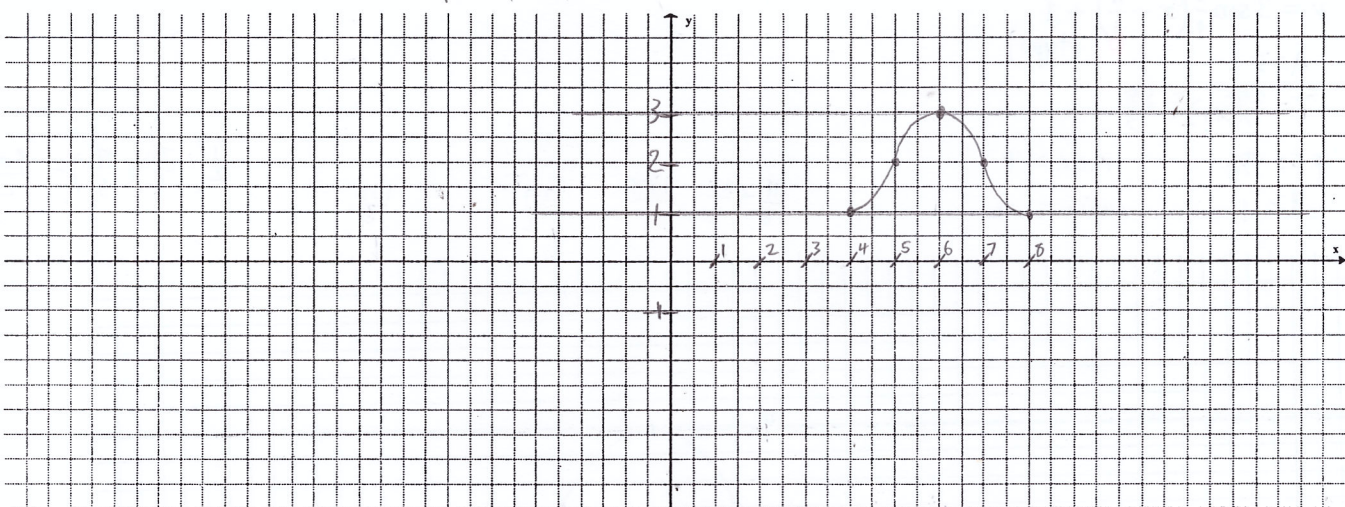
$A = 2$ $\max = -1$
 $T = 4\pi$ $\min = -5$
 $p_s = 6\pi$
 $v_d = -3$



9) $y = -\cos\left(\frac{\pi}{2}x - 2\pi\right) + 2$
 $= -\cos\frac{\pi}{2}(x - 4) + 2$

$A = 1$ $\max = 3$
 $T = 2\pi \div \frac{\pi}{2} = 4$ $\min = 1$
 $p_s = 4$ $v_d = 2$

$(8\pi, -1)$
 $(-7\pi, -3)$ $(9\pi, -3)$
 $(6\pi, -5)$ $(10\pi, -5)$



10) $y = \sin(2\pi x + 8\pi) + 3$
 $= \sin 2\pi(x + 4) + 3$

$A = 1$ $\max = 4$
 $T = 1$ $\min = 2$
 $p_s = -4$ $v_d = 3$

$(6, 3)$
 $(5, 2)$ $(7, 2)$
 $(4, 1)$ $(9, 1)$

