

## Pre-Exam Assignment - Part 2

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1.  $\cos 2x + \sin x = 0$   $0 \leq x \leq 2\pi$

$$(1 - 2\sin^2 x) + \sin x = 0$$

$$2\sin^2 x - \sin x - 1 = 0$$

$$(2\sin x + 1)(\sin x - 1) = 0$$

$$\sin x = -\frac{1}{2} \quad \sin x = 1$$

$$x = \frac{7\pi}{6}, \frac{11\pi}{6} \quad x = \frac{\pi}{2}$$

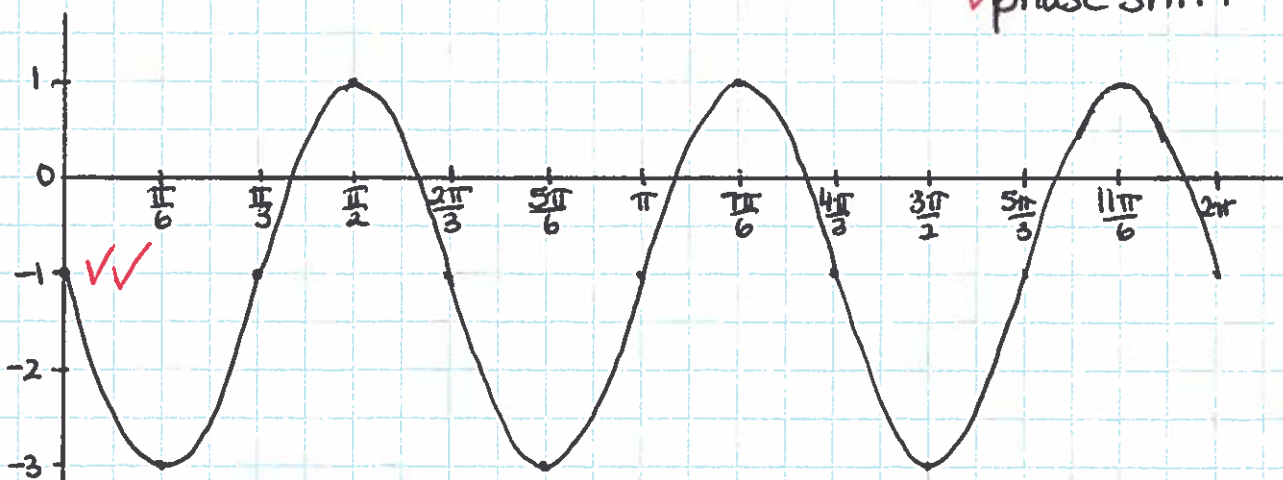
2.  $y = 2 \cos \left[ 3\theta + \frac{\pi}{2} \right] - 1$   $0 \leq \theta \leq 2\pi$

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

✓ period =  $\frac{2\pi}{3}$

✓ amp = 2

✓ phase shift = left  $\frac{\pi}{6}$



3. a) Method 1: Using sum/difference formula

$$\begin{aligned}\sin\left(\frac{7\pi}{12}\right) &= \sin\left(\frac{3\pi}{12} + \frac{4\pi}{12}\right) \\ &= \sin\left(\frac{\pi}{4} + \frac{\pi}{3}\right) \checkmark \\ &= \sin\frac{\pi}{4}\cos\frac{\pi}{3} + \cos\frac{\pi}{4}\sin\frac{\pi}{3} \checkmark \\ &= \left(\frac{1}{\sqrt{2}}\right)\left(\frac{1}{2}\right) + \left(\frac{1}{\sqrt{2}}\right)\left(\frac{\sqrt{3}}{2}\right) \\ &= \frac{1+\sqrt{3}}{2\sqrt{2}} \checkmark \quad *\end{aligned}$$

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Method 2: Using double angle formula

$$\text{Let } x = \frac{7\pi}{12} \text{ then } 2x = 2\left(\frac{7\pi}{12}\right) = \frac{7\pi}{6}$$

$$\begin{aligned}\cos 2x &= 1 - 2\sin^2 x \\ \cos\left(\frac{7\pi}{6}\right) &= 1 - 2\sin^2\left(\frac{7\pi}{12}\right) \checkmark\end{aligned}$$

$$\left(\frac{-\sqrt{3}}{2}\right) \checkmark = 1 - 2\sin^2\left(\frac{7\pi}{12}\right)$$

$$\frac{-\sqrt{3}}{2} - 1 = -2\sin^2\left(\frac{7\pi}{12}\right)$$

$$\checkmark \frac{-\sqrt{3}-2}{2} = -2\sin^2\left(\frac{7\pi}{12}\right)$$

$$\frac{-\sqrt{3}-2}{-4} = \sin^2\left(\frac{7\pi}{12}\right)$$

$$\checkmark \frac{\sqrt{3}+2}{4} = \sin^2\left(\frac{7\pi}{12}\right)$$

$$\checkmark \frac{\sqrt{3}+2}{2} = \sin\left(\frac{7\pi}{12}\right)$$

\* equivalent to answer above

3. b) Let  $x = \frac{3\pi}{8}$  then  $2x = \frac{3\pi}{4}$

$$\cos 2x = 2\cos^2 x - 1$$
$$\cos\left(\frac{3\pi}{4}\right) = 2\cos^2\left(\frac{3\pi}{8}\right) - 1 \quad \checkmark$$

$$\checkmark \left(\frac{-1}{\sqrt{2}}\right) = 2\cos^2\left(\frac{3\pi}{8}\right) - 1$$

$$\frac{-1}{\sqrt{2}} + 1 = 2\cos^2\left(\frac{3\pi}{8}\right)$$

$$\checkmark \frac{-1 + \sqrt{2}}{\sqrt{2}} = 2\cos^2\left(\frac{3\pi}{8}\right)$$

$$\checkmark \frac{-1 + \sqrt{2}}{2\sqrt{2}} = \cos^2\left(\frac{3\pi}{8}\right)$$

$$\checkmark \sqrt{\frac{-1 + \sqrt{2}}{2\sqrt{2}}} = \cos\left(\frac{3\pi}{8}\right)$$

4. LS =  $2\sin x \sin y$

RS =  $\cos(x-y) - \cos(x+y)$

$$\text{RS} = \cos(x-y) - \cos(x+y)$$
$$= [\cancel{\cos x \cos y} + \checkmark \sin x \sin y] - [\cancel{\cos x \cos y} - \checkmark \sin x \sin y]$$

$$= 2\sin x \sin y \quad \checkmark$$

$$\therefore \text{LS} = \text{RS}$$

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5. a) angular velocity  $\omega = \frac{5(2\pi)}{120} = \frac{10\pi}{120} = \frac{\pi}{12}$  rad/second

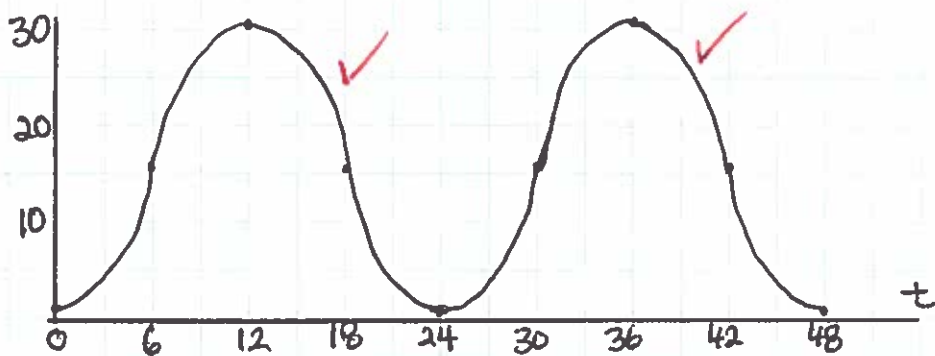
b)  $a = \theta r = \frac{15\pi}{4}(15)$  ✓  $\theta = \frac{\pi}{12}(45) = \frac{15\pi}{4}$  ✓  $r = 15$  m

$a = \frac{225\pi}{4}$

$a \approx 176.7$  m ✓

c)

t	h
0	1
6	16
12	31
18	16
24	1



d) Let the function be  $h = a \sin[k(t-p)] + q$

$a = \frac{31-1}{2} = 15$  m

$p =$  phase shift  $=$  right  $+ b$   
 $\therefore p = 6$

$k$ : period  $= 24$  sec  
 $\frac{2\pi}{k} = 24 \Rightarrow k = \frac{\pi}{12}$

$q =$  vertical shift  
 $q = 16$

$\therefore h = 15 \sin\left[\frac{\pi}{12}(t-6)\right] + 16$