

5.1-5.4 Assignment with solutions

Math 3200 In-Class Assignment Sections 5.1-5.4

Answer all questions in the space provided. Show ALL workings!!!!

1. For the function $y = 2 \sin 3(x - 30^\circ) + 6$ determine the following:

- a) Period 120
 b) Amplitude 2
 c) Phase Shift 30° Right
 d) Vertical Displacement 6 up
 e) Domain $x \in \mathbb{R}$
 f) Range $4 \leq y \leq 8$
 g) Maximum Value $d+a = 6+2 = 8$
 h) Minimum Value $d-a = 6-2 = 4$

(4 marks)

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

amp \downarrow HT \downarrow VT \downarrow

$$360^\circ \times \frac{1}{3} = 120^\circ$$

2. a) Write the equation of a sine function in the form $y = a \sin b(x-c) + d$ with the following characteristics: amplitude $\frac{2}{3}$, period 4π , phase shift $\frac{\pi}{3}$ left, vertical displacement 3 units down

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

(4 marks)

$$HS = \frac{\text{per}}{2\pi} = \frac{4\pi}{2\pi} = 2$$

b) Write the equation of a cosine function in the form $y = a \cos b(x-c) + d$ with the following characteristics: amplitude 5, period $\frac{\pi}{2}$, phase shift $\frac{\pi}{4}$ right, vertical displacement 2 units up

$$y = 5 \cos 4 \left(x - \frac{\pi}{4} \right) + 2$$

(4 marks)

$$HS = \frac{\pi}{2} \div 2\pi = \frac{1}{4}$$

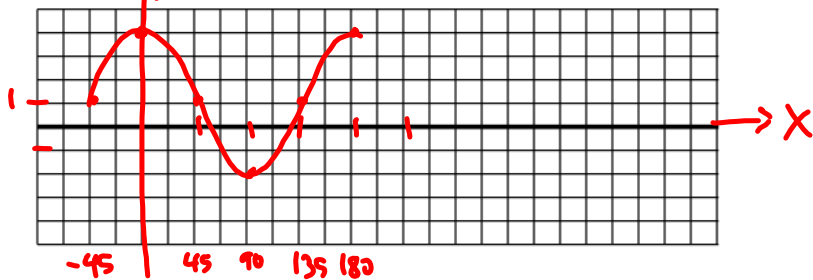
3. Sketch a graph of the following: $y = -3 \sin 2(x - 45^\circ) + 1$

$$(x, y) \rightarrow \left(\frac{1}{2}x + 45, -3y + 1 \right)_y$$

$$y = \sin x$$

x	y
-180	0
-90	-1
0	0
90	1
180	0
270	-1
360	0

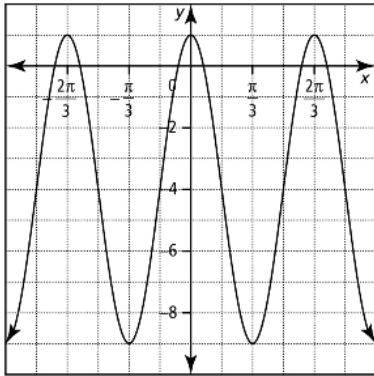
x	y
-45	1
0	4
45	1
90	-2
135	1
180	4
225	1



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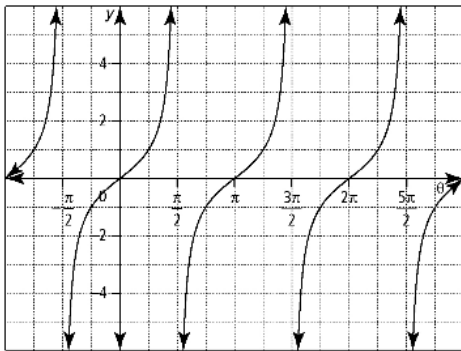
4. For the following graph determine an equation in the form of $y = a \sin b(x-c) + d$ and $y = a \cos b(x-c) + d$.

(7 marks)



5. Use the given graph of $y = \tan x$ to determine each value:

(2 marks)



$$\tan x = 1$$

$$x = \frac{\pi}{4} + \pi k, k \in \mathbb{I}$$

$$\tan x = -1$$

$$x = \frac{3\pi}{4} + \pi k, k \in \mathbb{I}$$

a) $\tan(\pi) = 0$

b) $\tan\left(\frac{17\pi}{4}\right) = ($

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6. The range of a trigonometric function of the form $y = a \cos b(x-c) + d$ is $\{y \mid -7 \leq y \leq 19, y \in \mathbb{R}\}$.

State the value of a and d .

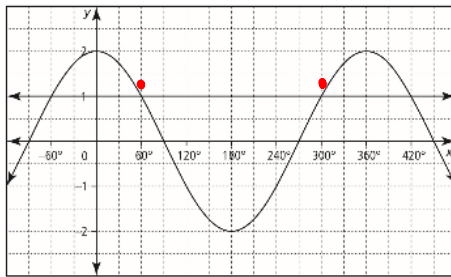
(2 marks)

$$a = 13 \quad d = 6$$

7. Using the graphs of $y = 2 \cos x$ and $y = 1$ provided, give the general solution to the equation

$2 \cos x = 1$, in degrees.

(2 marks)



Solution:

$$x = 60^\circ + 360^\circ k, k \in \mathbb{I}$$

$$x = 300^\circ + 360^\circ k, k \in \mathbb{I}$$

8. Solve the following equation algebraically: $\sin \frac{\pi}{3}(x-1) = 0.5$ (general solution in radians)

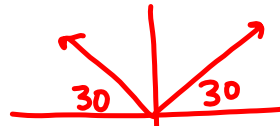
(4 marks)

$$\text{per} = 2\pi \div \frac{\pi}{3}$$

$$\text{per} = 2\pi \times \frac{3}{\pi}$$

$$\text{per} = 6$$

$$\sin A = 0.5$$



$$A = \frac{\pi}{6}$$

$$\frac{\pi}{3} \frac{\pi}{3} (x-1) = \frac{\pi}{6} \frac{3}{\pi} \quad x = \frac{3}{2}$$

$$A = \frac{5\pi}{6}$$

$$\frac{\pi}{3} \frac{\pi}{3} (x-1) = \frac{5\pi}{6} \frac{3}{\pi} \quad x = \frac{7}{2}$$

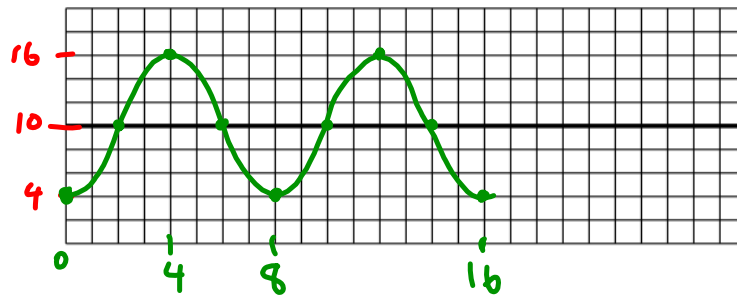
$$\frac{3}{2} + 6k, k \in \mathbb{I}$$

$$\frac{7}{2} + 6k, k \in \mathbb{I}$$

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9. At the bottom of its rotation, the tip of the blade of a windmill is 4 metres above the ground. At the top of its rotation, the blade tip is 16 metres above the ground. The blade rotates once every 8 seconds.

a) Sketch two complete cycles of this situation, starting with the tip at the bottom of its rotation. (2 marks)



b) A bug is perched on the tip of the blade. Determine the cosine equation to represent the height of the bug over time. (4 marks)

$$a = 6 \quad d = 10 \quad \text{per} = 8 \quad HS = \frac{8}{2\pi} = \frac{4}{\pi}$$

$$y = -6 \cos\left(\frac{\pi}{4}x\right) + 10$$

$$b = \frac{\pi}{4}$$

OR
$$y = 6 \cos\left(\frac{\pi}{4}(x-4)\right) + 10$$

c) What is the height of the bug at 10 seconds? (1 mark)

$$y = -6 \cos\left(\frac{\pi}{4}(10)\right) + 10$$

$$y = -6 \cos\left(\frac{5\pi}{2}\right) + 10$$

$$y = 10 \text{ m}$$