

Name: \_\_\_\_\_

Student #: \_\_\_\_\_

Date: \_\_\_\_\_

T.A. #: \_\_\_\_\_

## Mathematics 12 Pre-Calculus

### LEARNING GUIDE 8 TEST – TRIG FUNCTIONS

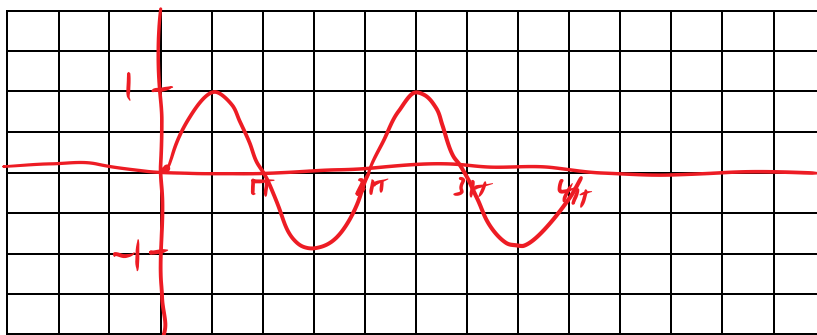
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### \*GRAPHING CALCULATORS ARE NOT PERMITTED ON THIS PART OF THE TEST\*

When using a calculator, you should provide a decimal answer that is correct **to at least two decimal places** (unless otherwise indicated). Such rounding should occur **only** in the final step of the solution.

1. For  $y = \sin x$ ,
  - a) Graph at least 2 complete cycles. (1 mark)
  - b) State the x and y intercepts. (1 mark)
  - c) State the domain and range. (1 mark)
  - d) State the maximum and minimum values of y. (1 mark)
  - e) State the values of x for which the maximum y values occur. (1/2 mark)
  - f) State the values of x for which the minimum y values occur. (1/2 mark)

$$y = \sin x$$



$$x\text{-int: } n\pi, n \in \mathbb{Z}$$

$$y\text{-int: } 0$$

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

$$R: -1 \leq y \leq 1$$

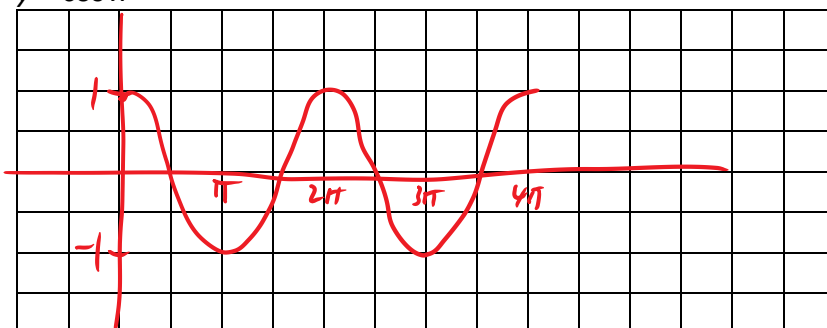
$$\text{max: } 1 \text{ at } x = \frac{\pi}{2} + n2\pi, n \in \mathbb{Z}$$

$$\text{min: } -1 \text{ at } x = \frac{3\pi}{2} + n2\pi, n \in \mathbb{Z}$$

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2. For  $y = \cos x$ ,
- g) Graph at least 2 complete cycles. (1 mark)
  - h) State the x and y intercepts. (1 mark)
  - i) State the domain and range. (1 mark)
  - j) State the maximum and minimum values of y. (1 mark)
  - k) State the values of x for which the maximum y values occur. (1/2 mark)
  - l) State the values of x for which the minimum y values occur. (1/2 mark)

$$y = \cos x$$



$$x\text{-int: } \frac{\pi}{2} + n\pi, n \in \mathbb{Z}$$

$$y\text{-int: } 1$$

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

$$R: y \in \mathbb{R}$$

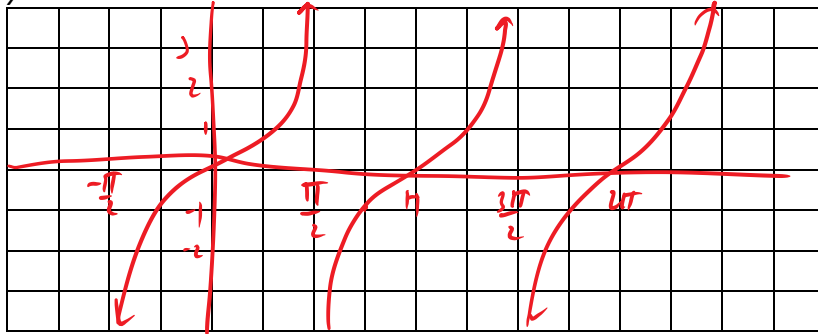
$$\text{MAX: } 1 \text{ AT } x = n2\pi, n \in \mathbb{Z}$$

$$\text{MIN: } -1 \text{ AT } x = \pi + n2\pi, n \in \mathbb{Z}$$

3. For the function  $y = \tan x$ ,

- a) Graph at least 2 complete cycles. (1 mark)
- b) State the x and y intercepts. (1 mark)
- c) State the domain and range. (1 mark)

$$y = \tan x$$



$$x\text{-int: } n\pi, n \in \mathbb{Z}$$

$$y\text{-int: } 0$$

$$D: x \in \mathbb{R}, x \neq \frac{\pi}{2} + n\pi, n \in \mathbb{Z}$$

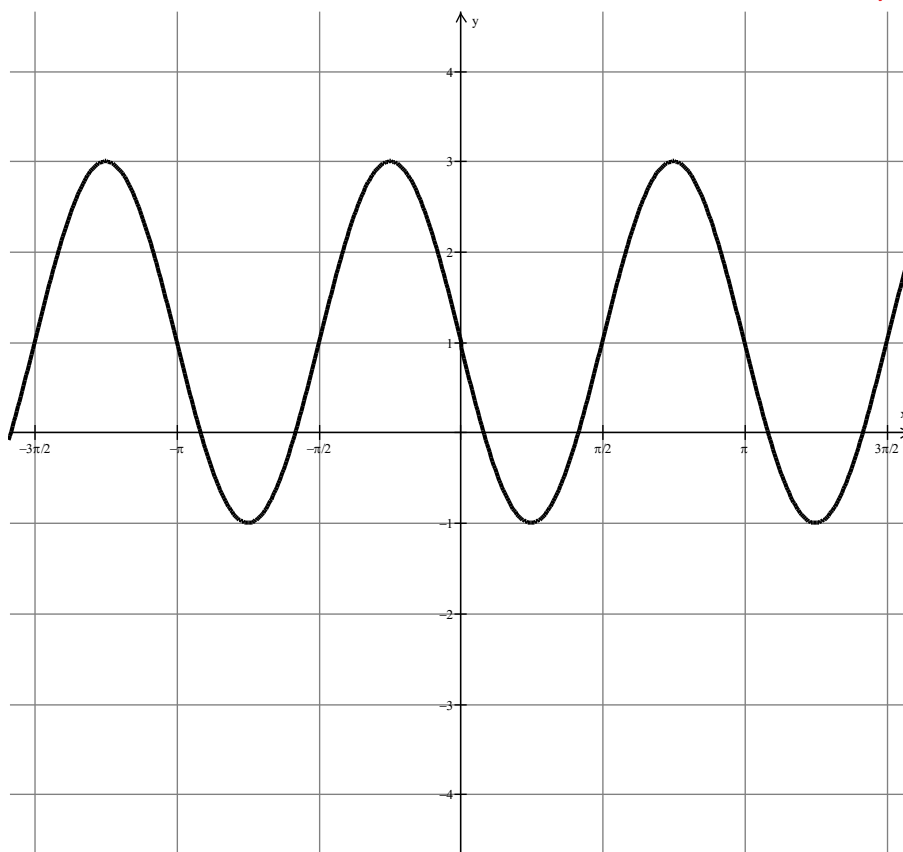
$$R: y \in \mathbb{R}$$

4. Describe the indicated attributes of the graph of  $f(x) = -4 \sin \frac{1}{3}(x - \pi) - 1$   
(4 marks)

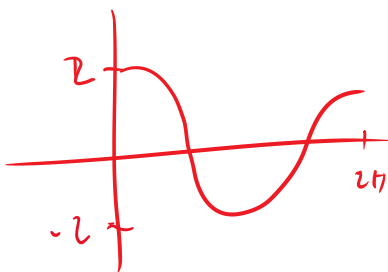
a) Period  $6\pi$       b) phase shift RIGHT  $\pi$   
c) amplitude 4      d) vertical displacement -1

5. For the cosine graph below, state the:

a) period (1 mark)  $\pi$       b) domain (1 mark)  $x \in \mathbb{R}$   
c) range (1 mark)  $-1 \leq y \leq 1$       d) possible phase shift (1 mark) LEFT  $\frac{\pi}{4}$   
e) vertical displacement (1 mark) 1      RIGHT  $\frac{3\pi}{2}$   
f) Equation of the graph (2 marks)  $y = 2 \cos 2(x + \frac{\pi}{4}) + 1$



6. Determine an equation of the form  $f(x) = 2 \cos(x - b) + c$  that has a maximum value of 1 when  $x = \frac{\pi}{2}$ . (2 marks)



Right  $\frac{\pi}{2}$

down 1

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

**GRAPHING CALCULATORS ARE PERMITTED ON THIS PORTION OF THE TEST.****\*Full marks will NOT be given for the final answer only.**

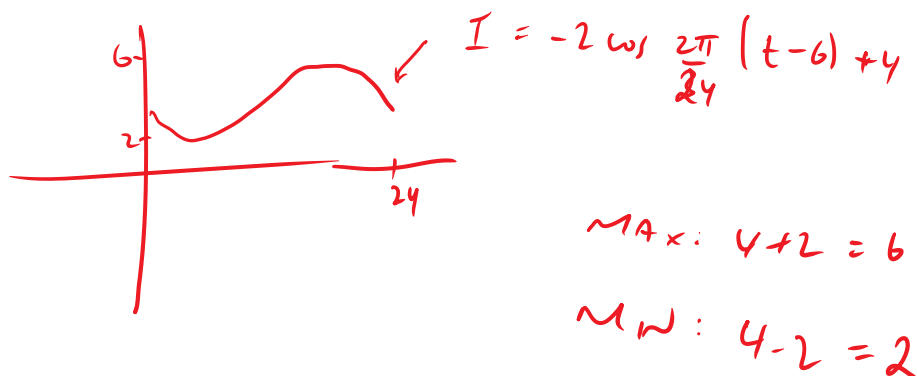
If, in a justification, you refer to information produced by the graphing calculator, this information must be presented clearly in the response. For example, if a graph is used in the solution of the problem, it is important to sketch the graph, show the equation(s) used and how you used the graph(s) to determine the solution(s).

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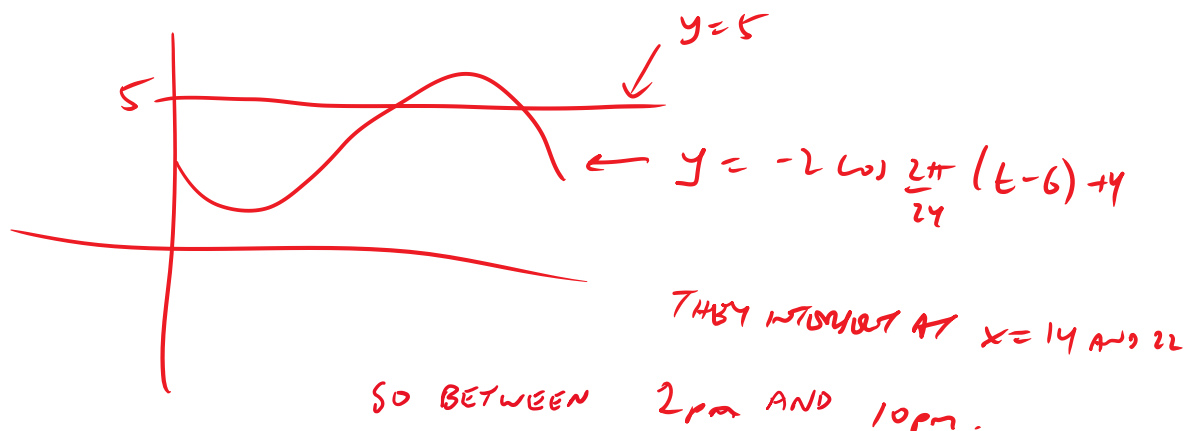
7. The air quality index,  $I$ , in a large city can be modelled by the equation

$$I = -2 \cos \frac{2\pi}{24}(t - 6) + 4, \text{ where } t \text{ represents the time, in hours, after midnight.}$$

- a) What are the current minimum and maximum values of the index in the city? (1 mark)



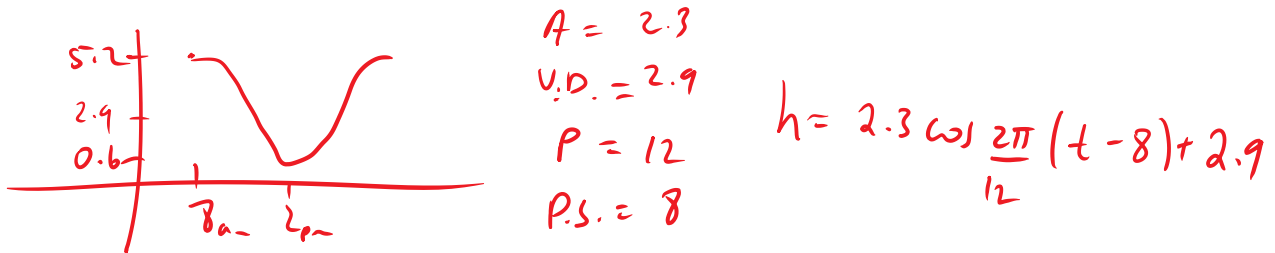
- b) If an air quality alert is issued for times when the index is above 5, during what time period will an air quality alert be issued? (1 mark)



8. At a certain ocean bay, the high tide of 5.2m occurs at 8:00 a.m. The next low tide of 0.6m occurs at 2:00pm. Assume that the relationship between the height,  $h$ , in metres, and the time,  $t$ , in hours, is sinusoidal.

a) Write an equation that expresses the height of the water as a function of time.

(2 marks)



b) Calculate the height of the water at 10am. (1 mark)

$$h = 2.3 \cos \frac{2\pi}{12} (10 - 8) + 2.9$$

$$= 4.05 \text{ m}$$

- c) A freighter needs a depth of at least 2m to safely dock. How many hours can the freighter tie up at the dock before it needs to cast off? (2 marks)

