

**TEST: Trigonometric Functions**

|            |                    |                 |            |
|------------|--------------------|-----------------|------------|
| K/U<br>/16 | Application<br>/14 | Thinking<br>/11 | Comm<br>/4 |
|------------|--------------------|-----------------|------------|

**Part A: Knowledge and Understanding**

The following questions (1-4) are about the following function:  $y = -3\cos(x - \pi) + 4$

1. State the Domain and Range of **one cycle** of the function [2 marks]

Domain: Range:

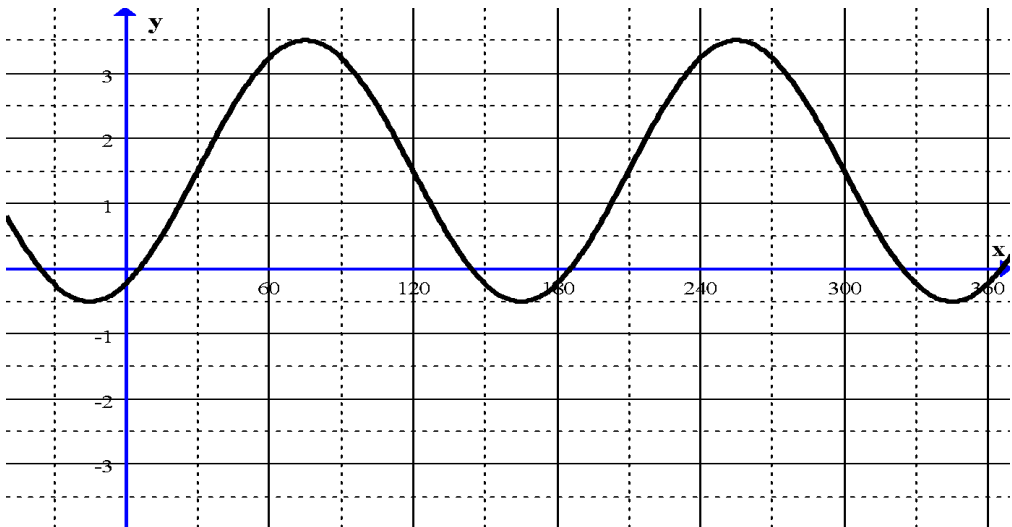
2. What is the amplitude of the function [1 mark]

3. What is the phase shift of the function (include 'left' or 'right') [1 mark]

4. What is the maximum and minimum value of the following function [1 mark]

5. Determine an equation for a transformed **sine** function with an amplitude of 6, a period of  $90^\circ$ , a phase shift of  $22^\circ$  to the left, a vertical displacement down 3, and a vertical reflection. [3 marks]

6. Determine one equation for **cosine** and one equation for **sine** to model the function shown. Show your calculations for full marks. [6 marks]



7. State the amplitude and the period of the following periodic function. [2 marks]

Amplitude: \_\_\_\_\_

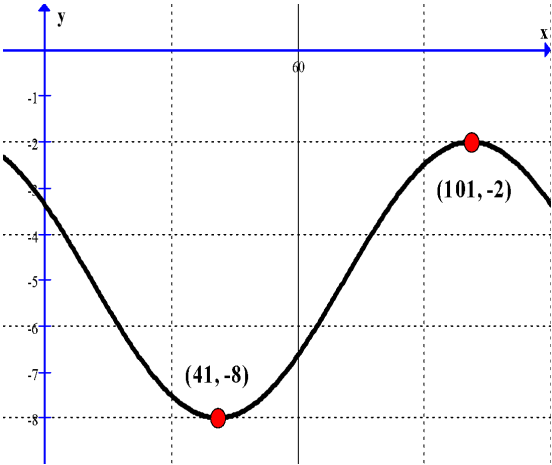
Period: \_\_\_\_\_

**Part B: Application**

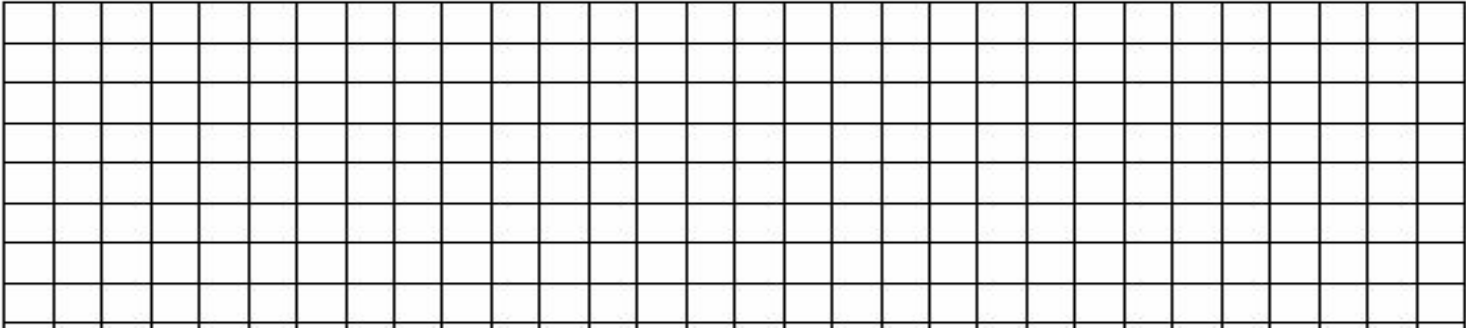
$$y=3\cos \frac{1}{4}(x+2\pi)-2$$

8. Consider the function:

- a) State the amplitude, period, phase shift and vertical displacement for  $f(x)$ . [4 marks]



- b) Graph the function for one cycle. Label clearly, showing at least 5 significant points. Choose an appropriate scale for x and y. [4 marks]



9. The height,  $h$ , in metres, above the flat sea, of a surfer on a big wave after  $t$  **seconds** can be modelled using the sinusoidal function  $h(t) = -10\cos [3(t - 10)] + 11.5$ .

- a) Find the maximum and minimum values for the height,  $h$ , of the surfer above level sea. [2 marks]

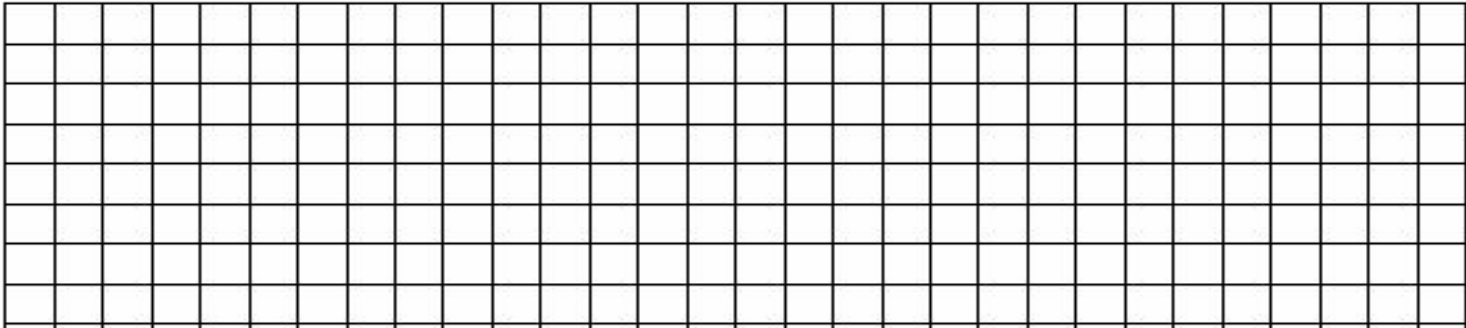
- b) At what TIMES ( $t$ ) does the surfer reach the maximum and minimum heights? [2 marks]

- c) What is the height of the surfer after **1 minute**? [2 marks]

Part C: Thinking

10. On a carousel, a horse goes up and down while the carousel spins. The maximum height the horse reaches is 48 inches and the minimum height is 28 inches. It takes 16 seconds for the carousel to make one complete revolution. During this carousel revolution, the horse goes up and down exactly 4 times. Assume the horse starts at its *average* height and starts going up when the ride starts.

a) Draw a graph to show the relationship between the time elapsed (in seconds) and height of the horse (in inches) for ONE complete revolution of the carousel. [2 marks]



b) Determine the equation of a **cosine** function which could model this graph. [4 marks]

12. Determine the equation of a **sine** function that would have the range of  $\{y \in R, -2 \leq y \leq 14\}$  and a period of  $120^\circ$ .

[2 marks]

13. State two possible **sine** equations for the periodic function  $y = \cos 3(x - 1)$ .

[2 marks]

14. The graph of the function  $g(x) = -8 \sin \sin x + c$  just touches the x-axis but doesn't cross it. Determine two values of  $c$ . [1 mark]

**Communication** Your communication mark will be determined by how well you answer all of the questions, including proper mathematical form, notation and narration (where appropriate). A level will be assigned according to the following rubric: [4 marks]

| Communication - The conveying of meaning through various forms                                                                                                                |                                                                                                                                                   |                                                                                                                                                |                                                                                                                                                                       |                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Expectation                                                                                                                                                                   | 1                                                                                                                                                 | 2                                                                                                                                              | 3                                                                                                                                                                     | 4                                                                                                                                                                      |
| - provides explanation in writing; communicates ideas & solutions effectively using numbers & algebraic symbols, and/or using pictures, diagrams, charts, tables, graphs, etc | This student expressed & organized mathematical thinking with limited effectiveness. Please show all steps neatly and clearly, using proper form. | This student expressed & organized mathematical thinking with some effectiveness. Please show all steps neatly and clearly, using proper form. | This student expressed & organized mathematical thinking with considerable effectiveness. Please make sure all steps are shown neatly and clearly, using proper form. | This student expressed & organized mathematical thinking with a high degree of effectiveness. Please continue to show all steps neatly and clearly, using proper form. |