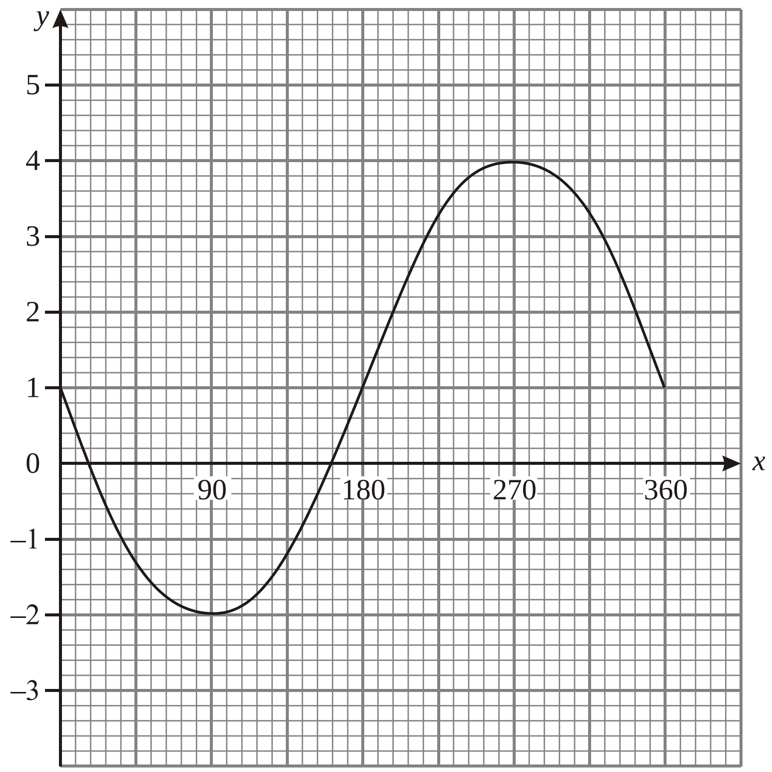
IB MATHEMATICS SL

Trigonometry Class work

NAME ______________________________________ **DATE:**____________

1. The diagram below shows the graph of $y = -a \sin x° + c$, $0 \le x \le 360$.



Use the graph to find the values of

(a) c;

(b) a.

(Total 4 marks)

2. (a) For $y = 0.5 \cos 0.5\,x$, find

(i) the amplitude;

(ii) the period.

(b) Let $y = -3 \sin x + 2$, where $90° \le x \le 270°$.

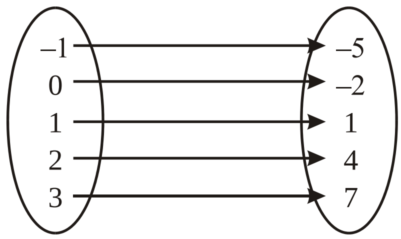
By drawing the graph of y or otherwise, complete the table below for the given values of y.

x	y
	–1
	2

-

(Total 4 marks)

3. (a) A function f is represented by the following mapping diagram.



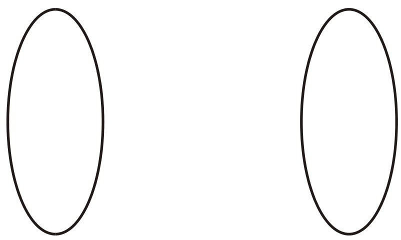
Write down the function f in the form

$$f : x \mapsto y, \quad x \in \{\text{the domain of } f\}.$$

(b) The function g is defined as follows

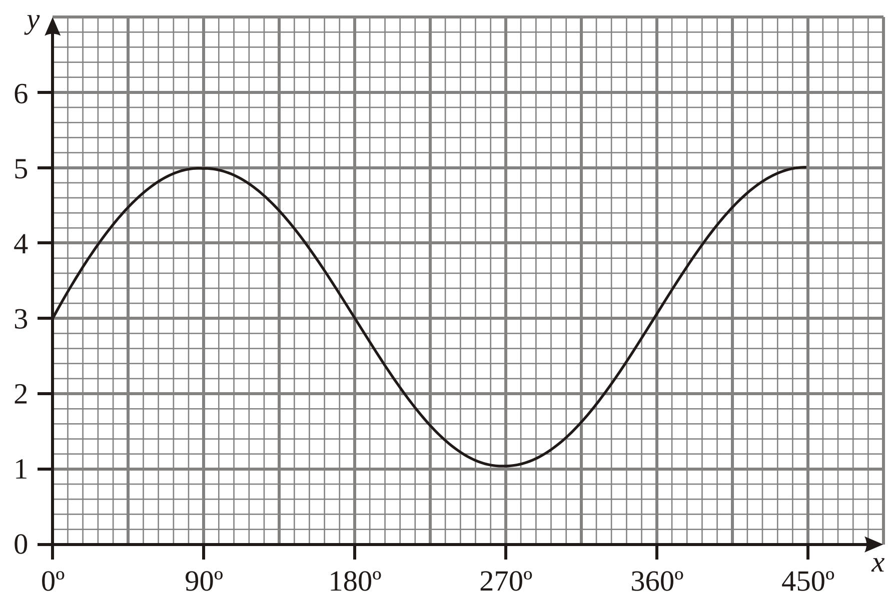
$$g : x \mapsto \sin 15x°, \quad \{x \in \mathbb{N} \text{ and } 0 < x \le 4\}.$$

Complete the following mapping diagram to represent the function g.



(Total 4 marks)

4. The graph below shows part of the function $y = 2 \sin x + 3$.

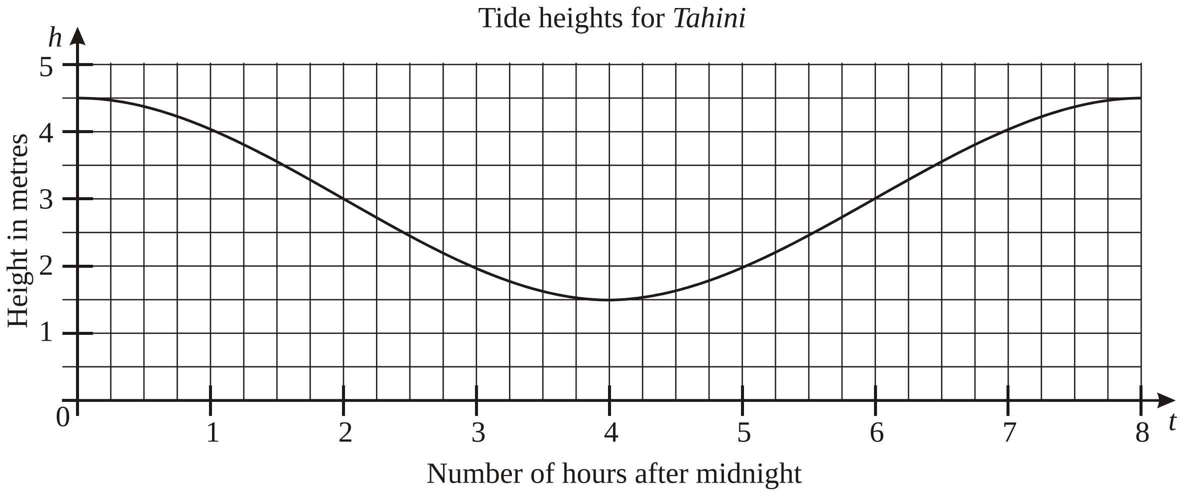


(a) Write the domain of the part of the function shown on the graph.

(b) Write the range of the part of the function shown on the graph.

(Total 4 marks)

5. The graph below shows the tide heights, h metres, at time t hours after midnight, for *Tahini* island.



(a) Use the graph to find

(i) the height of the tide at 03:15;

(ii) the times when the height of the tide is 3.5 metres.

(3)

(b) The best time to catch fish is when the tide is **below** 3 metres. Find this best time, giving your answer as an inequality in t.

(3)

Due to the location of *Tahini* island, there is very little variation in the pattern of tidal heights. The maximum tide height is 4.5 metres and the minimum tide height is 1.5 metres. The height h can be modelled by the function

$$h(t) = a\cos(bt°) + 3.$$

(c) Use the graph above to find the values of the variables a and b.

(4)

(d) Hence **calculate** the height of the tide at 13:00.

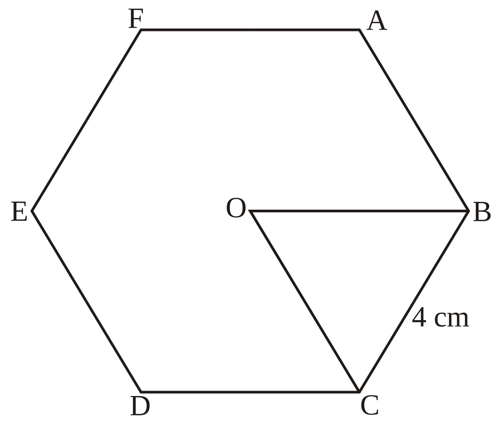
(3)

(e) At what time would the tide be at its lowest point in the **second** 8 hour period?

(2)

(Total 15 marks)

6. The figure below shows a hexagon with sides all of length 4 cm and with centre at O. The interior angles of the hexagon are all equal.



The interior angles of a polygon with n equal sides and n equal angles (regular polygon) add up to $(n - 2) \times 180°$.

(a) Calculate the size of angle $A\hat{B}C$.

(b) Given that OB = OC, find the area of the triangle OBC.

(c) Find the area of the whole hexagon.

(Total 8 marks)

7. The number of bacteria (y) present at any time is given by the formula:

$y = 15\,000e^{-025t}$, where t is the time in seconds and e = 2.72 correct to 3 s.f.

(a) Calculate the values of a, b and c to the nearest hundred in the table below:

Time in seconds (t)	0	1	2	3	4	5	6	7	8
Amount of bacteria (y) (nearest hundred)	a	11700	9100	7100	b	4300	3300	2600	c

(3)

(b) On graph paper using 1 cm for each second on the horizontal axis and 1 cm for each thousand on the vertical axis, draw and label the graph representing this information.

(5)

(c) Using your graph, answer the following questions:

(i) After how many seconds will there be 5000 bacteria? Give your answer correct to the nearest tenth of a second.

(ii) How many bacteria will there be after 6.8 seconds? Give your answer correct to the nearest hundred bacteria.

(iii) Will there be a time when there are no bacteria left? Explain your answer.

(6)
(Total 14 marks)

8. Consider the function $f(x) = 2\sin x - 1$ where $0 \leq x \leq 720°$.

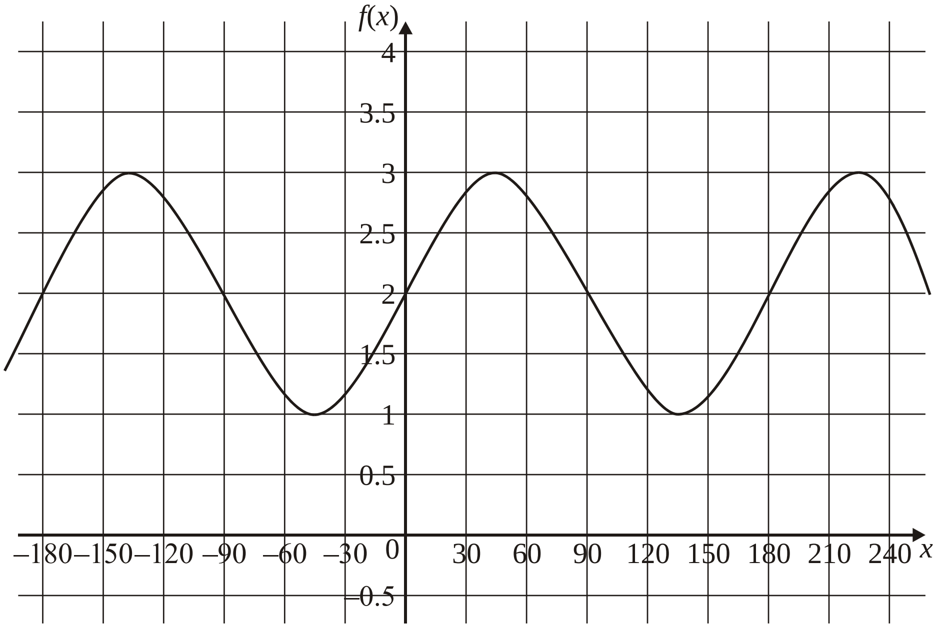
(a) Write down the period of the function.

(b) Find the minimum value of the function.

(c) Solve $f(x) = 1$.

(Total 8 marks)

9. The curve shown in the figure below is part of the graph of the function, $f(x) = 2 + \sin(2x)$, where x is measured in degrees.



(a) Find the range of $f(x)$.

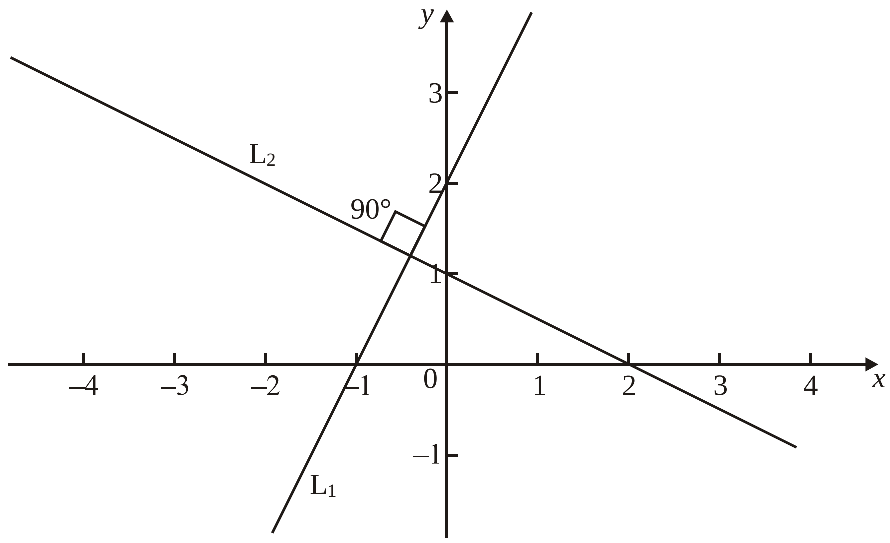
(b) Find the amplitude of $f(x)$.

(c) Find the period of $f(x)$.

(d) If the function is changed to $f(x) = 2 + \sin(4x)$ what is the effect on the period, compared to the period of the original function?

(Total 8 marks)

10. A student has drawn the two straight line graphs L_1 and L_2 and marked in the angle between them as a right angle, as shown below. The student has drawn one of the lines incorrectly.



Consider L_1 with equation $y = 2x + 2$ and L_2 with equation $y = -\frac{1}{4}x + 1$.

(a) Write down the gradients of L_1 and L_2 **using the given equations**.

(b) Which of the two lines has the student drawn incorrectly?

(c) How can you tell from the answer to part (a) that the angle between L_1 and L_2 should not be 90°?

(d) Draw the correct version of the incorrectly drawn line on the diagram.

(Total 8 marks)

11. Two functions are defined as follows

$$f(x) = \begin{cases} 6 - x \text{ for } 0 \le x < 6 \\ x - 6 \text{ for } x \ge 6 \end{cases}$$

$$g(x) = \frac{1}{2}x$$

(a) Draw the graphs of the functions f and g in the interval $0 \le x \le 14$, $0 \le y \le 8$ using a scale of 1 cm to represent 1 unit on both axes.

(5)

(b) (i) Mark the intersection points A and B of $f(x)$ and $g(x)$ on the graph.

(ii) Write down the coordinates of A and B.

(3)

(c) Calculate the midpoint M of the line AB.

(2)

(d) Find the equation of the straight line which joins the points M and N.

(4)

(Total 14 marks)