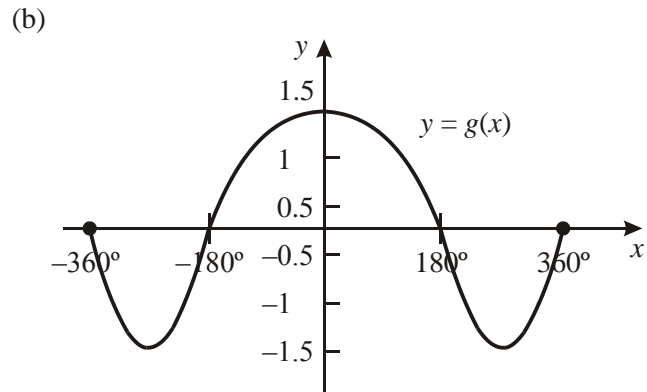
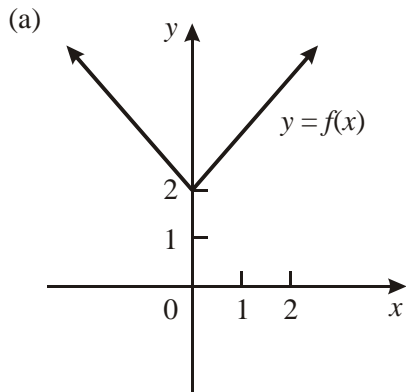


**Functions Review Packet from November Questions**

1. The diagrams below show the graphs of two functions,  $y = f(x)$ , and  $y = g(x)$ .

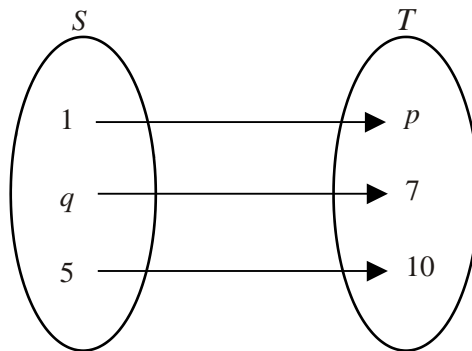


State the domain and range of

- (a) the function  $f$ ;
- (b) the function  $g$ .

**(Total 8 marks)**

2. (a)  $f: x \rightarrow 3x - 5$  is a mapping from the set  $S$  to the set  $T$  as shown below.



Find the values of  $p$  and  $q$ .

**(2)**

(b) A function  $g$  is such that  $g(x) = \frac{2}{(x-2)^2}$ .

(i) State the domain of the function  $g(x)$ .

**(2)**

(ii) State the range of the function  $g(x)$ .

**(1)**

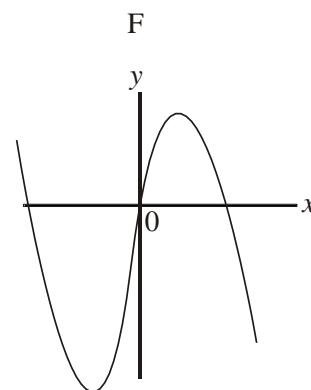
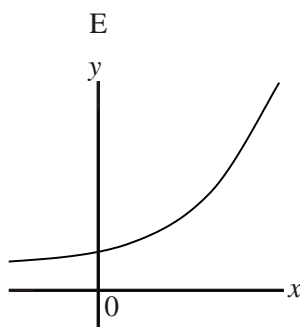
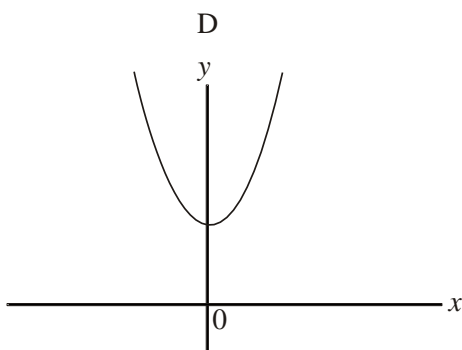
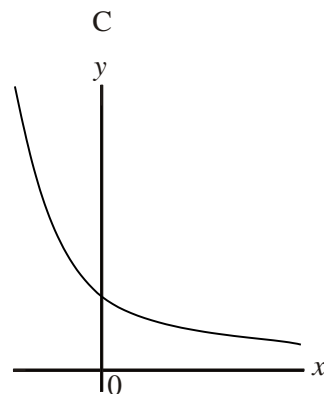
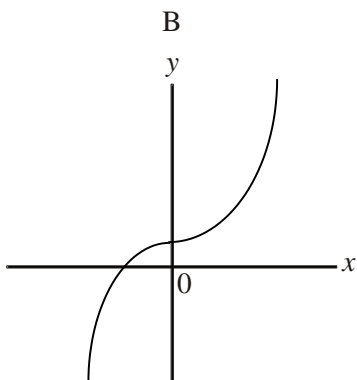
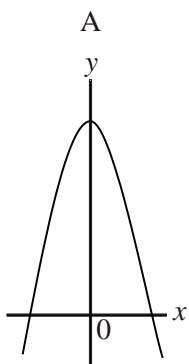
(iii) Write down the equation of the vertical asymptote.

**(1)**

**(Total 6 marks)**

3. The following curves are sketches of the graphs of the functions given below, but in a different order. Using your graphic display calculator, match the equations to the curves, writing your answers in the table below.

(the diagrams are not to scale)

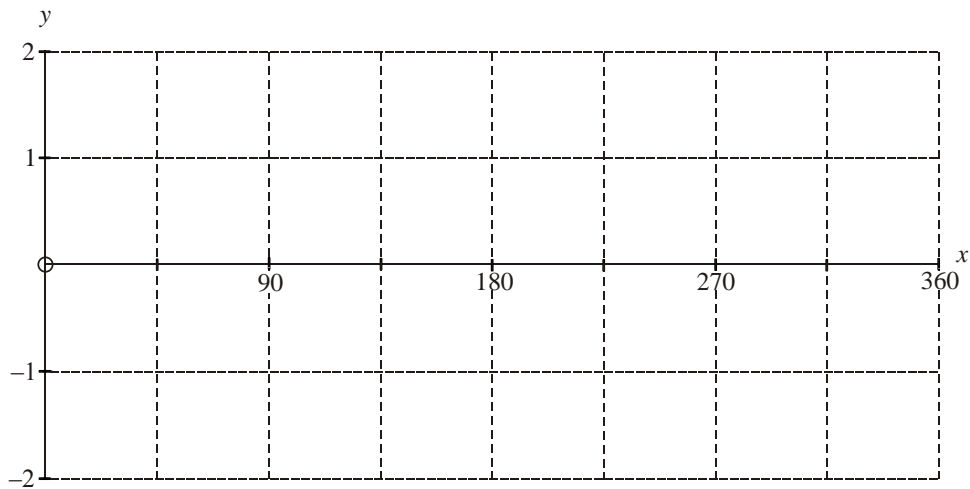


	Function	Graph label
(i)	$y = x^3 + 1$	
(ii)	$y = x^2 + 3$	
(iii)	$y = 4 - x^2$	
(iv)	$y = 2x + 1$	
(v)	$y = 3^{-x} + 1$	
(vi)	$y = 8x - 2x^2 - x^3$	

(Total 6 marks)

4. (a) Sketch the graph of the function  $y = 1 + \frac{\sin(2x)}{2}$  for  $0^\circ \leq x \leq 360^\circ$  on the axes below.

(4)



- (b) Write down the period of the function.

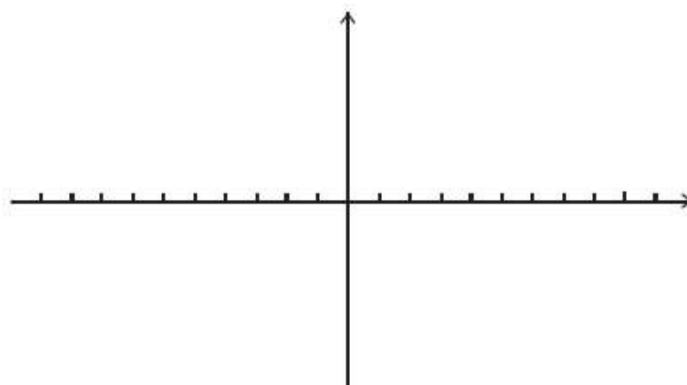
(1)

- (c) Write down the amplitude of the function.

(1)

(Total 6 marks)

6. (a) Sketch the graph of  $y = 3 + \frac{3}{x+1}$  for  $-10 \leq x \leq 10$ .



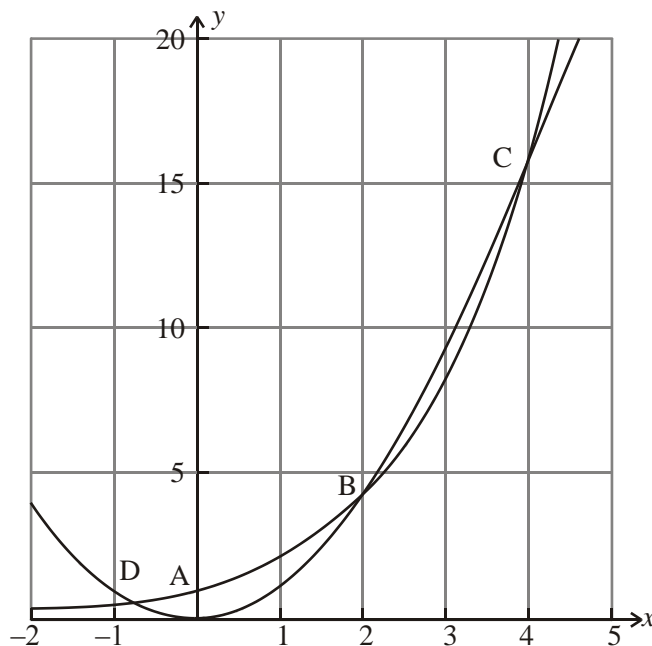
- (b) Write down the equations of

- (i) the horizontal asymptote;  
(ii) the vertical asymptote.

(Total 6 marks)

5. The figure below shows the graphs of the functions  $y = x^2$  and  $y = 2^x$  for values of  $x$  between  $-2$  and  $5$ .

The points of intersection of the two curves are labelled as B, C and D.



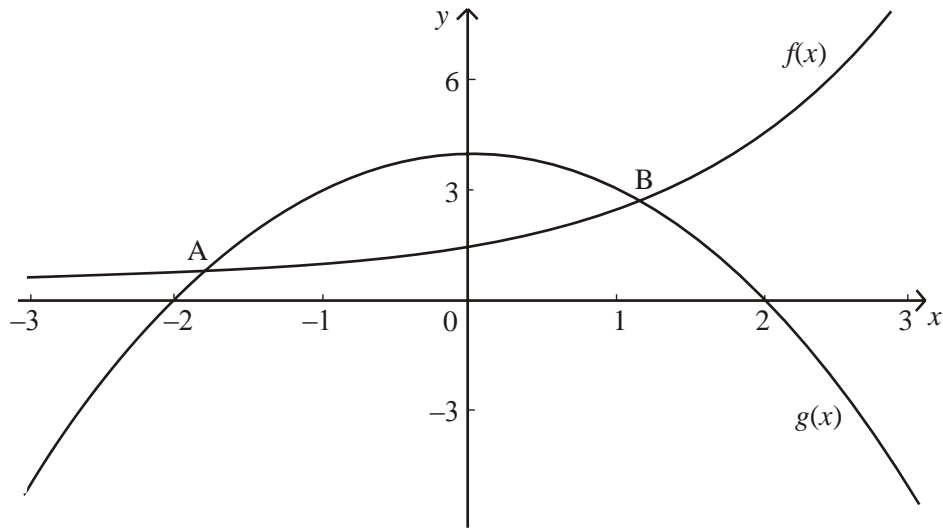
- (a) Write down the coordinates of the point A. (2)
  - (b) Write down the coordinates of the points B and C. (2)
  - (c) Find the  $x$ -coordinate of the point D. (1)
  - (d) Write down, using interval notation, all values of  $x$  for which  $2^x \leq x^2$ . (3)
- (Total 8 marks)**

7. The graph of a quadratic function  $f(x)$  intersects the horizontal axis at  $(1, 0)$  and the equation of the axis of symmetry is  $x = -1$ .

- (a) Write down the  $x$ -coordinate of the other point where the graph of  $y = f(x)$  intersects the horizontal axis.
- (b)  $y = f(x)$  reaches its maximum value at  $y = 5$ .
  - (i) Write down the value of  $f(-1)$ .
  - (ii) Find the range of the function  $y = f(x)$ .

**(Total 6 marks)**

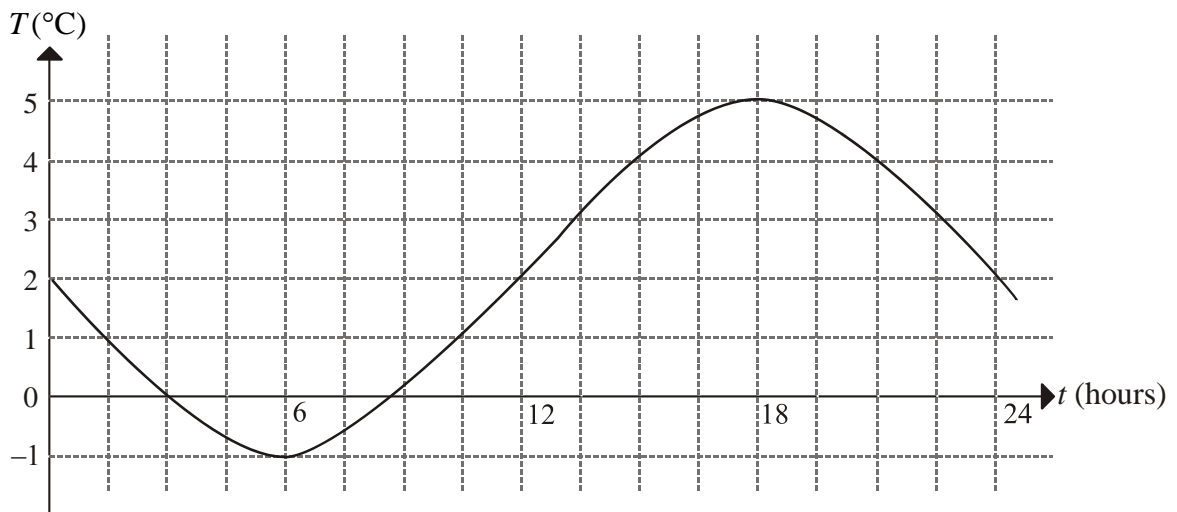
8. The figure below shows the graphs of the functions  $f(x) = 2^x + 0.5$  and  $g(x) = 4 - x^2$  for values of  $x$  between  $-3$  and  $3$ .



- (a) Write down the coordinates of the points A and B.
- (b) Write down the set of values of  $x$  for which  $f(x) < g(x)$ .

(Total 6 marks)

9. The temperature ( $^{\circ}\text{C}$ ) during a 24 hour period in a certain city can be modelled by the function  $T(t) = -3 \sin(bt) + 2$ , where  $b$  is a constant,  $t$  is the time in hours and  $bt$  is measured in degrees. The graph of this function is illustrated below.



- (a) Determine how many times the temperature is exactly  $0^{\circ}\text{C}$  during this 24 hour period.
- (b) Write down the time at which the temperature reaches its maximum value.
- (c) Write down the interval of time in which the temperature changes from  $-1^{\circ}\text{C}$  to  $2^{\circ}\text{C}$ .
- (d) Calculate the value of  $b$ .

(Total 6 marks)

10. A function is represented by the equation  $f(x) = 3(2)^x + 1$ .

The table of values of  $f(x) - 3 \leq x \leq 2$  is given below.

$x$	-3	-2	-1	0	1	2
$f(x)$	1.375	1.75	$a$	4	7	$b$

(a) Calculate the values for  $a$  and  $b$ .

(2)

(b) On graph paper, draw the graph of  $f(x)$ , for  $-3 \leq x \leq 2$ , taking 1 cm to represent 1 unit on both axes.

(4)

The domain of the function  $f(x)$  is the real numbers,  $\mathbb{R}$ .

(c) Write down the range of  $f(x)$ .

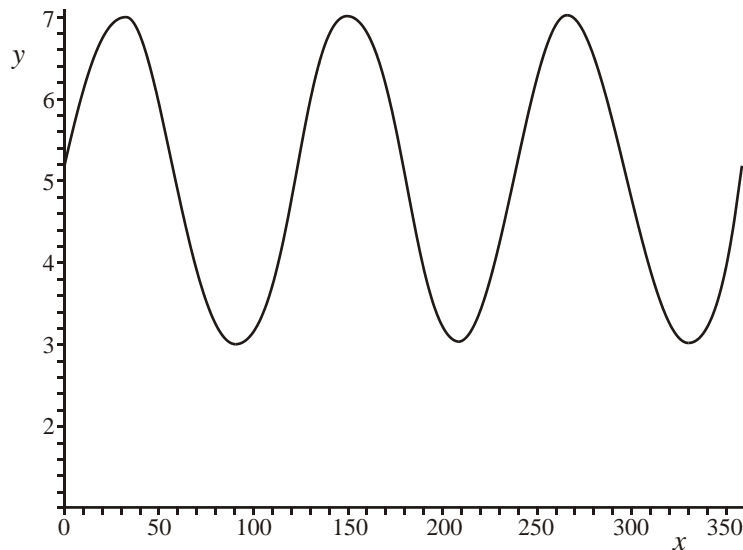
(2)

(d) Using your graph, or otherwise, find the approximate value for  $x$  when  $f(x) = 10$ .

(2)

(Total 10 marks)

11. Below is a graph of the function  $y = a + b \sin(cx)$  where  $a$ ,  $b$  and  $c$  are positive integers and  $x$  is measured in degrees.



Find the values of  $a$ ,  $b$  and  $c$ .

(Total 6 marks)

12. The functions  $f$  and  $g$  are defined by

$$f: x \mapsto \frac{x+4}{x}, x \in \mathbb{R}, x \neq 0$$

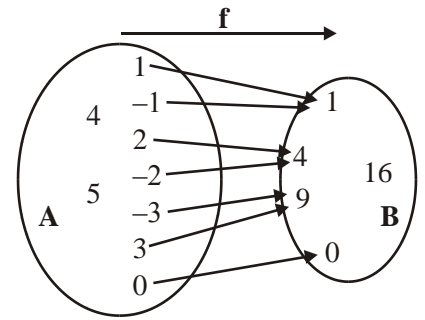
$$g: x \mapsto x, x \in \mathbb{R}$$

- (a) Sketch the graph of  $f$  for  $-10 \leq x \leq 10$ . (4)
- (b) Write down the equations of the horizontal and vertical asymptotes of the function  $f$ . (4)
- (c) Sketch the graph of  $g$  on the same axes. (2)
- (d) Hence, or otherwise, find the solutions of  $\frac{x+4}{x} = x$ . (4)
- (e) Write down the range of function  $f$ . (2)
- (Total 16 marks)**

13. (a) Sketch the graph of the function  $f: x \mapsto 1 + 2 \sin x$ , where  $x \in \mathbb{R}, -360^\circ \leq x \leq 360^\circ$ . (4)
- (b) Write down the range of this function for the given domain. (2)
- (c) Write down the amplitude of this function. (1)
- (d) On the same diagram sketch the graph of the function  $g: x \mapsto \sin 2x$ , where  $x \in \mathbb{R}, -360^\circ \leq x \leq 360^\circ$ . (4)
- (e) Write down the period of this function. (1)
- (f) Use the sketch graphs drawn to find the number of solutions to the equation  $f(x) = g(x)$  in the given domain. (1)
- (g) Hence solve the equation  $1 + 2 \sin x = \sin 2x$  for  $0^\circ \leq x \leq 360^\circ$ . (4)
- (Total 17 marks)**

14.

The diagram shows a function  $f$ , mapping members of set A to members of set B.



- (a) (i) Using set notation, write down all members of the domain of  $f$ .
- (ii) Using set notation, write down all members of the range of  $f$ .
- (iii) Write down the equation of the function  $f$ .

The equation of a function  $g$  is  $g(x) = x^2 + 1$ . The domain of  $g$  is  $\mathbb{R}$ .

- (b) Write down the range of  $g$ .

(Total 6 marks)

15. (a) Sketch a graph of  $y = \frac{x}{2+x}$  for  $-10 \leq x \leq 10$ .

- (b) Hence write down the equations of the horizontal and vertical asymptotes.

(Total 6 marks)

16. Two functions are defined as follows

$$f(x) = \begin{cases} 6 - x & \text{for } 0 \leq x < 6 \\ x - 6 & \text{for } x \geq 6 \end{cases}$$

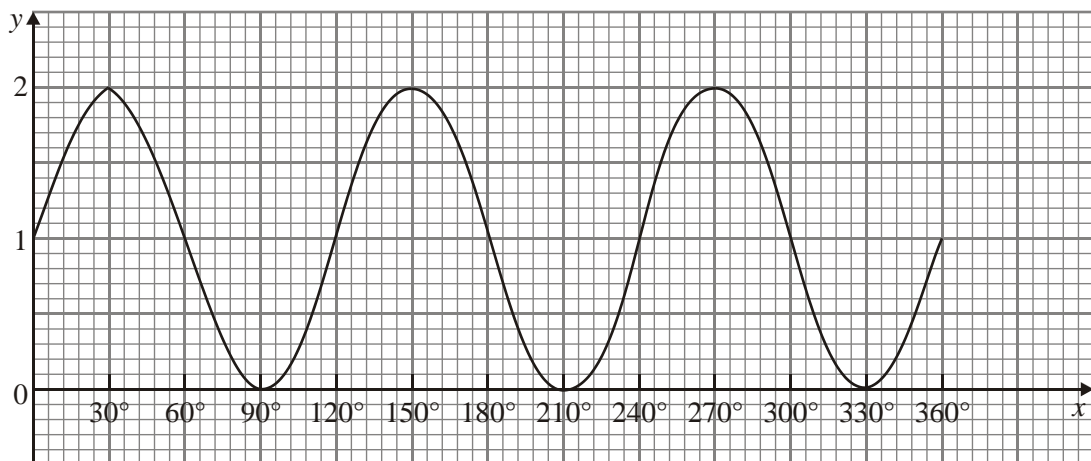
$$g(x) = \frac{1}{2}x$$

- (a) Draw the graphs of the functions  $f$  and  $g$  in the interval  $0 \leq x \leq 14$ ,  $0 \leq y \leq 8$  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. (3)
- (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)



17. The diagram shows the graph of  $y = \sin ax + b$ .



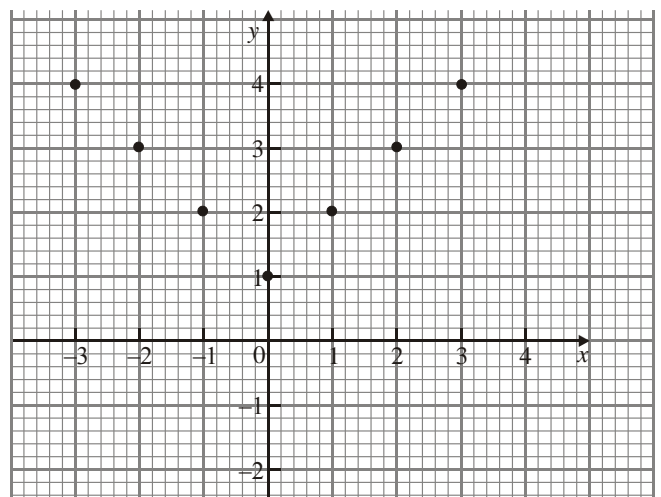
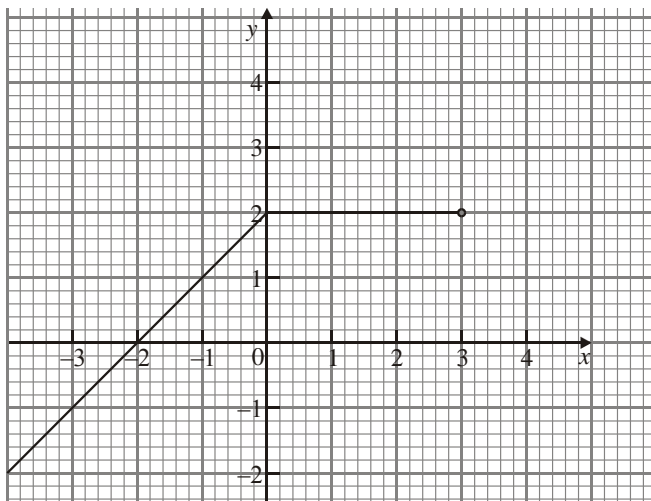
(a) Using the graph, write down the following values

- (i) the period;
- (ii) the amplitude;
- (iii)  $b$ .

(b) Calculate the value of  $a$ .

**(Total 8 marks)**

18. Write down the domain and range of the following functions.



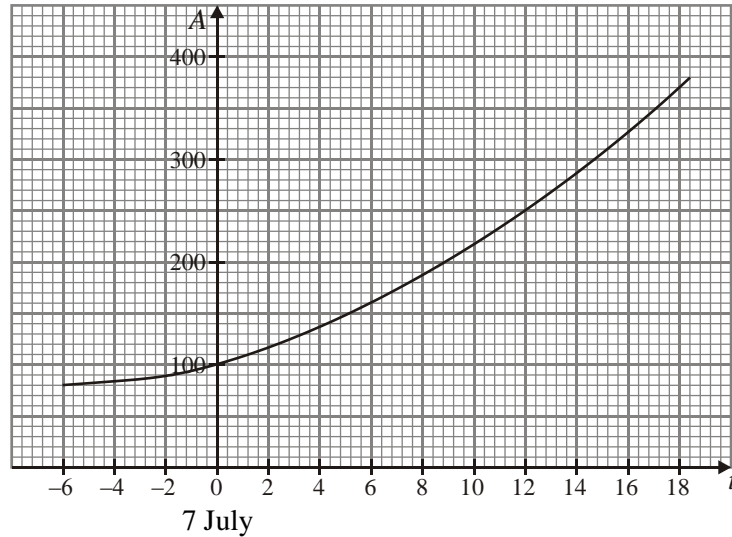
**(Total 8 marks)**

19. The area,  $A \text{ m}^2$ , of a fast growing plant is measured at noon (12:00) each day. On 7 July the area was  $100 \text{ m}^2$ . Every day the plant grew by 7.5%. The formula for  $A$  is given by

$$A = 100 (1.075)^t$$

where  $t$  is the number of days after 7 July. (on 7 July,  $t = 0$ )

The graph of  $A = 100(1.075)^t$  is shown below.



- (a) What does the graph represent when  $t$  is negative? (2)
- (b) Use the graph to find the value of  $t$  when  $A = 178$ . (1)
- (c) Calculate the area covered by the plant at noon on 28 July. (3)

(Total 6 marks)

20. Consider the function  $f(x) = 2 \sin x - 1$  where  $0 \leq x \leq 720^\circ$ .

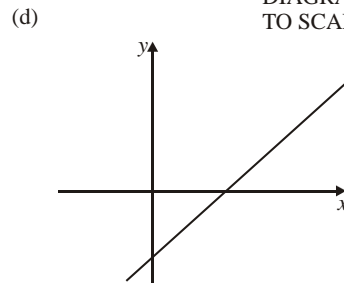
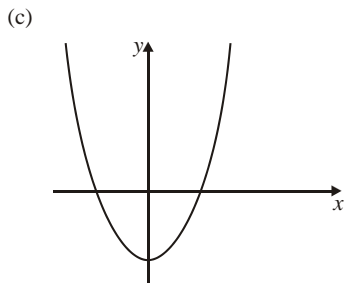
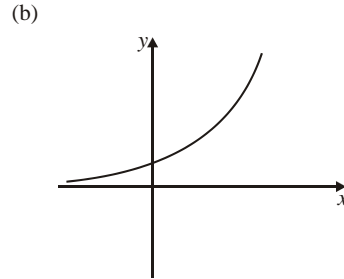
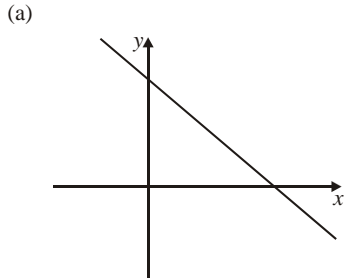
- (a) Write down the period of the function.
- (b) Find the minimum value of the function.
- (c) Solve  $f(x) = 1$ .

(Total 8 marks)

21. The diagrams below are sketches of some of the following functions.

(i)  $y = a^x$     (ii)  $y = x^2 - a$     (iii)  $y = a - x^2$

(iv)  $y = a - x$     (v)  $y = x - a$



DIAGRAMS NOT TO SCALE

Complete the table to match each sketch to the correct function.

Sketch	Function
(a)	
(b)	
(c)	
(d)	

(Total 8 marks)

22. The diagram below shows a part of the graph of  $y = a^x$ . The graph crosses the y-axis at the point P. The point Q (4, 16) is on the graph.

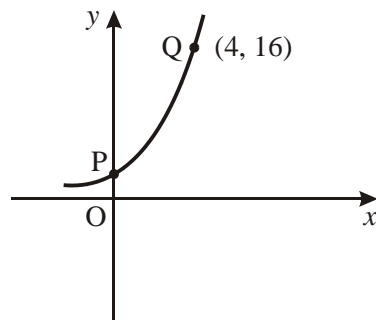


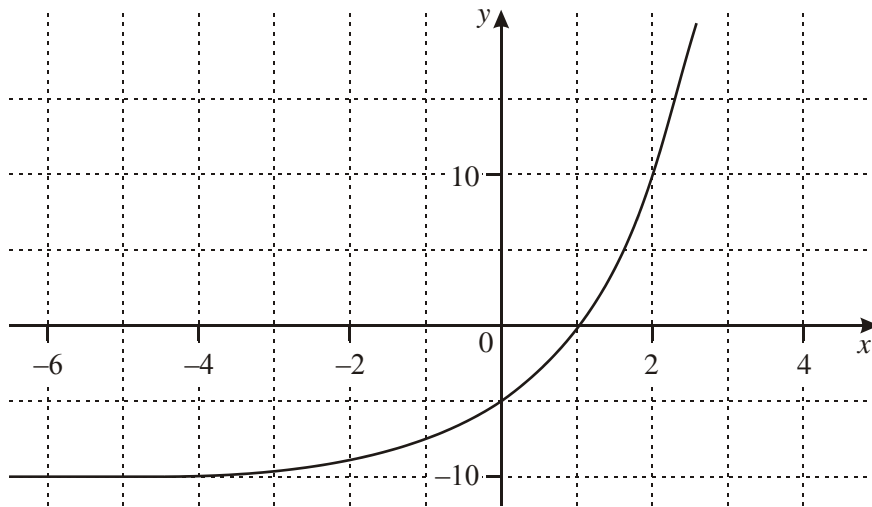
Diagram not to scale

Find

- (a) the coordinates of the point P;
- (b) the value of  $a$ .

(Total 8 marks)

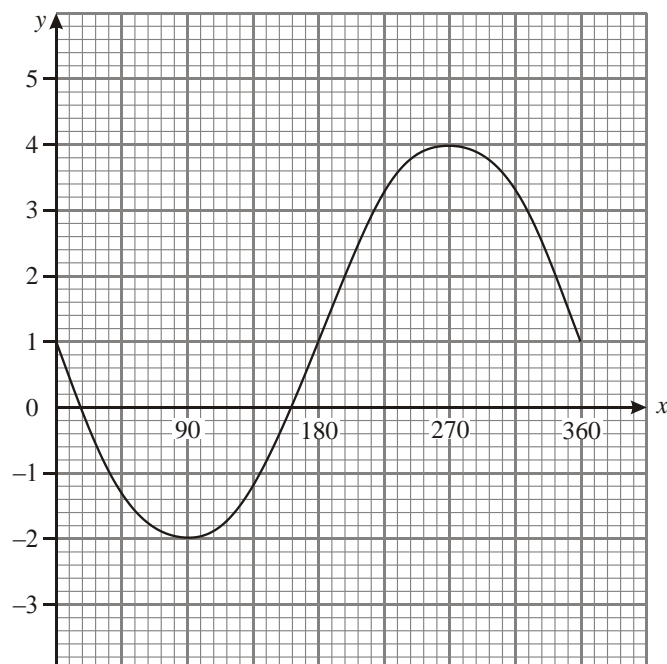
23. The graph below shows the curve  $y = k(2^x) + c$ , where  $k$  and  $c$  are constants.



Find the values of  $c$  and  $k$ .

(Total 4 marks)

24. The diagram below shows the graph of  $y = -a \sin x^\circ + c$ ,  $0 \leq x \leq 360$ .

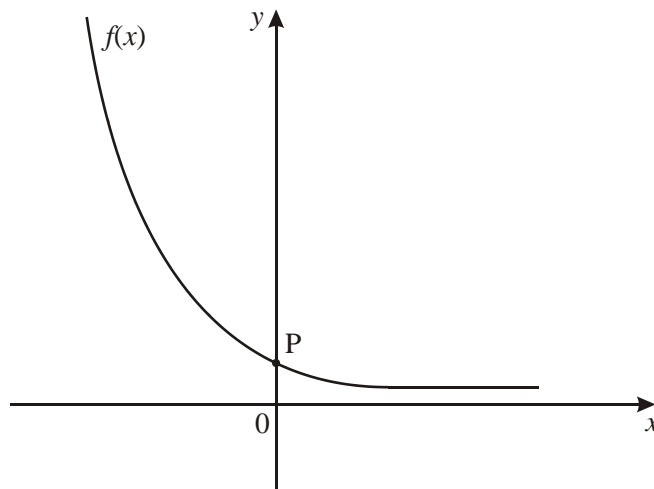


Use the graph to find the values of

- (a)  $c$ ;
- (b)  $a$ .

(Total 4 marks)

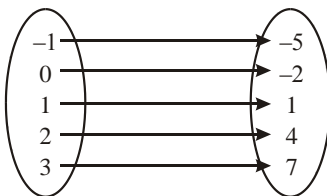
25. The following diagram shows part of the graph of an exponential function  $f(x) = a^{-x}$ , where  $x \in \mathbb{R}$ .



- What is the range of  $f$ ?
- Write down the coordinates of the point P.
- What happens to the values of  $f(x)$  as elements in its domain increase in value?

(Total 4 marks)

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



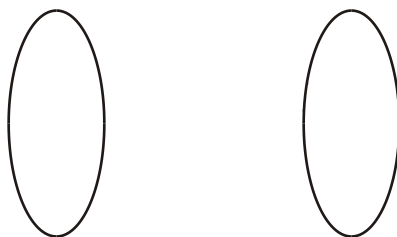
Write down the function  $f$  in the form

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

- (b) The function  $g$  is defined as follows

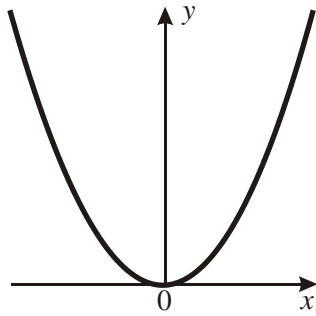
$$g: x \mapsto \sin 15x^\circ, \quad \{x \in \mathbb{N} \text{ and } 0 < x \leq 4\}.$$

Complete the following mapping diagram to represent the function  $g$ .



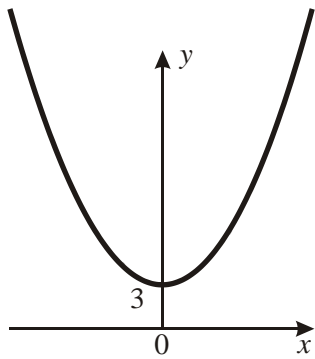
(Total 4 marks)

27. **Diagram 1** shows a part of the graph of  $y = x^2$ .

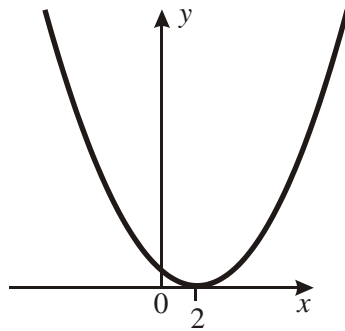


**Diagram 1**

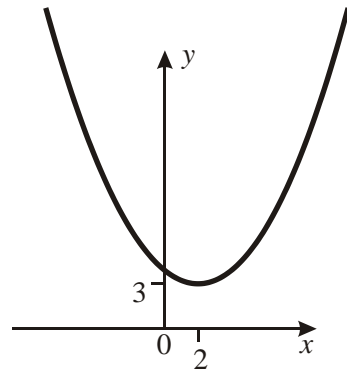
**Diagrams 2, 3 and 4** show a part of the graph of  $y = x^2$  after it has been moved parallel to the  $x$ -axis, or parallel to the  $y$ -axis, or parallel to one axis, then the other.



**Diagram 2**



**Diagram 3**



**Diagram 4**

Write down the equation of the graph shown in

- (a) **Diagram 2;**
- (b) **Diagram 3;**
- (c) **Diagram 4.**

**(Total 4 marks)**