

1. Find the set of values of  $x$  for which

(a)  $3(x - 2) < 8 - 2x$  (2)

(b)  $(2x - 7)(1 + x) < 0$  (3)

(c) both  $3(x - 2) < 8 - 2x$  and  $(2x - 7)(1 + x) < 0$  (1)  
(Total 6 marks)

2. The equation  $kx^2 + 4x + (5 - k) = 0$ , where  $k$  is a constant, has 2 different real solutions for  $x$ .

(a) Show that  $k$  satisfies

$$k^2 - 5k + 4 > 0. \quad (3)$$

(b) Hence find the set of possible values of  $k$ . (4)  
(Total 7 marks)

3. The width of a rectangular sports pitch is  $x$  metres,  $x > 0$ . The length of the pitch is 20 m more than its width. Given that the perimeter of the pitch must be less than 300 m,

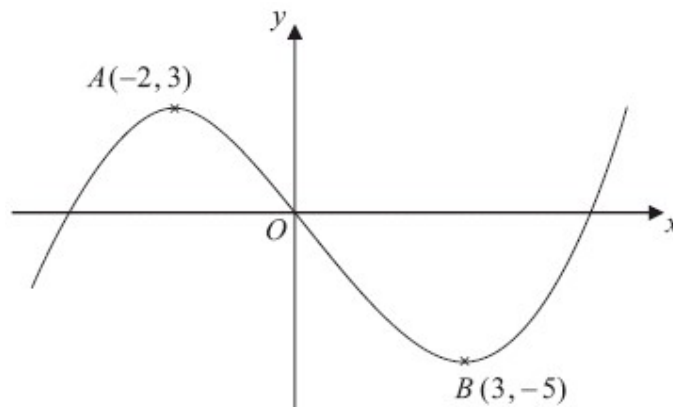
(a) form a linear inequality in  $x$ . (2)

Given that the area of the pitch must be greater than  $4800 \text{ m}^2$ ,

(b) form a quadratic inequality in  $x$ . (2)

(c) by solving your inequalities, find the set of possible values of  $x$ . (4)  
(Total 8 marks)

4.



The diagram above shows a sketch of the curve with equation  $y = f(x)$ . The curve has a maximum point  $A$  at  $(-2, 3)$  and a minimum point  $B$  at  $(3, -5)$ .

On separate diagrams sketch the curve with equation

(a)  $y = f(x + 3)$  (3)

(b)  $y = 2f(x)$  (3)

On each diagram show clearly the coordinates of the maximum and minimum points.

The graph of  $y = f(x) + a$  has a minimum at  $(3, 0)$ , where  $a$  is a constant.

(c) Write down the value of  $a$ . (1)  
(Total 7 marks)

5. (a) Sketch the graphs of

(i)  $y = x(4 - x)$

(ii)  $y = x^2(7 - x)$

showing clearly the coordinates of the points where the curves cross the coordinate axes. (5)

(b) Show that the  $x$ -coordinates of the points of intersection of

$$y = x(4 - x) \text{ and } y = x^2(7 - x)$$

are given by the solutions to the equation  $x(x^2 - 8x + 4) = 0$  (3)

The point  $A$  lies on both of the curves and the  $x$  and  $y$  coordinates of  $A$  are both positive.

(c) Find the exact coordinates of  $A$ , leaving your answer in the form  $(p + q\sqrt{3}, r + s\sqrt{3})$ , where  $p, q, r$  and  $s$  are integers. (7)  
(Total 15 marks)

6. (a) Factorise completely  $x^3 - 6x^2 + 9x$  (3)

(b) Sketch the curve with equation

$$y = x^3 - 6x^2 + 9x$$

showing the coordinates of the points at which the curve meets the  $x$ -axis. (4)

Using your answer to part (b), or otherwise,

(c) sketch, on a separate diagram, the curve with equation

$$y = (x - 2)^3 - 6(x - 2)^2 + 9(x - 2)$$

showing the coordinates of the points at which the curve meets the  $x$ -axis. (2)  
(Total 9 marks)

7. Given that  $f(x) = \frac{1}{x}, \quad x \neq 0,$

(a) sketch the graph of  $y = f(x) + 3$  and state the equations of the asymptotes.

(4)

(b) Find the coordinates of the point where  $y = f(x) + 3$  crosses a coordinate axis.

(2)

**(Total 6 marks)**