

- 1 a Find the value of  $x$  such that  
$$2^{x-1} = 16. \quad (3)$$
- b Find the value of  $y$  such that  
$$2(3^y - 10) = 34. \quad (2)$$
- 2 a Express  $x^2 - 6x + 11$  in the form  $(x + a)^2 + b$ . (2)
- b Sketch the curve  $y = x^2 - 6x + 11$ , and show the coordinates of the turning point of the curve. (3)
- 3 a Express  $(12\frac{1}{4})^{-\frac{1}{2}}$  as an exact fraction in its simplest form. (2)
- b Solve the equation  
$$3x^{-3} = 7\frac{1}{9}. \quad (3)$$
- 4 Solve the equation  
$$x\sqrt{12} + 9 = x\sqrt{3},$$
  
giving your answer in the form  $k\sqrt{3}$ , where  $k$  is an integer. (4)
- 5 a Solve the equation  
$$x^2 + 10x + 13 = 0,$$
  
giving your answers in the form  $a + b\sqrt{3}$ , where  $a$  and  $b$  are integers. (4)
- b Hence find the set of values of  $x$  for which  
$$x^2 + 10x + 13 > 0. \quad (2)$$
- 6 Solve the equations
- a  $7(6x - 7) = 9x^2$  (3)
- b  $\frac{2}{y+1} + 1 = 2y$  (4)
- 7 Solve the simultaneous equations  
$$x - y + 3 = 0$$
  
$$3x^2 - 2xy + y^2 - 17 = 0 \quad (6)$$
- 8 a Find the value of  $x$  such that  
$$x^{\frac{3}{2}} = 64. \quad (2)$$
- b Given that  
$$\frac{\sqrt{3}+1}{2\sqrt{3}-3} \equiv a + b\sqrt{3},$$
  
find the values of the rational constants  $a$  and  $b$ . (4)
- 9 The point  $P(2k, k)$  lies within a circle of radius 3, centre  $(2, 4)$ .
- a Show that  $5k^2 - 16k + 11 < 0$ . (4)
- b Hence find the set of possible values of  $k$ . (3)

10 Solve each of the following inequalities.

a  $4x - 1 \leq 2x + 6$  (2)

b  $x(2x + 1) < 1$  (4)

11  $f(x) = 2x^2 - 8x + 5$ .

a Express  $f(x)$  in the form  $a(x + b)^2 + c$ , where  $a$ ,  $b$  and  $c$  are integers. (3)

b Write down the coordinates of the turning point of the curve  $y = f(x)$ . (1)

c Solve the equation  $f(x) = 0$ , giving your answers in the form  $p + q\sqrt{6}$ , where  $p$  and  $q$  are rational. (3)

12 Simplify

a  $\sqrt{12} - \frac{5}{\sqrt{3}}$  (3)

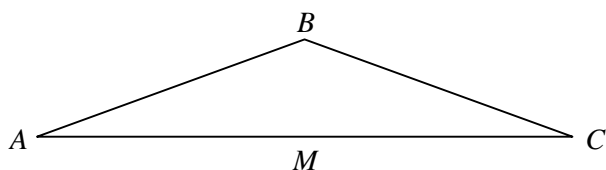
b  $\frac{(4\sqrt{x})^3}{16x}$  (2)

13 Given that the equation

$$x^2 - 2kx + k + 6 = 0$$

has no real roots, find the set of possible values of the constant  $k$ . (6)

14



The diagram shows triangle  $ABC$  in which  $AB = BC = 4 + \sqrt{3}$  and  $AC = 4 + 4\sqrt{3}$ .

Given that  $M$  is the mid-point of  $AC$ ,

a find the exact length  $BM$ , (4)

b show that the area of triangle  $ABC$  is  $6 + 2\sqrt{3}$ . (2)

15 Solve the equation

$$4^{2y+7} = 8^{y+3}. \quad (4)$$

16 Show that

$$(x^2 - x + 3)(2x^2 - 3x - 9) \equiv Ax^4 + Bx^3 + C,$$

where  $A$ ,  $B$  and  $C$  are constants to be found. (4)

17  $f(x) = x^2 + 4x + k$ .

a By completing the square, find in terms of the constant  $k$  the roots of the equation  $f(x) = 0$ . (4)

b State the set of values of  $k$  for which the equation  $f(x) = 0$  has real roots. (1)

c Use your answers to part a to solve the equation

$$x^2 + 4x - 4 = 0,$$

giving your answers in the form  $a + b\sqrt{2}$ , where  $a$  and  $b$  are integers. (2)