1   Solve the inequality

$$(x + 1)(x + 2) \le 12.$$ **(5)**
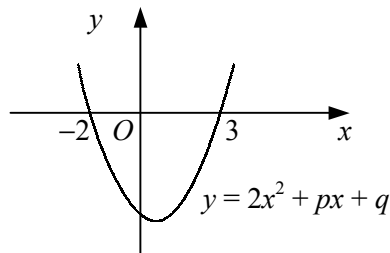
2   **a** Express $2^{\frac{7}{2}} - 2^{\frac{3}{2}}$ in the form $k\sqrt{2}$.   **(2)**

   b Show that

$$(\sqrt{x} + 6)^2 + (2\sqrt{x} - 3)^2$$

   can be written in the form $ax + b$ where a and b are integers to be found.   **(3)**

3

The diagram shows the curve with equation $y = 2x^2 + px + q,$ where p and q are constants, which crosses the x-axis at the points with coordinates $(-2, 0)$ and $(3, 0)$.

   a Show that $p = -2$ and find the value of q.   **(4)**

   b Find the coordinates of the turning point of the curve.   **(3)**

4   Solve the equation

$$2(x - \sqrt{32}) = \sqrt{98} - x,$$

   giving your answer in the form $k\sqrt{2}$.   **(4)**

5   Given that the equation

$$kx^2 - 4kx + 3 = 0,$$

   where k is a constant, has real and distinct roots,

   a show that $k(4k - 3) > 0,$ **(3)**

   b find the set of possible values of k.   **(2)**

6   Solve the simultaneous equations

$$4^{2x} = 2^{y-1}$$
$$9^{4x} = 3^{y+1}$$ **(7)**

7   **a** Find the values of the constants a and b such that

$$x^2 - 7x + 9 \equiv (x + a)^2 + b.$$ **(3)**

   b Hence, write down an equation of the line of symmetry of the curve $y = x^2 - 7x + 9$.   **(1)**

8   **a** Solve the inequality

$$y^2 - 2y - 15 < 0.$$ **(3)**

   b Find the exact values of x for which

$$\frac{x}{x-3} = \frac{4}{2-x}.$$ **(5)**

9 Solve the equation

$$2^{x^2+2} = 8^x.$$ **(5)**

10 Giving your answers in terms of surds, solve the equations

a $t(1 - 2t) = 3(t - 5)$ **(4)**

b $x^4 - x^2 - 6 = 0$ **(4)**

11 Find the set of values of x for which

$$21 - 4x - x^2 \le 0.$$ **(4)**

12 a Given that $y = 3^x$ express 3^{2x+2} in terms of y. **(2)**

b Hence, or otherwise, solve the equation

$$3^{2x+2} - 10(3^x) + 1 = 0.$$ **(4)**

13 a Express $5\sqrt{3}$ in the form $\sqrt{k}$. **(2)**

b Hence find the integer n such that

$$n < 5\sqrt{3} < n + 1.$$ **(3)**

14 Solve the simultaneous equations

$$2x^2 - y^2 - 7 = 0$$
$$2x - 3y + 7 = 0$$ **(8)**

15 Express each of the following in the form $a + b\sqrt{2}$, where a and b are integers.

a $\dfrac{\sqrt{48} - \sqrt{600}}{\sqrt{12}}$ **(3)**

b $\dfrac{\sqrt{2}}{4 + 3\sqrt{2}}$ **(4)**

16 Given that $5^{x+1} = 25^{y-3}$,

a find an expression for y in terms of x. **(4)**

Given also that $16^{x-1} = 4^z$,

b find an expression for z in terms of y. **(4)**

17 a By completing the square, find in terms of the constant k the roots of the equation

$$x^2 - 2kx - k = 0.$$ **(4)**

b Hence, find the set of values of k for which the equation has real roots. **(3)**

18 a Given that $y = x^{\frac{1}{5}}$, show that the equation

$$x^{-\frac{1}{5}} - x^{\frac{1}{5}} = \tfrac{3}{2}$$

can be written as

$$2y^2 + 3y - 2 = 0.$$ **(3)**

b Hence find the values of x for which

$$x^{-\frac{1}{5}} - x^{\frac{1}{5}} = \tfrac{3}{2}.$$ **(4)**

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