

Practice paper

You may not use a calculator when answering this paper.

You must show sufficient working to make your methods clear.

Answers without working may gain no credit.

1 a Write down the value of $16^{\frac{1}{2}}$. (1)

b Hence find the value of $16^{\frac{3}{2}}$. (2)

2 Find $\int (6x^2 + \sqrt{x}) dx$. (4)

3 A sequence $a_1, a_2, a_3, \dots, a_n$ is defined by

$$a_1 = 2, a_{n+1} = 2a_n - 1.$$

a Write down the value of a_2 and the value of a_3 . (2)

b Calculate $\sum_{r=1}^5 a_r$. (2)

4 a Express $(5 + \sqrt{2})^2$ in the form $a + b\sqrt{2}$, where a and b are integers. (3)

b Hence, or otherwise, simplify $(5 + \sqrt{2})^2 - (5 - \sqrt{2})^2$. (2)

5 Solve the simultaneous equations:

$$x - 3y = 6$$

$$3xy + x = 24$$
 (7)

6 The points A and B have coordinates $(-3, 8)$ and $(5, 4)$ respectively.

The straight line l_1 passes through A and B.

a Find an equation for l_1 , giving your answer in the form $ax + by + c = 0$, where a , b and c are integers. (4)

b Another straight line l_2 is perpendicular to l_1 and passes through the origin. Find an equation for l_2 . (2)

c The lines l_1 and l_2 intersect at the point P . Use algebra to find the coordinates of P . (3)

7 On separate diagrams, sketch the curves with equations:

a $y = \frac{2}{x}$, $-2 \leq x \leq 2, x \neq 0$ (2)

b $y = \frac{2}{x} - 4$, $-2 \leq x \leq 2, x \neq 0$ (3)

$$\text{c } y = \frac{2}{x+1}, \quad -2 \leq x \leq 2, x \neq -1 \quad (3)$$

In each part, show clearly the coordinates of any point at which the curve meets the x -axis or the y -axis.

- 8** In the year 2007, a car dealer sold 400 new cars. A model for future sales assumes that sales will increase by x cars per year for the next 10 years, so that $(400 + x)$ cars are sold in 2008, $(400 + 2x)$ cars are sold in 2009, and so on.

Using this model with $x = 30$, calculate:

a The number of cars sold in the year 2016. (2)

b The total number of cars sold over the 10 years from 2007 to 2016. (3)

The dealer wants to sell at least 6000 cars over the 10-year period.

Using the same model:

c Find the least value of x required to achieve this target. (4)

- 9 a** Given that

$$x^2 + 4x + c = (x + a)^2 + b$$

where a , b and c are constants:

i Find the value of a . (1)

ii Find b in terms of c . (2)

Given also that the equation $x^2 + 4x + c = 0$ has unequal real roots:

iii Find the range of possible values of c . (2)

- b** Find the set of values of x for which:

i $3x < 20 - x$, (2)

ii $x^2 + 4x - 21 > 0$, (4)

iii both $3x < 20 - x$ and $x^2 + 4x - 21 > 0$. (2)

10 a Show that $\frac{(3x-4)^2}{x^2}$ may be written as $P + \frac{Q}{x} + \frac{R}{x^2}$, where P , Q and R are constants to be found. (3)

b The curve C has equation $y = \frac{(3x-4)^2}{x^2}$, $x \neq 0$. Find the gradient of the tangent to C at the point on C where $x = -2$. (5)

c Find the equation of the normal to C at the point on C where $x = -2$, giving your answer in the form $ax + by + c = 0$, where a , b and c are integers. (5)