

# C1 GRAPHS OF FUNCTIONS

## Worksheet A

1 Sketch and label each pair of graphs on the same set of axes showing the coordinates of any points where the graphs intersect. Write down the equations of any asymptotes.

**a**  $y = x^2$  and  $y = x^3$

**b**  $y = x^2$  and  $y = x^4$

**c**  $y = \frac{1}{x}$  and  $y = \frac{1}{x^2}$

**d**  $y = x$  and  $y = \sqrt{x}$

**e**  $y = x^2$  and  $y = 3x^2$

**f**  $y = \frac{1}{x}$  and  $y = \frac{2}{x}$

2  $f(x) = (x - 1)(x - 3)(x - 4)$ .

**a** Find  $f(0)$ .

**b** Write down the solutions of the equation  $f(x) = 0$ .

**c** Sketch the curve  $y = f(x)$ .

3 Sketch each graph showing the coordinates of any points of intersection with the coordinate axes.

**a**  $y = (x + 1)(x - 1)(x - 3)$

**b**  $y = 2x(x - 1)(x - 5)$

**c**  $y = -(x + 2)(x + 1)(x - 2)$

**d**  $y = x^2(x - 4)$

**e**  $y = 3x(2 + x)(1 - x)$

**f**  $y = (x + 2)(x - 1)^2$

4 **a** Factorise fully  $x^3 + 6x^2 + 9x$ .

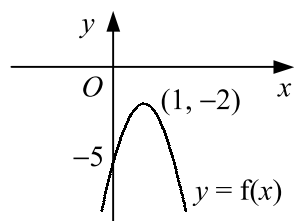
**b** Hence, sketch the curve  $y = x^3 + 6x^2 + 9x$ , showing the coordinates of any points where the curve meets the coordinate axes.

5 Given that the constants  $p$  and  $q$  are such that  $p > q > 0$ , sketch each of the following graphs showing the coordinates of any points of intersection with the coordinate axes.

**a**  $y = (x - p)(x - q)^2$

**b**  $y = (x - p)(x^2 - q^2)$

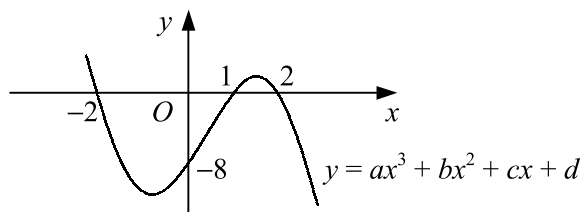
6



The diagram shows the curve with equation  $y = f(x)$  which has a turning point at  $(1, -2)$  and crosses the  $y$ -axis at the point  $(0, -5)$ .

Given that  $f(x)$  is a quadratic function, find an expression for  $f(x)$ .

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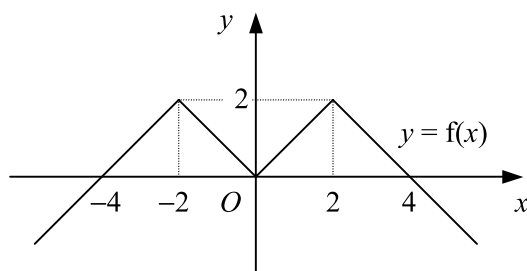
The diagram shows the curve with equation  $y = ax^3 + bx^2 + cx + d$ .

Given that the curve crosses the  $y$ -axis at the point  $(0, -8)$  and crosses the  $x$ -axis at the points  $(-2, 0)$ ,  $(1, 0)$  and  $(2, 0)$ , find the values of the constants  $a$ ,  $b$ ,  $c$  and  $d$ .

## C1 GRAPHS OF FUNCTIONS

## Worksheet A continued

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The diagram shows the graph of  $y = f(x)$ .

Use the graph to write down the number of solutions that exist to each of the following equations.

**a**  $f(x) = 1$                       **b**  $f(x) = 3$                       **c**  $f(x) = -1$                       **d**  $f(x) = 0$

9

**a** Sketch on the same set of axes the graphs of  $y = x^2$  and  $y = 1 - 2x$ .

**b** Hence state the number of roots that the equation  $x^2 + 2x - 1 = 0$  has and give a reason for your answer.

10

**a** Find the coordinates of the turning point of the curve  $y = x^2 + 2x - 3$ .

**b** By sketching two suitable graphs on the same set of axes, show that the equation

$$x^2 + 2x - 3 - \frac{1}{x} = 0$$

has one positive and two negative real roots.

11

Show that the line  $y = x - 3$  is a tangent to the curve  $y = x^2 - 5x + 6$ .

12

**a** Solve the simultaneous equations

$$y = 3x + 7$$

$$y = x^2 + 5x + 8$$

**b** Hence, describe the geometrical relationship between the straight line  $y = 3x + 7$  and the curve  $y = x^2 + 5x + 8$ .

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**a** Find the coordinates of the points where the straight line  $y = x + 6$  meets the curve  $y = x^3 - 4x^2 + x + 6$ .

**b** Given that

$$x^3 - 4x^2 + x + 6 \equiv (x + 1)(x - 2)(x - 3),$$

sketch the straight line  $y = x + 6$  and the curve  $y = x^3 - 4x^2 + x + 6$  on the same diagram, showing the coordinates of the points where the curve crosses the coordinate axes.

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Find the value of the constant  $k$  such that the straight line with equation  $y = 3x + k$  is a tangent to the curve with equation  $y = 2x^2 - 5x + 1$ .

15

Find the set of values of the constant  $a$  for which the line  $y = 2 - 5x$  intersects the curve  $y = x^2 + ax + 18$  at two points.

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The curve  $C$  has the equation  $y = x^2 - 2x + 6$ .

**a** Find the values of  $p$  for which the line  $y = px + p$  is a tangent to the curve  $C$ .

**b** Prove that there are no real values of  $q$  for which the line  $y = qx + 7$  is a tangent to the curve  $C$ .