Edexcel GCE

Core Mathematics C1

Advanced Subsidiary

Algebra and Functions

Materials required for examination	**Items included with question papers**
Mathematical Formulae (Pink or Green)	Nil

Calculators may NOT be used in this examination.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You must show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.

1. Find the set of values of x for which

(a) $4x - 3 > 7 - x$ **(2)**

(b) $2x^2 - 5x - 12 < 0$ **(4)**

(c) **both** $4x - 3 > 7 - x$ **and** $2x^2 - 5x - 12 < 0$ **(1)**

2. The equation $x^2 + 3px + p = 0$, where p is a non-zero constant, has equal roots.

Find the value of p. **(4)**

3. Factorise completely $x^3 - 9x$. **(3)**

4. (a) By eliminating y from the equations

$$y = x - 4,$$

$$2x^2 - xy = 8,$$

show that

$$x^2 + 4x - 8 = 0.$$

(2)

(b) Hence, or otherwise, solve the simultaneous equations

$$y = x - 4,$$

$$2x^2 - xy = 8,$$

giving your answers in the form $a \pm b\sqrt{3}$, where a and b are integers. **(5)**

5. $$x^2 - 8x - 29 \equiv (x + a)^2 + b,$$

where a and b are constants.

(a) Find the value of a and the value of b. **(3)**

(b) Hence, or otherwise, show that the roots of

$$x^2 - 8x - 29 = 0$$

are $c \pm d\sqrt{5}$, where c and d are integers to be found. **(3)**

6. Solve the simultaneous equations

$$y = x - 2,$$

$$y^2 + x^2 = 10.$$

(7)

7. Find the set of values of x for which

$$x^2 - 7x - 18 > 0.$$

(4)

8. Factorise completely

$$x^3 - 4x^2 + 3x.$$

(3)

9. 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

$$k^2 - 5k + 4 > 0.$$

(3)

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

(4)

10. Solve the simultaneous equations

$$x - 2y = 1,$$

$$x^2 + y^2 = 29.$$

(6)

11. Given that the equation $2qx^2 + qx - 1 = 0$, where q is a constant, has no real roots,

(*a*) show that $q^2 + 8q < 0$.

(2)

(*b*) Hence find the set of possible values of q.

(3)

12. The equation

$$x^2 + kx + 8 = k$$

has no real solutions for x.

(*a*) Show that k satisfies $k^2 + 4k - 32 < 0$.

(3)

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

(4)

13. The equation $x^2 + kx + (k + 3) = 0$, where k is a constant, has different real roots.

(*a*) Show that $k^2 - 4k - 12 > 0$.

(2)

(*b*) Find the set of possible values of k.

(4)

14. Solve the simultaneous equations

$$x + y = 2$$

$$x^2 + 2y = 12.$$

(6)

15. The equation $2x^2 - 3x - (k + 1) = 0$, where k is a constant, has no real roots.

Find the set of possible values of k.

(4)

16. The equation $x^2 + 2px + (3p + 4) = 0$, where p is a positive constant, has equal roots.

(*a*) Find the value of p.

(4)

(*b*) For this value of p, solve the equation $x^2 + 2px + (3p + 4) = 0$.

(2)

17. Find the set of values of x for which

(a) $3(2x + 1) > 5 - 2x$,

(2)

(b) $2x^2 - 7x + 3 > 0$,

(4)

(c) **both** $3(2x + 1) > 5 - 2x$ **and** $2x^2 - 7x + 3 > 0$.

(2)

18. Given that the equation $kx^2 + 12x + k = 0$, where k is a positive constant, has equal roots, find the value of k.

19.

$$x^2 + 2x + 3 \equiv (x + a)^2 + b.$$

(a) Find the values of the constants a and b.

(2)

(b) Sketch the graph of $y = x^2 + 2x + 3$, indicating clearly the coordinates of any intersections with the coordinate axes.

(3)

(c) Find the value of the discriminant of $x^2 + 2x + 3$. Explain how the sign of the discriminant relates to your sketch in part (b).

(2)

The equation $x^2 + kx + 3 = 0$, where k is a constant, has no real roots.

(d) Find the set of possible values of k, giving your answer in surd form.

(4)

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1.

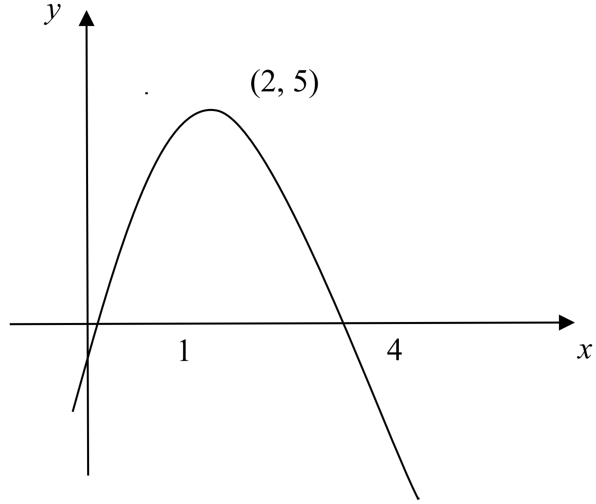

Figure 1

Figure 1 shows a sketch of the curve with equation $y = \mathrm{f}(x)$. The curve crosses the x-axis at the points (1, 0) and (4, 0). The maximum point on the curve is (2, 5).

In separate diagrams, sketch the curves with the following equations. On each diagram show clearly the coordinates of the maximum point and of each point at which the curve crosses the x-axis.

(*a*) $y = 2\mathrm{f}(x)$,

(3)

(*b*) $y = \mathrm{f}(-x)$.

(3)

The maximum point on the curve with equation $y = \mathrm{f}(x + a)$ is on the y-axis.

(*c*) Write down the value of the constant a.

(1)

2. On separate diagrams, sketch the graphs of

(*a*) $y = (x + 3)^2$,

(3)

(*b*) $y = (x + 3)^2 + k$, where k is a positive constant.

(2)

Show on each sketch the coordinates of each point at which the graph meets the axes.

3. The point $P(1, a)$ lies on the curve with equation $y = (x + 1)^2(2 - x)$.

(a) Find the value of a.

(1)

(b) Sketch the curves with the following equations:

(i) $y = (x + 1)^2(2 - x)$,

(ii) $y = \dfrac{2}{x}$.

On your diagram show clearly the coordinates of any points at which the curves meet the axes.

(5)

(c) With reference to your diagram in part (b), state the number of real solutions to the equation

$$(x + 1)^2(2 - x) = \frac{2}{x}.$$

(1)

4. (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)

5. **Figure 1**

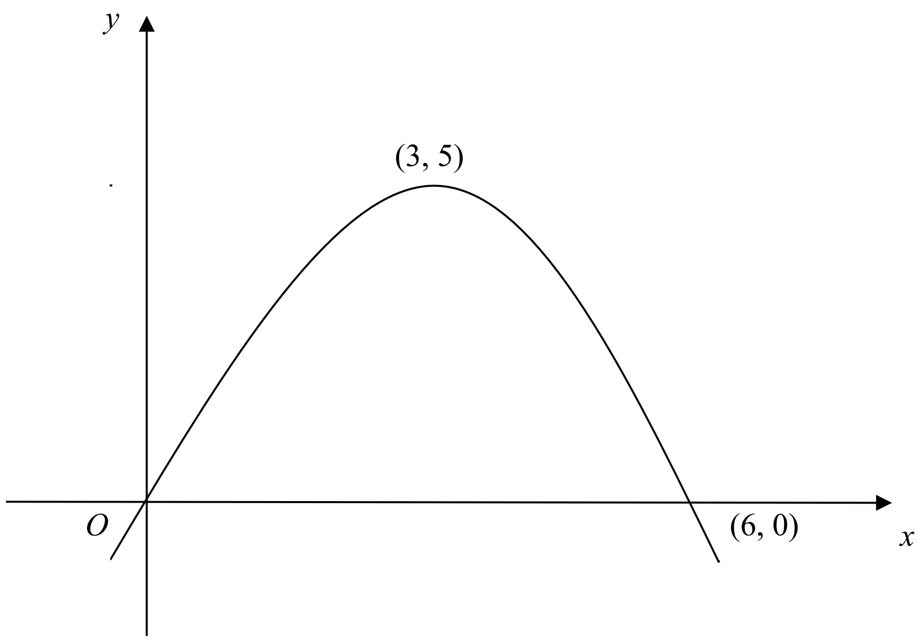

Figure 1 shows a sketch of the curve with equation $y = f(x)$. The curve passes through the origin O and through the point (6, 0). The maximum point on the curve is (3, 5).

On separate diagrams, sketch the curve with equation

(*a*) $y = 3f(x)$,

(2)

(*b*) $y = f(x + 2)$.

(3)

On each diagram, show clearly the coordinates of the maximum point and of each point at which the curve crosses the x-axis.

6. The curve C has equation $y = \frac{3}{x}$ and the line l has equation $y = 2x + 5$.

(*a*) Sketch the graphs of C and l, indicating clearly the coordinates of any intersections with the axes.

(3)

(*b*) Find the coordinates of the points of intersection of C and l.

(6)

7.

Figure 1

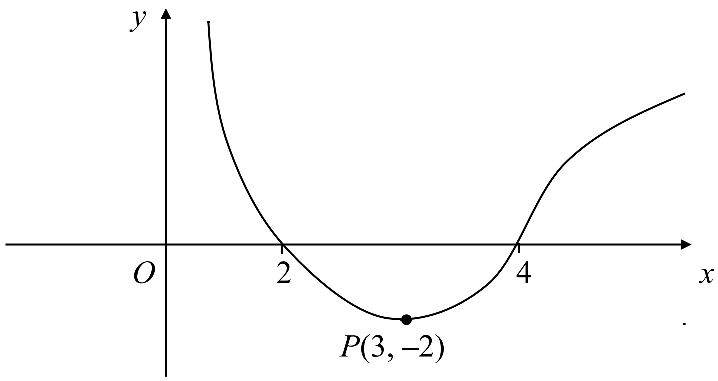

Figure 1 shows a sketch of the curve with equation $y = \mathrm{f}(x)$. The curve crosses the x-axis at the points (2, 0) and (4, 0). The minimum point on the curve is $P(3, -2)$.

In separate diagrams sketch the curve with equation

(*a*) $y = -\mathrm{f}(x)$,

(3)

(*b*) $y = \mathrm{f}(2x)$.

(3)

On each diagram, give the coordinates of the points at which the curve crosses the x-axis, and the coordinates of the image of P under the given transformation.

8.

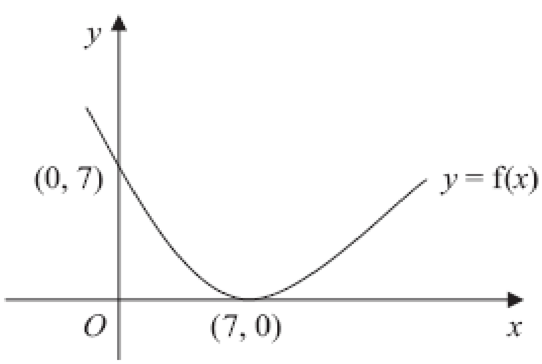

Figure 1

Figure 1 shows a sketch of the curve with equation $y = \mathrm{f}(x)$. The curve passes through the point (0, 7) and has a minimum point at (7, 0).

On separate diagrams, sketch the curve with equation

(*a*) $y = \mathrm{f}(x) + 3$,

(3)

(*b*) $y = \mathrm{f}(2x)$.

(2)

9.

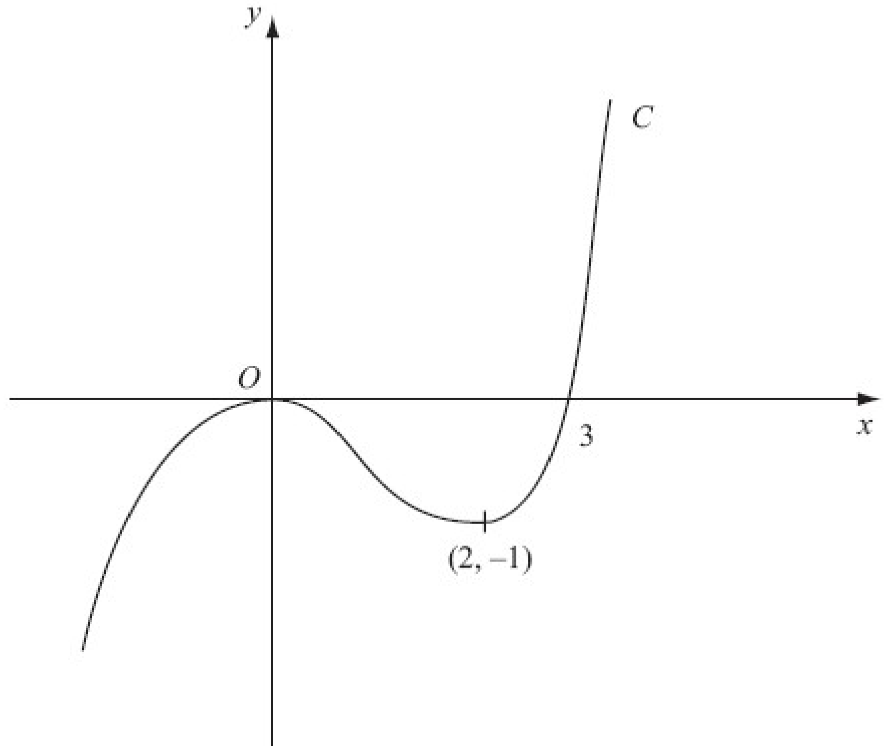

Figure 1

Figure 1 shows a sketch of the curve C with equation $y = f(x)$. There is a maximum at (0, 0), a minimum at (2, –1) and C passes through (3, 0).

On separate diagrams, sketch the curve with equation

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

(3)

(*b*) $y = f(-x)$.

(3)

On each diagram show clearly the coordinates of the maximum point, the minimum point and any points of intersection with the x-axis.

10. Given that $f(x) = (x^2 - 6x)(x - 2) + 3x$,

(*a*) express $f(x)$ in the form $x(ax^2 + bx + c)$, where a, b and c are constants.

(3)

(*b*) Hence factorise $f(x)$ completely.

(2)

(*c*) Sketch the graph of $y = f(x)$, showing the coordinates of each point at which the graph meets the axes.

(3)

11.

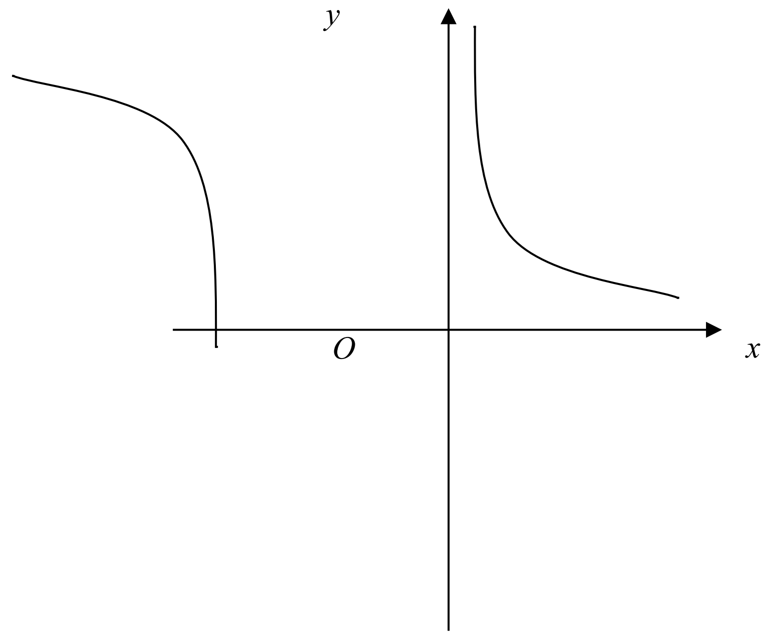

Figure 1

Figure 1 shows a sketch of the curve with equation $y = \frac{3}{x}, \quad x \neq 0$.

(a) On a separate diagram, sketch the curve with equation $y = \frac{3}{x+2}, \quad x \neq -2$, showing the coordinates of any point at which the curve crosses a coordinate axis.

(3)

(b) Write down the equations of the asymptotes of the curve in part (a).

(2)

12. Given that

$$\mathrm{f}(x) = \frac{1}{x}, \quad x \neq 0,$$

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

(4)

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

(2)

13. **Figure 1**

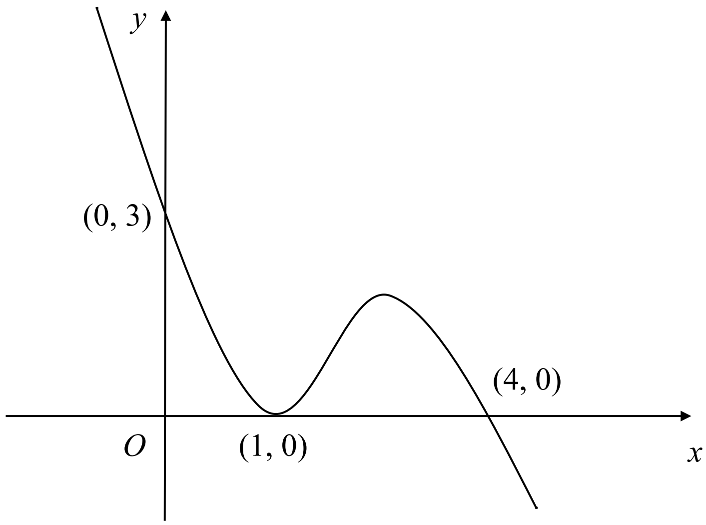

Figure 1 shows a sketch of the curve with equation $y = \mathrm{f}(x)$. The curve passes through the points (0, 3) and (4, 0) and touches the x-axis at the point (1, 0).

On separate diagrams, sketch the curve with equation

(*a*) $y = \mathrm{f}(x + 1)$,

(3)

(*b*) $y = 2\mathrm{f}(x)$,

(3)

(*c*) $y = \mathrm{f}\left(\frac{1}{2}x\right)$.

(3)

On each diagram show clearly the coordinates of all the points at which the curve meets the axes.

14. (*a*) On the same axes sketch the graphs of the curves with equations

(i) $y = x^2(x - 2)$,

(3)

(ii) $y = x(6 - x)$,

(3)

and indicate on your sketches the coordinates of all the points where the curves cross the x-axis.

(*b*) Use algebra to find the coordinates of the points where the graphs intersect.

(7)

END