Core Mathematics C1 Paper F

1. *(i)* Calculate the discriminant of $2x^2 + 8x + 8$. [2]

(ii) State the number of real roots of the equation $2x^2 + 8x + 8 = 0$. [1]

2. Find the set of values of x for which

$$(x - 1)(x - 2) < 20.$$ [4]

3. *(i)* Solve the equation

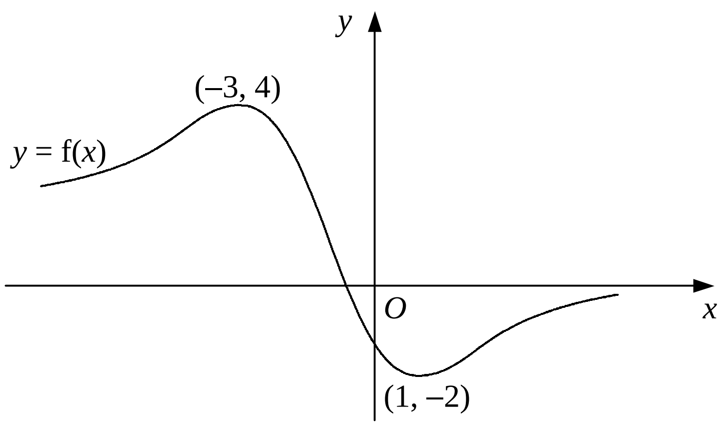
$$x^{\frac{3}{2}} = 27.$$ [2]

(ii) Express $(2\tfrac{1}{4})^{-\frac{1}{2}}$ as an exact fraction in its simplest form. [2]

4. Differentiate with respect to x

$$\frac{6x^2 - 1}{2\sqrt{x}}.$$ [5]

5.



The diagram shows a sketch of the curve with equation $y = f(x)$. The curve has a maximum at $(-3, 4)$ and a minimum at $(1, -2)$.

Showing the coordinates of any turning points, sketch on separate diagrams the curves with equations

(i) $y = 2f(x)$, [3]

(ii) $y = -f(x)$. [3]

6. $$f(x) = 2x^2 - 4x + 1.$$

(i) Find the values of the constants a, b and c such that

$$f(x) = a(x + b)^2 + c.$$ [4]

(ii) State the equation of the line of symmetry of the curve $y = f(x)$. [1]

(iii) Solve the equation $f(x) = 3$, giving your answers in exact form. [3]

7. A curve has the equation

$$y = x^3 + ax^2 - 15x + b,$$

where a and b are constants.

Given that the curve is stationary at the point $(-1, 12)$,

(i) find the values of a and b, [6]

(ii) find the coordinates of the other stationary point of the curve. [3]

8. The circle C has the equation

$$x^2 + y^2 + 10x - 8y + k = 0,$$

where k is a constant.

Given that the point with coordinates $(-6, 5)$ lies on C,

(i) find the value of k, [2]

(ii) find the coordinates of the centre and the radius of C. [3]

A straight line which passes through the point A (2, 3) is a tangent to C at the point B.

(iii) Find the length AB in the form $k\sqrt{3}$. [5]

Turn over

9. A curve has the equation $y = x + \dfrac{3}{x}$, $x \neq 0$.

The point P on the curve has x-coordinate 1.

(i) Show that the gradient of the curve at P is -2. [3]

(ii) Find an equation for the normal to the curve at P, giving your answer in the form $y = mx + c$. [3]

(iii) Find the coordinates of the point where the normal to the curve at P intersects the curve again. [4]

10. The straight line l_1 has equation $2x + y - 14 = 0$ and crosses the x-axis at the point A.

(i) Find the coordinates of A. [2]

The straight line l_2 is parallel to l_1 and passes through the point B $(-6, 6)$.

(ii) Find an equation for l_2 in the form $y = mx + c$. [3]

The line l_2 crosses the x-axis at the point C.

(iii) Find the coordinates of C. [1]

The point D lies on l_1 and is such that CD is perpendicular to l_1.

(iv) Show that D has coordinates $(5, 4)$. [5]

(v) Find the area of triangle ACD. [2]