# Core-Maths-C1 - 2008-June

## Question 1

1. Find $\int (2 + 5x^2)\,dx$.

**(3)**

## Question 2

2. Factorise completely

$$x^3 - 9x.$$

**(3)**

## Question 3

3.

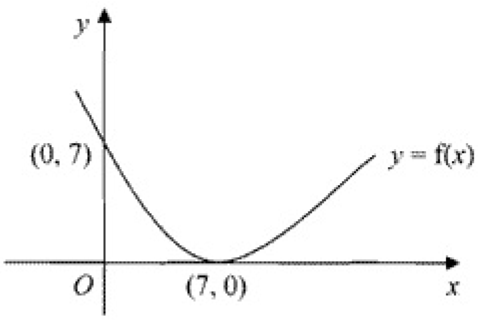



**Figure 1**

Figure 1 shows a sketch of the curve with equation $y = f(x)$. 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) $y = f(x) + 3$,

**(3)**

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

**(2)**

On each diagram, show clearly the coordinates of the minimum point and the coordinates of the point at which the curve crosses the $y$-axis.

# Question 4

**4.** $$f(x) = 3x + x^3, \qquad x > 0.$$

(a) Differentiate to find $f'(x)$.

**(2)**

Given that $f'(x) = 15$,

(b) find the value of $x$.

**(3)**

# Question 5

**5.** A sequence $x_1, x_2, x_3, \ldots$ is defined by

$$x_1 = 1,$$

$$x_{n+1} = ax_n - 3, \quad n \geqslant 1,$$

where $a$ is a constant.

(a) Find an expression for $x_2$ in terms of $a$.

**(1)**

(b) Show that $x_3 = a^2 - 3a - 3$.

**(2)**

Given that $x_3 = 7$,

(c) find the possible values of $a$.

**(3)**

# Question 6

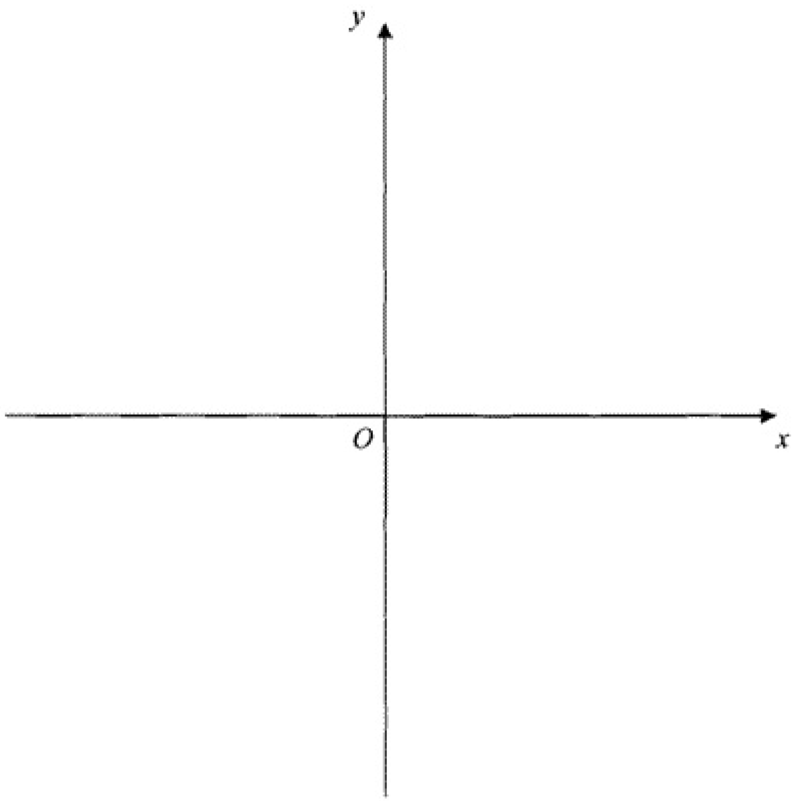
**6.** The curve $C$ has equation $y = \frac{3}{x}$ and the line $l$ has equation $y = 2x + 5$.

(a) On the axes below, 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)**



# Question 7

Sue is training for a marathon. Her training includes a run every Saturday starting with a run of 5 km on the first Saturday. Each Saturday she increases the length of her run from the previous Saturday by 2 km.

(a) Show that on the 4th Saturday of training she runs 11 km.

**(1)**

(b) Find an expression, in terms of $n$, for the length of her training run on the $n$th Saturday.

**(2)**

(c) Show that the total distance she runs on Saturdays in $n$ weeks of training is $n(n + 4)$ km.

**(3)**

On the $n$th Saturday Sue runs 43 km.

(d) Find the value of $n$.

**(2)**

(e) Find the total distance, in km, Sue runs on Saturdays in $n$ weeks of training.

**(2)**

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# Question 8

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)**

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# Question 9

The curve $C$ has equation $y = kx^3 - x^2 + x - 5$, where $k$ is a constant.

(a) Find $\dfrac{dy}{dx}$ .

**(2)**

The point $A$ with $x$-coordinate $-\frac{1}{2}$ lies on $C$. The tangent to $C$ at $A$ is parallel to the line with equation $2y - 7x + 1 = 0$.

Find

(b) the value of $k$,

**(4)**

(c) the value of the $y$-coordinate of $A$.

**(2)**

# Question 10

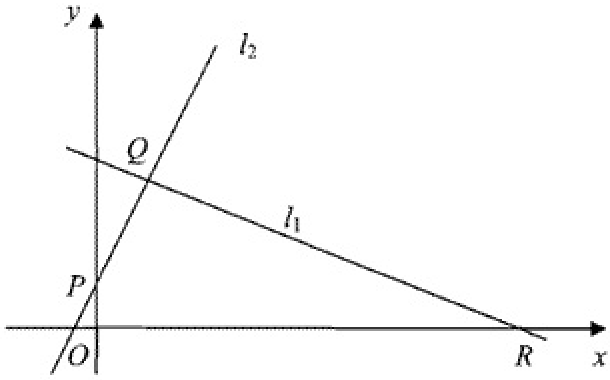


**Figure 2**

The points $Q$ (1, 3) and $R$ (7, 0) lie on the line $l_1$, as shown in Figure 2.

The length of $QR$ is $a\sqrt{5}$.

(a) Find the value of $a$.

**(3)**

The line $l_2$ is perpendicular to $l_1$, passes through $Q$ and crosses the $y$-axis at the point $P$, as shown in Figure 2.

Find

(b) an equation for $l_2$,

**(5)**

(c) the coordinates of $P$,

**(1)**

(d) the area of $\Delta PQR$.

**(4)**

# Question 11

The gradient of a curve $C$ is given by $\frac{dy}{dx} = \frac{(x^2+3)^2}{x^2}, x \neq 0$.

(a) Show that $\frac{dy}{dx} = x^2 + 6 + 9x^{-2}$.

**(2)**

The point (3, 20) lies on $C$.

(b) Find an equation for the curve $C$ in the form $y = f(x)$.

**(6)**