Edexcel Core 1 Jun 2008

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

(3)

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2. Factorise completely

$$x^3 - 9x.$$

(3)

3.

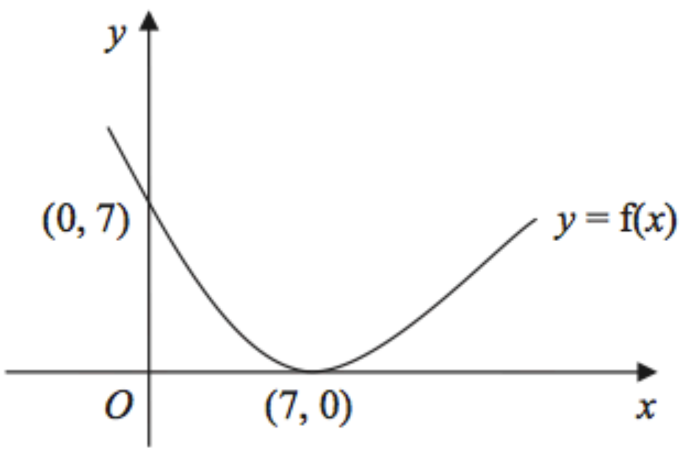

Figure 1

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.

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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)

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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)

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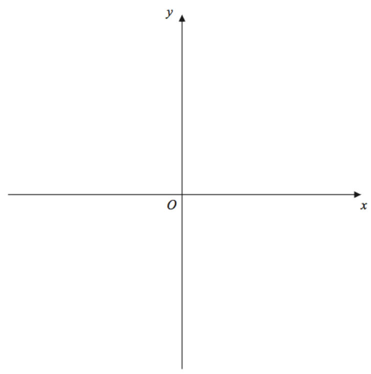
6. The curve C has equation $y = \frac{3}{x}$ and the line l has equation $y = 2x + 5$.

(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)



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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 nth 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 nth 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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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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9. The curve C has equation $y = kx^3 - x^2 + x - 5$, where k is a constant.

(a) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$.

(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)

10.

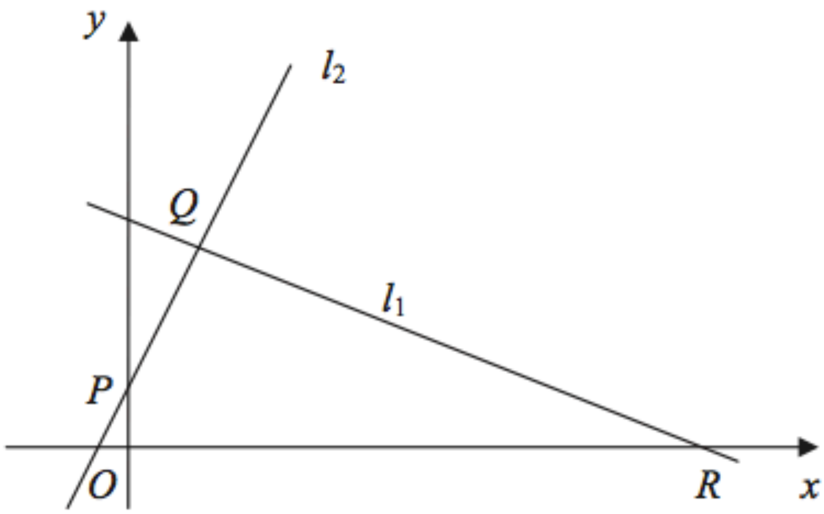

Figure 2

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 ΔPQR.

(4)

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

(a) Show that $\frac{\mathrm{d}y}{\mathrm{d}x} = x^2 + 6 + 9x^{-2}$.

(2)

The point (3, 20) lies on C.

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

(6)