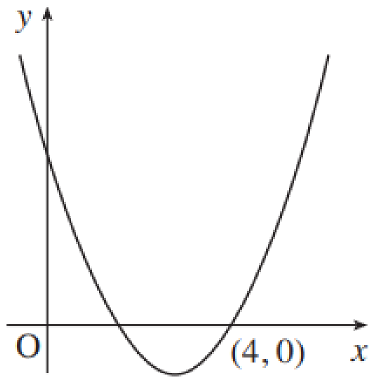
Mixed Calculus Exam Questions (From OCR 4752)

Q1, (Jan 2007, Q12)

Fig. 12 is a sketch of the curve $y = 2x^2 - 11x + 12$.



Not to scale

Fig. 12

(i) Show that the curve intersects the x-axis at $(4, 0)$ and find the coordinates of the other point of intersection of the curve and the x-axis. [3]

(ii) Find the equation of the normal to the curve at the point $(4, 0)$.

Show also that the area of the triangle bounded by this normal and the axes is 1.6 units^2. [6]

(iii) Find the area of the region bounded by the curve and the x-axis. [3]

Q2, Jan 2012, Q12)

The equation of a curve is $y = 9x^2 - x^4$.

(i) Show that the curve meets the x-axis at the origin and at $x = \pm a$, stating the value of a. **[2]**

(ii) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$.

Hence show that the origin is a minimum point on the curve. Find the x-coordinates of the maximum points. **[6]**

(iii) Use calculus to find the area of the region bounded by the curve and the x-axis between $x = 0$ and $x = a$, using the value you found for a in part **(i)**. **[4]**

Q3, (Jan 2011, Q11)

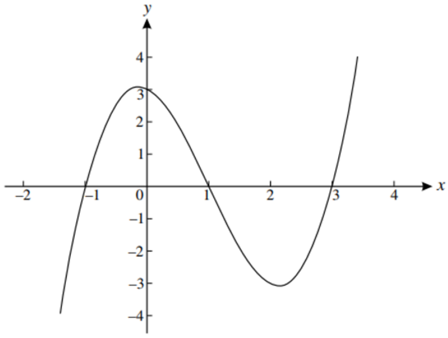


Fig. 11

Fig. 11 shows the curve $y = x^3 - 3x^2 - x + 3$.

(i) Use calculus to find $\int_1^3 (x^3 - 3x^2 - x + 3)\,dx$ and state what this represents. **[6]**

(ii) Find the x-coordinates of the turning points of the curve $y = x^3 - 3x^2 - x + 3$, giving your answers in surd form. Hence state the set of values of x for which $y = x^3 - 3x^2 - x + 3$ is a decreasing function. **[5]**

Q4, (Jun 2015, Q10)

The gradient of a curve is given by $\frac{dy}{dx} = 4x + 3$. The curve passes through the point $(2, 9)$.

(i) Find the equation of the tangent to the curve at the point $(2, 9)$. **[3]**

(ii) Find the equation of the curve and the coordinates of its points of intersection with the x-axis. Find also the coordinates of the minimum point of this curve. **[7]**

(iii) Find the equation of the curve after it has been stretched parallel to the x-axis with scale factor $\frac{1}{2}$. Write down the coordinates of the minimum point of the transformed curve. **[3]**

Q5, (Jan 2013, Q10)

Fig. 10 shows a sketch of the curve $y = x^2 - 4x + 3$. The point A on the curve has x-coordinate 4. At point B the curve crosses the x-axis.

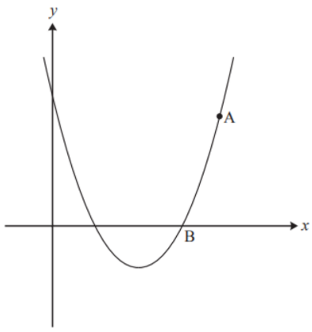


Fig. 10

(i) Use calculus to find the equation of the normal to the curve at A and show that this normal intersects the x-axis at C (16, 0). **[6]**

(ii) Find the area of the region ABC bounded by the curve, the normal at A and the x-axis. **[5]**

Q6, (Jan 2009, Q10)

Fig. 10 shows a sketch of the graph of $y - 7x - x^2 - 6$.

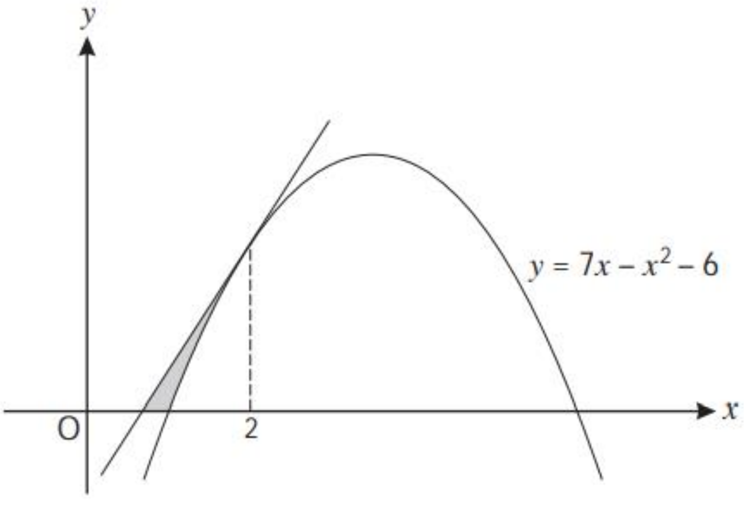


Fig. 10

(i) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$ and hence find the equation of the tangent to the curve at the point on the curve where $x = 2$.

Show that this tangent crosses the x-axis where $x = \frac{2}{3}$. **[6]**

(ii) Show that the curve crosses the x-axis where $x = 1$ and find the x-coordinate of the other point of intersection of the curve with the x-axis. **[2]**

(iii) Find $\int_1^2 (7x - x^2 - 6)\,\mathrm{d}x$.

Hence find the area of the region bounded by the curve, the tangent and the x-axis, shown shaded on Fig. 10. **[5]**