Specimen IGCSE Calculus Questions

1. Differentiate

(a) $x^3 + x^2 - 5x - 4$ (b) $2x^4 - 5x^2 + 2x - 3$ (c) $3x^5 + 7x^3 - x + 2.5$

(d) $5 - 2x + 4x^2 - 2x^3$ (e) $\frac{x^3}{6} + \frac{3x^2}{4} - \frac{2x}{3}$ (f) $\frac{7 - x^2}{2}$

2. Find $\frac{dy}{dx}$ for the following.

(a) $y = 2x^3 + 4x^2 + x^{-1}$ (b) $y = 6x + 3 - 4x^{-1} + 3x^{-2}$ (c) $y = \frac{2}{x} - \frac{6}{x^2}$

3. Find an expression for the gradient of each of these curves.

(a) $y = x^5 - 3x^3 + 2x - 4$ (b) $y = 3x + \frac{4}{x^2}$ (c) $y = \frac{3x^2 + 2x - 4}{3}$

4. Find the gradient of the tangent at the given point on each of the following curves.

(a) $y = x^2 - 5x - 6$, at the point where $x = 2$ (b) $y = x^3 - 2x^2 - 3x$, at the point (-4, -52)

(c) $y = 3x - \frac{4}{x^2}$, at the point where $x = \frac{1}{2}$ (d) $y = \frac{x^2 + 3x}{12}$ at the point (3, 1.5)

5. Expand and differentiate

(a) $(x + 3)^2$ (b) $(2x - 3)(x + 5)$ (c) $(4 - x)(2 + 3x)$ (d) $x^2(4 - 2x)$

6. A curve has equation $y = x^2 - 3x + 5$.

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

(b) Find the gradient of the curve at the point with coordinates (2, 3).

(c) Find the coordinates of the point on the curve where the gradient = -5.

7. A curve has equation $y = x^3 - 6x^2 + 9x - 2$.

(a) Find the coordinates of the point on this curve at which the tangent is parallel to the line $y = -3x + 5$.

(b) Find the coordinates of the two turning points on this curve.

8. For the curve with equation $y = x^2 - 4x + 5$

(a) Find $\frac{dy}{dx}$,

(b) Find the turning point,

(c) State, with a reason, whether this turning point is a maximum or a minimum.

9. Find the maximum value of y where $y = 3 + 6x - 2x^2$. Explain how you know that it is a maximum.

10. A publisher has to choose a price, £x, for a new book.
The total amount of money she will receive from sales is £y, where

$$y = 20\,000x - 5000x^2 .$$

(a) Find the price which gives the maximum amount of money from sales.

(b) Find the maximum amount of money from sales.

11. The temperature, T°, of a liquid at time t seconds is $t^2 - 6t + 9$.

(a) Find the rate of change of the temperature after 2 seconds.

(b) Find the time when the rate of change of temperature is –3 °/second.

12. A car is moving along a straight road. It passes a point O.
After t seconds its distance, s m, from O is given by

$$s = 10t - t^2 \quad \text{for } 0 \leq t \leq 10$$

(a) Find the time when the car passes through O again.

(b) Find $\frac{ds}{dt}$.

(c) Find the maximum distance of the car from O.

(d) Find the speed of the car 3 seconds after passing O.

(e) Find the acceleration of the car.

13. A curve has equation $y = 2x + \frac{8}{x}$.

(a) Find the turning points.

(b) Copy and complete the table of values for $y = 2x + \frac{8}{x}$.

x	-4	-3	-2	-1	1	2	3	4
y		-8.7	-8		10			

(c) Copy the grid and draw the curve for $-4 \leq x \leq 4$.