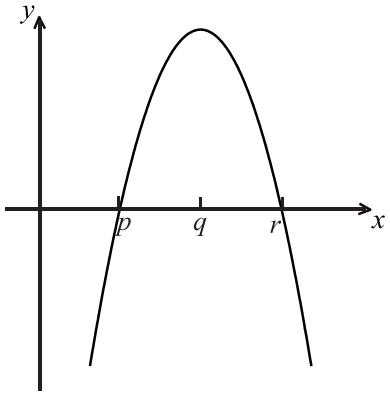
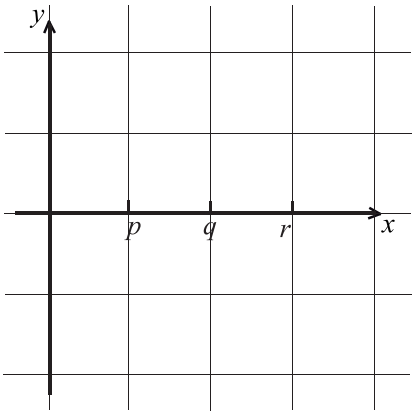
Differentiation 3

1)

The diagram below shows part of the graph of the **gradient** function, $y = f'(x)$.



(a) On the grid below, sketch a graph of $y = f''(x)$, clearly indicating the x-intercept. *[2 marks]*



(b) Complete the table, for the graph of $y = f(x)$. *[2 marks]*

	x-coordinate
(i) Maximum point on f	
(ii) Inflexion point on f	

(c) Justify your answer to part (b)(ii). *[2 marks]*

[Maximum mark: 6]

2)

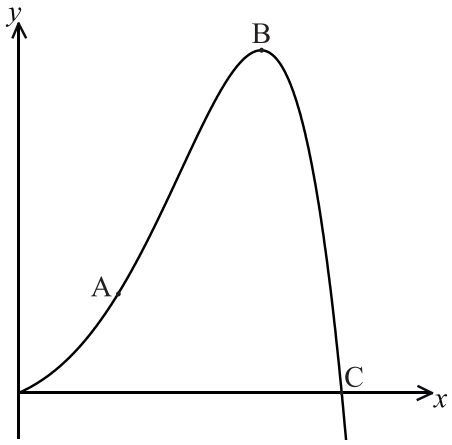
Let $f(x) = \cos 2x$ and $g(x) = \ln(3x - 5)$.

(a) Find $f'(x)$. *[2 marks]*

(b) Find $g'(x)$. *[2 marks]*

(c) Let $h(x) = f(x) \times g(x)$. Find $h'(x)$. *[2 marks]*

3)C The function f is defined as $f(x) = e^x \sin x$, where x is in radians. Part of the curve of f is shown below.



There is a point of inflexion at A, and a local maximum point at B. The curve of f intersects the x-axis at the point C.

(a) Write down the x-coordinate of the point C. *[1 mark]*

(b) (i) Find $f'(x)$.

(ii) Write down the value of $f'(x)$ at the point B. *[4 marks]*

(c) Show that $f''(x) = 2e^x \cos x$. *[2 marks]*

(d) (i) Write down the value of $f''(x)$ at A, the point of inflexion.

(ii) Hence, calculate the coordinates of A. *[4 marks]*

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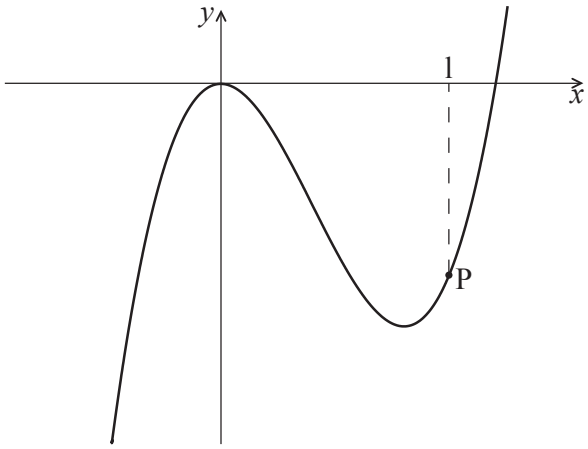
[Maximum mark: 6]

4) NC Part of the graph of $f(x) = ax^3 - 6x^2$ is shown below.



The point P lies on the graph of f. At P, $x = 1$.

(a) Find $f'(x)$. *[2 marks]*

(b) The graph of f has a gradient of 3 at the point P. Find the value of a. *[4 marks]*

5) C Let $f(x) = x^3 - 4x + 1$.

(a) Expand $(x+h)^3$. *[2 marks]*

(b) Use the formula $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ to show that the derivative of $f(x)$ is $3x^2 - 4$. *[4 marks]*

(c) The tangent to the curve of f at the point $\mathrm{P}(1, -2)$ is parallel to the tangent at a point Q. Find the coordinates of Q. *[4 marks]*

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6)C Let $f(x) = \cos(e^x)$, for $-2 \le x \le 2$.

(a) Find $f'(x)$. *[2 marks]*

(b) On the grid below, sketch the graph of $f'(x)$. *[4 marks]*