Higher Mathematics

Differentiation - **Questions** - 2013-2019

Marks are indicated in brackets after each question number

2013 Paper 1 Question 2, (2)

The point P (5, 12) lies on the curve with equation $y = x^2 - 4x + 7$.

What is the gradient of the tangent to this curve at P?

2013 Paper 1 Question 18, (2)

Given that $y = \sin(x^2 - 3)$, find $\frac{dy}{dx}$.

2014 Paper 1 Question 8, (2)

What is the derivative of $\left(4 - 9x^4\right)^{\frac{1}{2}}$?

2014 Paper 1 Question 9, (2)

$\sin x + \sqrt{3}\cos x$ can be written as $2\cos\left(x - \frac{\pi}{6}\right)$.

The maximum value of $\sin x + \sqrt{3}\cos x$ is 2.

What is the maximum value of $5\sin 2x + 5\sqrt{3}\cos 2x$?

2014 Paper 1 Question 21, (6) (2)

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

(*a*) Find the coordinates of the stationary points on this curve and determine their nature.

(*b*) State the coordinates of the points where the curve meets the coordinate axes and sketch the curve.

2014 Paper 2 Question 2, (4)

A curve has equation $y = x^4 - 2x^3 + 5$.

Find the equation of the tangent to this curve at the point where $x = 2$.

2015 Paper 1 Question 2, (4)

Find the equation of the tangent to the curve $y = 2x^3 + 3$ at the point where $x = -2$.

2015 Paper 1 Question 7, (4)

A function f is defined on a suitable domain by $f(x) = \sqrt{x}\left(3x - \frac{2}{x\sqrt{x}}\right)$.

Find $f'(4)$.

2016 Paper 1 Question 2, (3)

Given that $y = 12x^3 + 8\sqrt{x}$, where $x > 0$, find $\frac{dy}{dx}$.

2016 Paper 1 Question 9, (4) (2)

(a) Find the x-coordinates of the stationary points on the graph with equation $y = f(x)$, where $f(x) = x^3 + 3x^2 - 24x$.

(b) Hence determine the range of values of x for which the function f is strictly increasing.

2016 Paper 2 Question 10, (2) (1)

(a) Given that $y = (x^2 + 7)^{\frac{1}{2}}$, find $\frac{dy}{dx}$.

(b) Hence find $\int \frac{4x}{\sqrt{x^2 + 7}}\,dx$.

2017 Paper 1 Question 3, (2)

Given $y = (4x-1)^{12}$, find $\frac{dy}{dx}$.

2017 Paper 1 Question 8, (3)

Calculate the rate of change of $d(t) = \frac{1}{2t}$, $t \neq 0$, when $t = 5$.

2017 Paper 2 Question 7, (4) (3)

(a) Find the x-coordinate of the stationary point on the curve with equation $y = 6x - 2\sqrt{x^3}$.

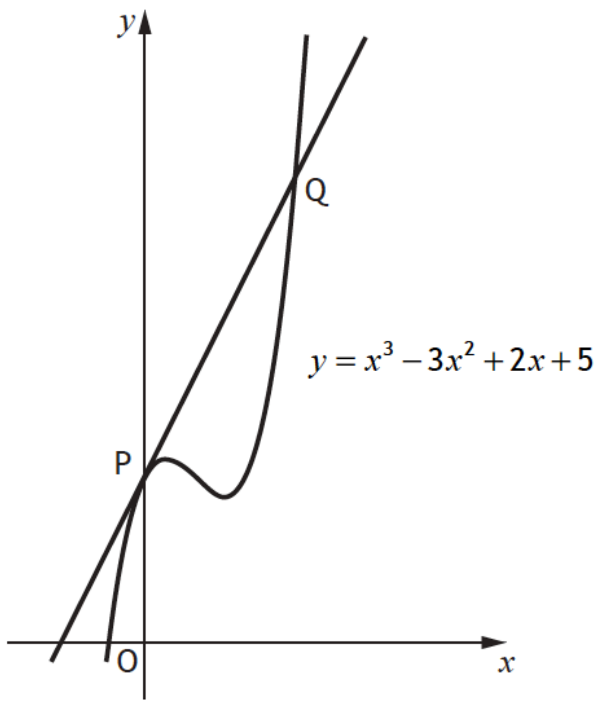
(b) Hence, determine the greatest and least values of y in the interval $1 \leq x \leq 9$.

2018 Paper 1 Question 3, (3)

Given $h(x) = 3\cos 2x$, find the value of $h'\left(\frac{\pi}{6}\right)$.

2018 Paper 1 Question 7, (1) (3) (4)

The curve with equation $y = x^3 - 3x^2 + 2x + 5$ is shown on the diagram.



(a) Write down the coordinates of P, the point where the curve crosses the y-axis .

(b) Determine the equation of the tangent to the curve at P.

(c) Find the coordinates of Q, the point where this tangent meets the curve again.

2018 Paper 1 Question 15, (5)

A cubic function, f, is defined on the set of real numbers.

- $(x+4)$ is a factor of $f(x)$
- $x = 2$ is a repeated root of $f(x)$
- $f'(-2) = 0$
- $f'(x) > 0$ where the graph with equation $y = f(x)$ crosses the y-axis

Sketch a possible graph of $y = f(x)$ on the diagram in your answer booklet.

2018 Paper 2 Question 3, (3)

A function, f, is defined on the set of real numbers by $f(x) = x^3 - 7x - 6$.

Determine whether f is increasing or decreasing when $x = 2$.

2018 Paper 2 Question 9, (6)

A sector with a particular fixed area has radius x cm.

The perimeter, P cm, of the sector is given by

$$P = 2x + \frac{128}{x}.$$

Find the minimum value of P.

2019 Paper 1 Question 1, (4)

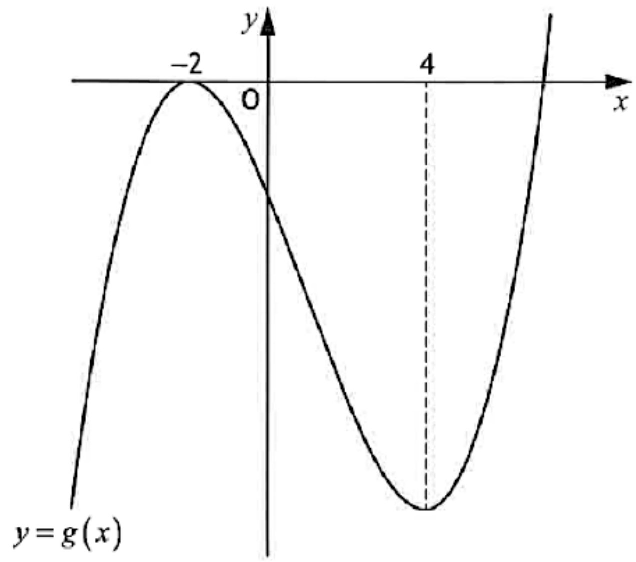
Find the x-coordinates of the stationary points on the curve with equation $y = \frac{1}{2}x^4 - 2x^3 + 6$.

2019 Paper 1 Question 6, (3)

Given that $y = \frac{1}{(1-3x)^5}$, $x \neq \frac{1}{3}$, find $\frac{dy}{dx}$.

2019 Paper 2 Question 5, (2)

The diagram below shows the graph of a cubic function $y = g(x)$, with stationary points at $x = -2$ and $x = 4$.



On the diagram in your answer booklet, sketch the graph of $y = g'(x)$.

2019 Paper 2 Question 7, (3) (3)

(a) Express $-6x^2 + 24x - 25$ in the form $p(x+q)^2 + r$.

(b) Given that $f(x) = -2x^3 + 12x^2 - 25x + 9$,
show that $f(x)$ is strictly decreasing for all $x \in \mathbb{R}$.