



Higher Mathematics

Polynomials - Questions

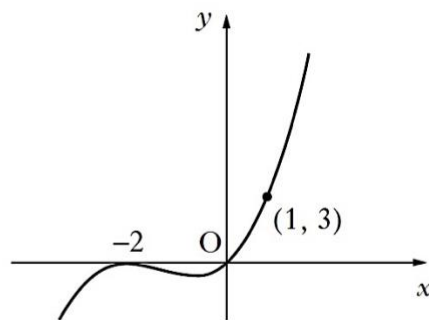
Marks are indicated in brackets after each question number

2013 Paper 1 Question 6, (2)

What is the remainder when $x^3 + 3x^2 - 5x - 6$ is divided by $(x - 2)$?

2013 Paper 1 Question 17, (2)

The diagram shows a curve with equation of the form $y = kx(x + a)^2$, which passes through the points $(-2, 0)$, $(0, 0)$ and $(1, 3)$.



What are the values of a and k ?

2013 Paper 2 Question 3, (4) (5)

(a) Given that $(x - 1)$ is a factor of $x^3 + 3x^2 + x - 5$, factorise this cubic fully.

(b) Show that the curve with equation

$$y = x^4 + 4x^3 + 2x^2 - 20x + 3$$

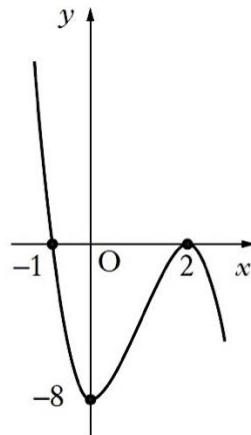
has only one stationary point.

Find the x -coordinate and determine the nature of this point.



2014 Paper 1 Question 15, (2)

The diagram shows a cubic curve passing through $(-1, 0)$, $(2, 0)$ and $(0, -8)$.



What is the equation of the curve?

2014 Paper 1 Question 22, (4) (3)

For the polynomial $6x^3 + 7x^2 + ax + b$,

- $x + 1$ is a factor
- 72 is the remainder when it is divided by $x - 2$.

(a) Determine the values of a and b .

(b) Hence factorise the polynomial completely.

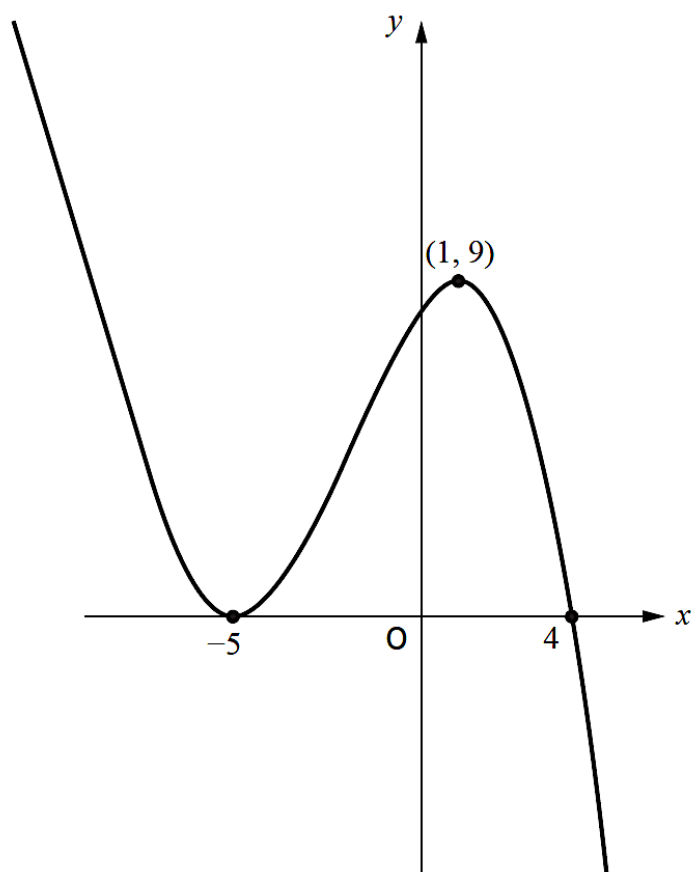
2015 Paper 1 Question 3, (4)

Show that $(x + 3)$ is a factor of $x^3 - 3x^2 - 10x + 24$ and hence factorise $x^3 - 3x^2 - 10x + 24$ fully.



2016 Paper 1 Question 15, (3) (1)

The diagram below shows the graph with equation $y = f(x)$, where $f(x) = k(x-a)(x-b)^2$.

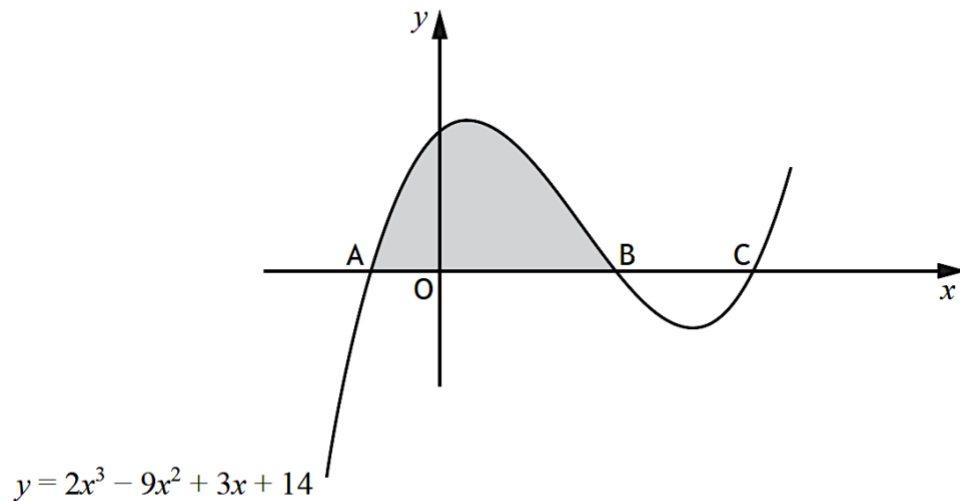


- (a) Find the values of a , b and k .
- (b) For the function $g(x) = f(x) - d$, where d is positive, determine the range of values of d for which $g(x)$ has exactly one real root.



2016 Paper 2 Question 3, (2) (3) (1) (4)

- (a) (i) Show that $(x+1)$ is a factor of $2x^3 - 9x^2 + 3x + 14$.
(ii) Hence solve the equation $2x^3 - 9x^2 + 3x + 14 = 0$.
- (b) The diagram below shows the graph with equation $y = 2x^3 - 9x^2 + 3x + 14$.
The curve cuts the x -axis at A, B and C.



- (i) Write down the coordinates of the points A and B.
(ii) Hence calculate the shaded area in the diagram.

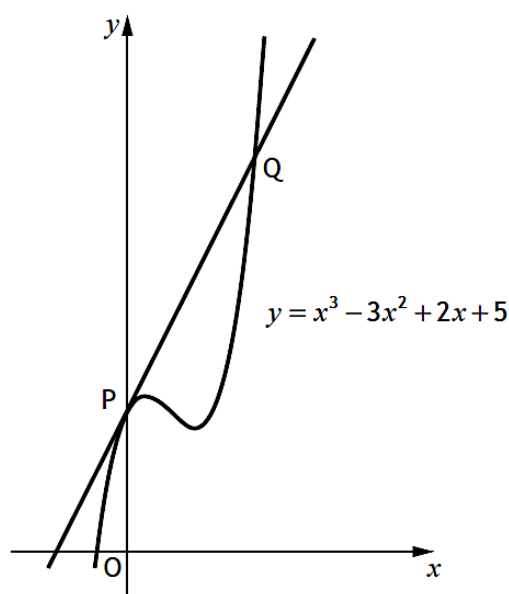
2017 Paper 2 Question 2, (2) (3)

- (a) Show that $(x-1)$ is a factor of $f(x) = 2x^3 - 5x^2 + x + 2$.
(b) Hence, or otherwise, solve $f(x) = 0$.



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

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



- Write down the coordinates of P, the point where the curve crosses the y -axis .
- Determine the equation of the tangent to the curve at P.
- 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 7, (2) (2)

- (a) (i) Show that $(x-2)$ is a factor of $2x^3 - 3x^2 - 3x + 2$.
(ii) Hence, factorise $2x^3 - 3x^2 - 3x + 2$ fully.

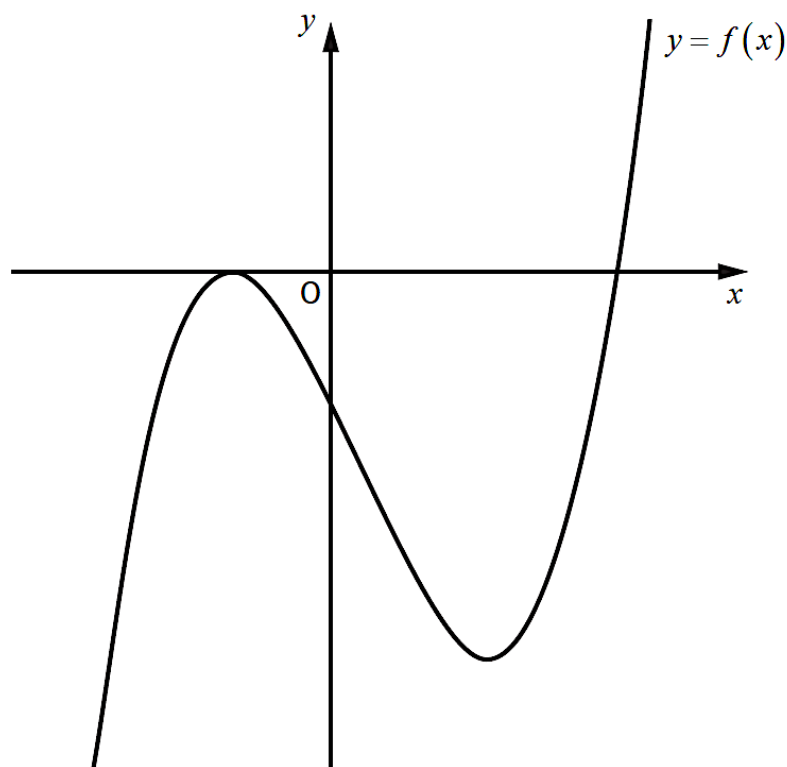
2019 Paper 2 Question 10, (2)

- (a) Show that $(x+3)$ is a factor of $3x^4 + 10x^3 + x^2 - 8x - 6$.
(b) Hence, or otherwise, factorise $3x^4 + 10x^3 + x^2 - 8x - 6$ fully.

2022 Paper 1 Question 13, (2) (3) (1)

- (a) (i) Show that $(x+2)$ is a factor of $f(x) = x^3 - 2x^2 - 20x - 24$.
(ii) Hence, or otherwise, solve $f(x) = 0$.

The diagram shows the graph of $y = f(x)$.



- (b) The graph of $y = f(x-k)$, $k > 0$ has a stationary point at $(1, 0)$.
State the value of k .



2023 Paper 1 Question 10, (2) (5)

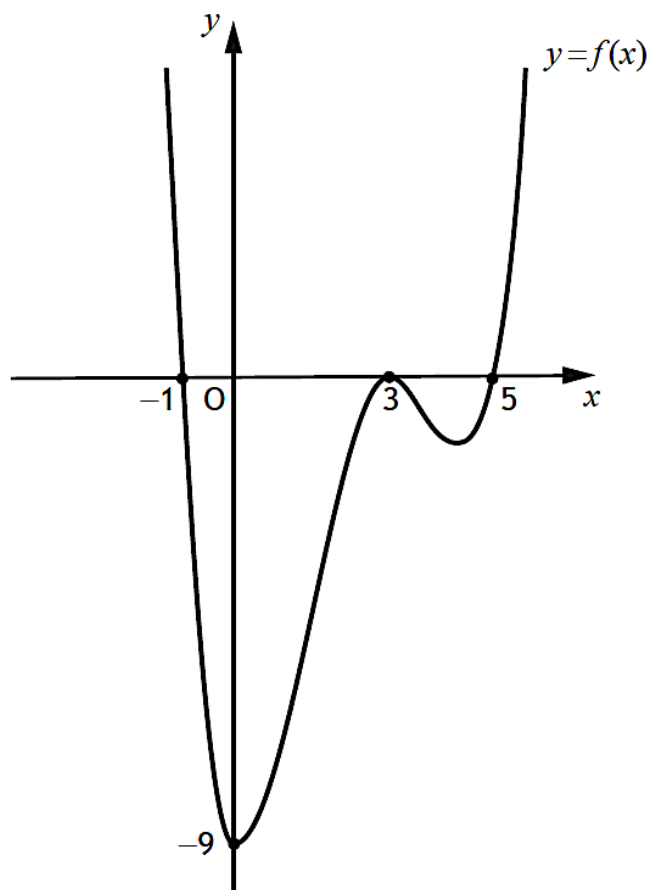
- (a) Show that $(x+5)$ is a factor of $x^4 + 3x^3 - 7x^2 + 9x - 30$.
- (b) Hence, or otherwise, solve $x^4 + 3x^3 - 7x^2 + 9x - 30 = 0$, $x \in \mathbb{R}$.

2024 Paper 1 Question 10, (2) (4)

- (a) Show that $(x-1)$ is a factor of $2x^4 + 3x^3 - 4x^2 - 3x + 2$.
- (b) Hence, or otherwise, factorise $2x^4 + 3x^3 - 4x^2 - 3x + 2$ fully.

2024 Paper 2 Question 13, (3)

The diagram shows the graph of $y = f(x)$, where $f(x)$ is a quartic function.



Express $f(x)$ in the form $f(x) = k(x+a)^2(x+b)(x+c)$.



2025 Paper 1 Question 7, (2) (3)

- (a) Show that $(x+3)$ is a factor of $5x^3 + 16x^2 - x - 12$.
- (b) Hence, or otherwise, solve $5x^3 + 16x^2 - x - 12 = 0$.

2026 Paper 1 Question 11, (2) (2) (4)

- (a) (i) Show that $(x+2)$ is a factor of $x^3 + 7x^2 + 18x + 16$.
- (ii) Explain why $(x+2)$ is the only linear factor of $x^3 + 7x^2 + 18x + 16$.
Give a reason for your answer.
- (b) Find the coordinates of the point(s) where the curves with equations $y = 2x^3 + 20x^2 + 27x + 9$ and $y = 6x^2 - 9x - 23$ intersect.