



Differentiation

Higher Maths Exam Questions

Source: 2019 P1 Q1 Higher Maths

(1)

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

Source: 2019 P2 Q7b Higher Maths

(2)

(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 $x \in \mathbb{R}$.

Source: 2018 P2 Q3 Higher Maths

(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 $x = 2$.

Source: 2018 P2 Q9 Higher Maths

- (4) 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 .

Source: 2017 P1 Q8 Higher Maths

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

Source: 2017 P2 Q4 Higher Maths

- (6)
- (a) Express $3x^2 + 24x + 50$ in the form $a(x+b)^2 + c$.
 - (b) Given that $f(x) = x^3 + 12x^2 + 50x - 11$, find $f'(x)$.
 - (c) Hence, or otherwise, explain why the curve with equation $y = f(x)$ is strictly increasing for all values of x .

Source: 2017 P2 Q7 Higher Maths

- (7)
- (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 $1 \leq x \leq 9$.

Source: 2016 P1 Q2 Higher Maths

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

Source: 2016 P1 Q9 Higher Maths

- (9)
- (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.

Source: 2015 P1 Q2 Higher Maths

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

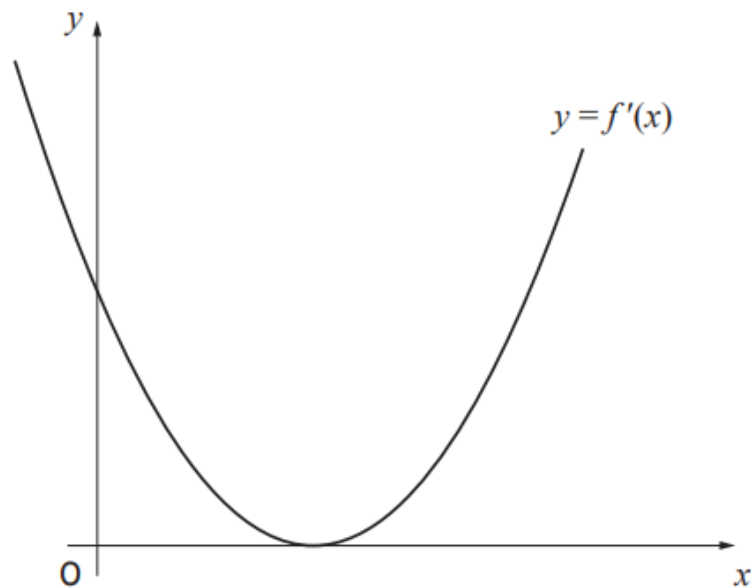
Source: 2015 P1 Q7 Higher Maths

(11) A function f is defined on a suitable domain by $f(x) = \sqrt{x} \left(3x - \frac{2}{x\sqrt{x}} \right)$.
Find $f'(4)$.

Source: Specimen P1 Q11 Higher Maths

(12)

The diagram shows the graph of $y = f'(x)$. The x -axis is a tangent to this graph.



- (a) Explain why the function $f(x)$ is never decreasing.
- (b) On a graph of $y = f(x)$, the y -coordinate of the stationary point is negative. Sketch a possible graph for $y = f(x)$.

Source: Exemplar P1 Q1 Higher Maths

(13)

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

Answer: $y - 12 = 6(x - 5)$

Source: Exemplar P2 Q10 Higher Maths

(14)

Acceleration is defined as the rate of change of velocity.

An object is travelling in a straight line. The velocity, v m/s, of this object, t seconds after the start of the motion, is given by $v(t) = 8\cos(2t - \frac{\pi}{2})$.

- (a) Find a formula for $a(t)$, the acceleration of this object, t seconds after the start of the motion.
- (b) Determine whether the velocity of the object is increasing or decreasing when $t=10$.
- (c) Velocity is defined as the rate of change of displacement.
Determine a formula for $s(t)$, the displacement of the object, given that $s(t)=4$ when $t=0$.

Source: 2014 P2 Q2 Higher Maths

(15)

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

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