17. A curve has equation \( y = x^2 + \frac{16}{x} \)

The curve has one turning point.

Find \( \frac{dy}{dx} \) and use your answer to find the coordinates of this turning point.

Jan 2012 Paper 3H

14

The diagram shows a rectangular photo frame of area \( A \) cm\(^2\).

The width of the photo frame is \( x \) cm.

The height of the photo frame is \( y \) cm.

The perimeter of the photo frame is 72 cm.

(a) Show that \( A = 36x - x^2 \)

(b) Find \( \frac{dA}{dx} \)  

(c) Find the maximum value of \( A \).
A farmer has 120 metres of fencing. He is going to make a rectangular enclosure \( PQRS \) with the fencing. He is also going to divide the enclosure into two equal parts by fencing along \( MN \).

The width of the enclosure is \( x \) metres.
The length of the enclosure is \( y \) metres.

(a) (i) Show that \( y = 60 - 1.5x \)

The area of the enclosure \( PQRS \) is \( A \) m\(^2\)

(ii) Show that \( A = 60x - 1.5x^2 \)

(b) Find \( \frac{dA}{dx} \)  
(c) Find the maximum value of \( A \).
14 A farmer has 180 metres of fencing.
With the 180 metres of fencing, he makes an enclosure divided into eight equal, rectangular pens.
The fencing is used for the perimeter of each pen.

The length of each pen is \( x \) metres and the width of each pen is \( y \) metres.

(a) (i) Show that \( y = 18 - 1.2x \)

The total area of the enclosure is \( A \) m\(^2\).

(ii) Show that \( A = 144x - 9.6x^2 \)

(b) Find \( \frac{dA}{dx} \)

(c) Find the maximum value of \( A \).
The diagram shows a cuboid of volume $V \text{ cm}^3$

The length of the cuboid is $y \text{ cm}$

The width and height of the cuboid are both $x \text{ cm}$

The total length of all the edges of the cuboid is 112 cm

(a) Show that $V = 28x^2 - 2x^3$

(b) Find $\frac{dV}{dx}$

(c) Find the maximum value of $V$

Give your answer correct to 3 significant figures.
Calculus and Differentiation IGCSE Past Exam Questions

Nov 2006 3H Paper

14. (a) For the equation \( y = 5000x - 625x^2 \), find \( \frac{dy}{dx} \).

(b) Find the coordinates of the turning point on the graph of \( y = 5000x - 625x^2 \).

(c) (i) State whether this turning point is a maximum or a minimum.

..........................

(ii) Give a reason for your answer.

(d) A publisher has to set the price for a new book. The profit, \( £y \), depends on the price of the book, \( £x \), where

\[ y = 5000x - 625x^2 \]

(i) What price would you advise the publisher to set for the book?

\[ £ \text{...............} \]

(ii) Give a reason for your answer.
14. A farmer wants to make a rectangular pen for keeping sheep. He uses a wall, $AB$, for one side. For the other three sides, he uses 28 m of fencing. He wants to make the area of the pen as large as possible.

The width of the pen is $x$ metres.
The length parallel to the wall is $(28 - 2x)$ metres.

(a) The area of the pen is $y$ m$^2$.
   Show that $y = 28x - 2x^2$.

(b) For $y = 28x - 2x^2$

   (i) find $\frac{dy}{dx}$,

   (ii) find the value of $x$ for which $y$ is a maximum.
(iii) Explain how you know that this value gives a maximum.

(c) Find the largest possible area of the pen.
21

ABCD is a rectangle.
AB = 10 cm.
BC = 8 cm.
P, Q, R and S are points on the sides of the rectangle.
BP = CQ = DR = AS = x cm.

(a) Show that the area, A cm², of the quadrilateral PQRS is given by the formula

\[ A = 2x^2 - 18x + 80 \]

(b) For \( A = 2x^2 - 18x + 80 \)

(i) find \( \frac{dA}{dx} \),

(ii) find the value of \( x \) for which \( A \) is a minimum.

(iii) Explain how you know that \( A \) is a minimum for this value of \( x \).