



# CLASSIFIED

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## International Examinations Papers

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# MATHEMATICS A

## TOPIC- Calculus

(d) For the curve with equation  $y = x^3 - 3x - 1$

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

(ii) find the gradient of the curve at the point where  $x = 4$



(4)

(Total for Question 3 is 10 marks)

4 (a) Differentiate with respect to  $x$

(i)  $8x^2$

(ii)  $\frac{2}{x}$



(b) The curve with equation  $y = 8x^2 + \frac{2}{x}$  has one turning point.

Find the coordinates of this turning point.  
Show your working clearly.

(3)

(....., .....)  
(4)

(Total for Question 4 is 7 marks)

- 5 A particle is moving in a straight line which passes through a fixed point  $O$ .  
The displacement,  $s$  metres, of the particle from  $O$  at time  $t$  seconds is given by

$$s = 10 + 9t^2 - t^3$$

- (a) Find an expression for the velocity,  $v$  m/s, of the particle at time  $t$  seconds.



- (b) Find the time at which the acceleration of the particle is zero.

..... seconds

(2)

(Total for Question 5 is 4 marks)

(a) (i) show that  $y = 4$  when  $x = 2$

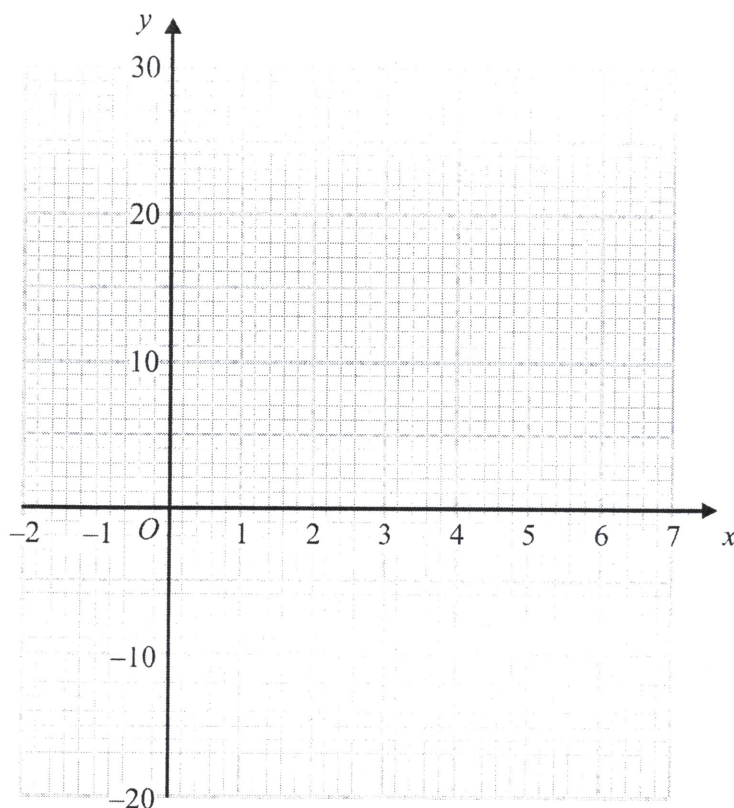
(ii) complete the table of values

$x$	-1	0	1	2	3	4	5	6
$y$		20	15		-7	-12		20



(2)

(b) On the grid, draw the graph of  $y = x^3 - 6x^2 + 20$  for values of  $x$  from -1 to 6



(2)

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

(ii) find the gradient of the curve at  $x = -3$



.....  
(4)

**(Total for Question 6 is 8 marks)**

- 7 A particle moves along a straight line.  
The fixed point  $O$  lies on this line.  
The displacement of the particle from  $O$  at time  $t$  seconds is  $s$  metres, where

$$s = t^3 - 6t + 3$$

- (a) Find an expression for the velocity,  $v$  m/s, of the particle at time  $t$  seconds



(2)

(2)

(Total for Question 7 is 4 marks)

1  $y = x^3 + 6x^2 + 5$

(a) Find  $\frac{dy}{dx}$



$\frac{dy}{dx} = \dots\dots\dots$   
(2)

The curve with equation  $y = x^3 + 6x^2 + 5$  has two turning points.

- (b) Work out the coordinates of these two turning points.  
Show your working clearly.

.....  
(4)

(Total for Question 1 is 6 marks)



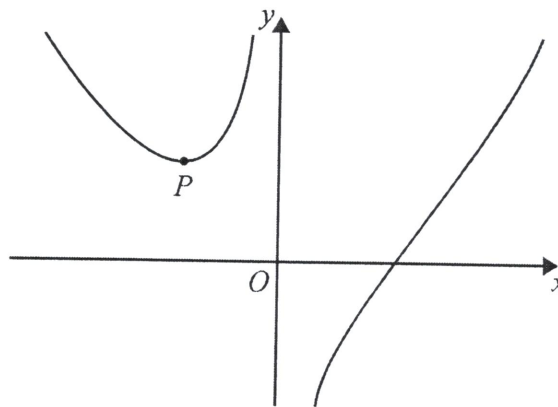
2  $y = x^2 - \frac{16}{x}$

(a) Find  $\frac{dy}{dx}$



$\frac{dy}{dx} =$  .....

(3)



The graph shows part of the curve with equation  $y = x^2 - \frac{16}{x}$

The point  $P$  is the turning point of the curve.

(b) Work out the coordinates of  $P$ .

(....., .....)

(4)

(Total for Question 2 is 7 marks)

3 The curve  $C$  has equation  $y = 3x^2 - 12x + 8$

(a) Find  $\frac{dy}{dx}$



$$\frac{dy}{dx} = \dots\dots\dots (2)$$

(b) Find the coordinates of the point on  $C$  where the gradient of the curve is 18

$$(\dots\dots\dots, \dots\dots\dots) (3)$$

**(Total for Question 3 is 5 marks)**

- 4 A particle is moving along a straight line.  
The fixed point  $O$  lies on this line.  
The displacement of the particle from  $O$  at time  $t$  seconds is  $s$  metres where

$$s = 2t^3 - 12t^2 + 7t$$

- (a) Find an expression for the velocity,  $v$  m/s, of the particle at time  $t$  seconds.



$v = \dots\dots\dots$

(2)

- (b) Find the time at which the acceleration of the particle is instantaneously zero.

(2)

**(Total for Question 4 is 4 marks)**

5  $y = x^3 - \frac{9}{2}x^2 - 54x + 10$

(a) Find  $\frac{dy}{dx}$

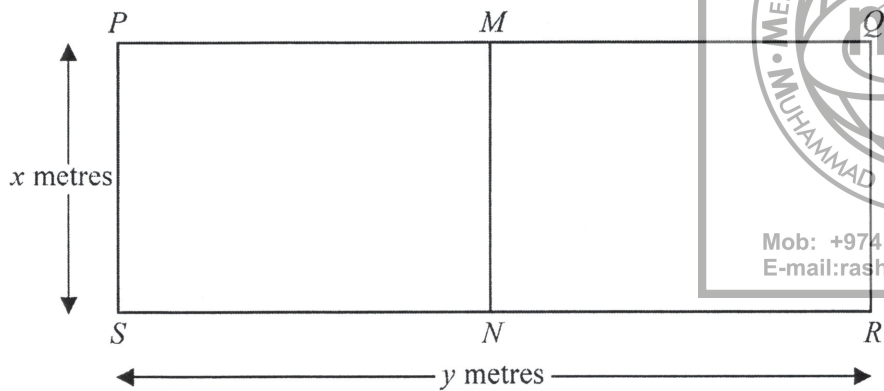
$y = x^3 - \frac{9}{2}x^2 - 54x + 10$



(3)

(Total for Question 5 is 5 marks)

- 1 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<sup>2</sup>

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

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

(3)

(2)

(3)

(Total for Question 1 is 8 marks)

2 For the curve with equation  $y = 4x^3 - 2x + 5$

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



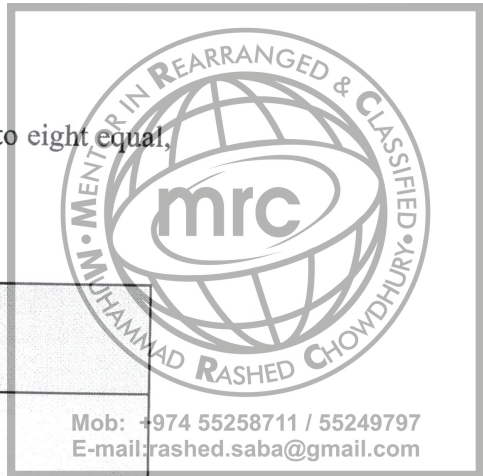
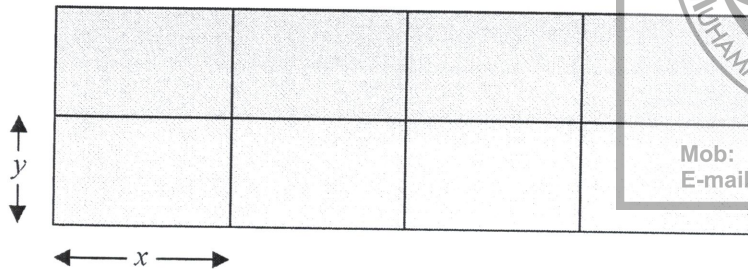
(ii) find the coordinates of the two points on the curve where the gradient of the curve is 1

(....., ..... ) and (....., ..... )

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**(Total for Question 2 is 6 marks)**

- 3 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<sup>2</sup>.

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

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

(3)

(2)

(c) Find the maximum value of  $A$ .



(Total for Question 3 is 8 marks)



4 (a)  $y = 2x^3 + 3x^2 + 2$

Find  $\frac{dy}{dx}$



(2)

$P$

$y \quad x \quad x$

$P \quad -\frac{3}{2}$

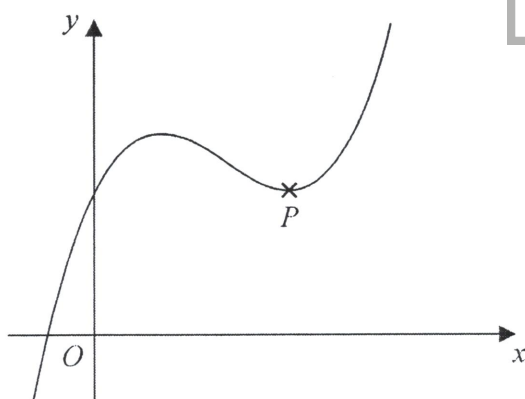
$P$

(5)

(Total for Question 4 is 7 marks)

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

(a) Find  $\frac{dy}{dx}$



y x x x

P

P

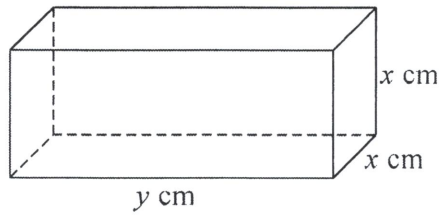
x

(4)

(2)

(Total for Question 5 is 8 marks)

6



The diagram shows a cuboid of volume  $V \text{ cm}^3$

$y$

$x$

$$V = x \quad x$$

Diagram NOT  
accurately drawn



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$$\frac{V}{x}$$

$$\frac{V}{x} =$$

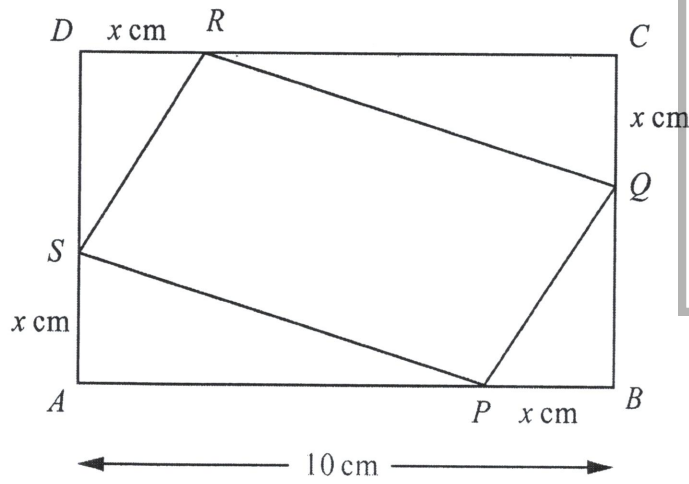
$V$

$$V =$$

(3)

(Total for Question 6 is 8 marks)

1



$ABCD$  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,  $A$  cm<sup>2</sup>, 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.



$x =$  .....

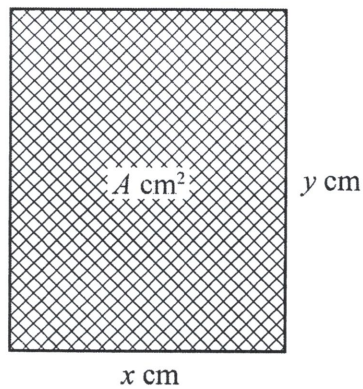
(iii) Explain how you know that  $A$  is a minimum for this value of  $x$ .

.....  
.....

(5)

**(Total for Question 1 is 8 marks)**

2



The diagram shows a rectangular photo frame of area  $A$  cm<sup>2</sup>.  
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  $\frac{dA}{dx}$

(3)

(c) Find the maximum value of  $A$ .

.....  
(2)

$A =$  .....  
(3)

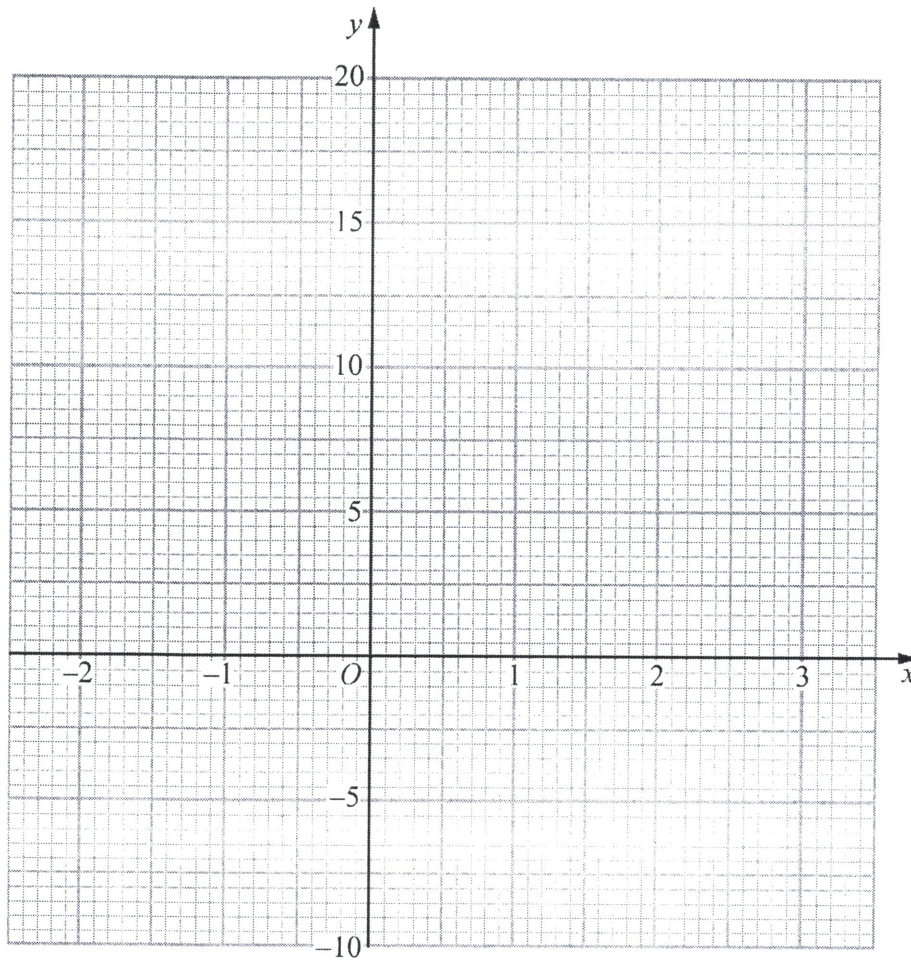
(Total for Question 2 is 8 marks)

3 (a) Complete the table of values for  $y = x^3 - 3x - 1$

$x$	-2	-1	0	1	2	3
$y$		1				



(b) On the grid, draw the graph of  $y = x^3 - 3x - 1$  for  $-2 \leq x \leq 3$



(c) By drawing a suitable straight line on the grid, find an estimate for the solution of the equation  $x^3 - 3x - 6 = 0$

Give your answer correct to 1 decimal place.

(2)

(2)