1. **[2 marks]**

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

Find $\frac{dy}{dx}$

.....

(2)

2. **[8 marks]**

A curve has equation $y = x^2 - 4x + 1$.

(a) For this curve find

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

.....

(ii) the coordinates of the turning point.

.....

(4)

(b) State, with a reason, whether the turning point is a maximum or a minimum.

.....

.....

(2)

(c) Find the equation of the line of symmetry of the curve $y = x^2 - 4x + 1$

.....

(2)

3. **[6 marks]**

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 (..... , ...)

4. **[5 marks]**

A curve has equation $y = x^3 - 5x^2 + 8x - 7$

(a) Find the gradient of the curve at (2, –3).

.....

(4)

(b) What does your answer to part (a) tell you about the point (2, −3)?

.....

(1)

5. **[4 marks]**

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.

$v =$ .....

(2)

(b) Find the acceleration of the particle at time 5 seconds.

..... m/s^2

(2)

6. **[3 marks]**

Differentiate with respect to x

(a) $5x^2$

.....

(b) $\frac{3}{x}$

.....

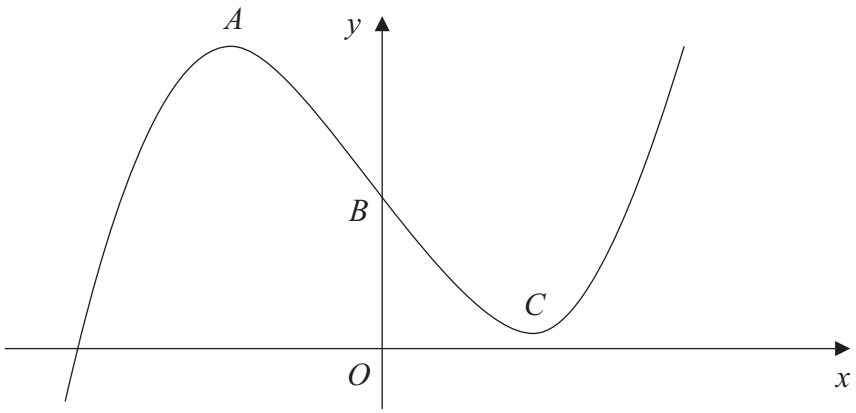
(c) $\sqrt{x}$

.....

(3)

7. **[8 marks]**

The diagram shows the graph of $y = x^3 - 12x + 17$
A is the maximum point on the curve.
C is the minimum point on the curve.
The curve crosses the y axis at B.



For the equation $y = x^3 - 12x + 17$

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

.....

(2)

(b) find the gradient of the curve at B,

.....

(2)

(c) find the coordinates of A and C.

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

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

(4)

8. **[4 marks]**

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.

$v =$ .....

(2)

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

..... seconds

(2)

9. **[4 marks]**

Differentiate with respect to x

(a) $\frac{5}{x}$

.....

(b) $3\sqrt{x}$

.....

(c) $x(x+4)$

.....

(4)

10. **[8 marks]**

A curve has equation $y = x^3 + 3x^2 - 24x$

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

.....

(3)

(b) Find the coordinates of the turning points of the curve.

.....

(5)

11. **[4 marks]**

A particle moves in a straight line through a fixed point O.
The displacement, s metres, of the particle from O at time t seconds is given by

$$s = t^3 - 5t^2 + 8$$

(a) Find an expression for the velocity, v m/s, of the particle after t seconds.

$v =$ .....

(2)

(b) Find the time at which the acceleration of the particle is $20\,\text{m/s}^2$.

..... seconds

(2)

12. **[3 marks]**

Differentiate with respect to x

(a) $x(x^2 - x)$

.....

(b) $\frac{1}{x}$

.....

(3)

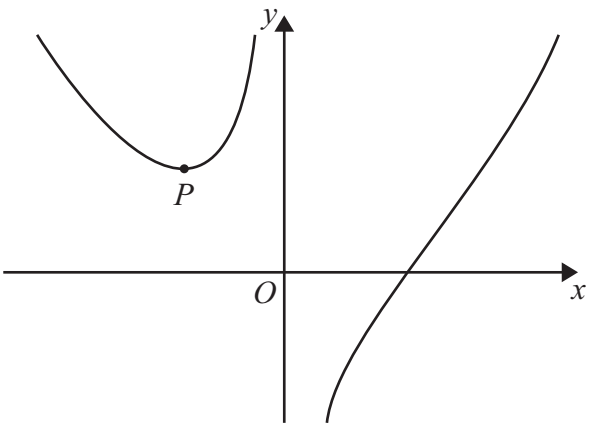
13. **[7 marks]**

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

(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)

14. **[6 marks]**

A particle moves in a straight line through a fixed point O.
The displacement of the particle from O at time t seconds is s metres, where

$$s = t^2 - 6t + 10$$

(a) Find $\frac{ds}{dt}$

.....

(2)

(b) Find the velocity of the particle when $t = 5$

..... m/s

(2)

(c) Find the acceleration of the particle.

..... m/s^2

(2)

15. **[3 marks]**

Differentiate with respect to x

(a) $x^2\left(2x + \frac{5}{x}\right)$

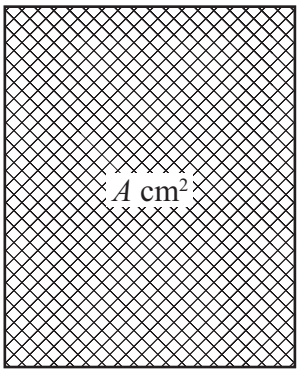
.....

(c) $5\sqrt{x}$

.....

(3)

16. **[8 marks]**



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 $A = 36x - x^2$

(3)

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

.....

(2)

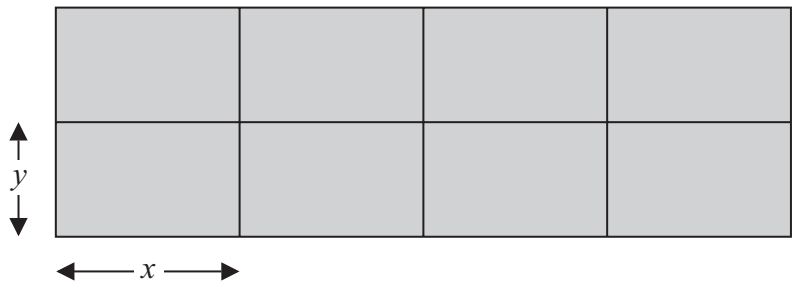
(c) Find the maximum value of A.

$A =$ .....

(3)

17. **[8 marks]**

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 $A = 144x - 9.6x^2$

(3)

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

.....

(2)

(c) Find the maximum value of A.

$A =$.....

(3)