

A-level MATHS

Differentiation and Integration (Topics G,H)

Version 1.0

Total number of marks: 40

- 1 Given that $\frac{dy}{dx} = \frac{1}{6x^2}$ find y .

Circle your answer.

[1 mark]

$$\frac{-1}{3x^3} + c$$

$$\frac{1}{2x^3} + c$$

$$\frac{-1}{6x} + c$$

$$\frac{-1}{3x} + c$$

- 3 It is given that

$$y = 3x^4 + \frac{2}{x} - \frac{x}{4} + 1$$

Find an expression for $\frac{d^2y}{dx^2}$

[3 marks]

- 5 Differentiate from first principles

$$y = 4x^2 + x$$

[4 marks]

- 5 $f'(x) = \left(2x - \frac{3}{x}\right)^2$ and $f(3) = 2$

Find $f(x)$.

[4 marks]

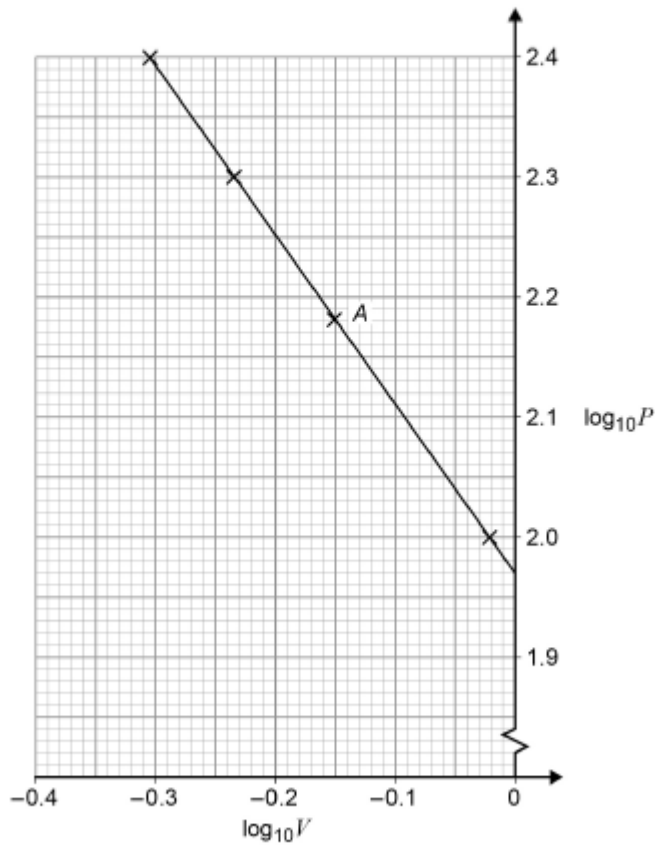
- 8 Maxine measures the pressure, P kilopascals, and the volume, V litres, in a fixed quantity of gas.

Maxine believes that the pressure and volume are connected by the equation

$$P = cV^d$$

where c and d are constants.

Using four experimental results, Maxine plots $\log_{10}P$ against $\log_{10}V$, as shown in the graph below.



- 8 (a) Find the value of P and the value of V for the data point labelled A on the graph. [2 marks]
- 8 (b) Calculate the value of each of the constants c and d . [4 marks]
- 9 (a) (i) Find

$$\int (4x - x^3) dx$$

[2 marks]

9 (a) (ii) Evaluate

$$\int_{-2}^2 (4x - x^3) dx$$

[1 mark]

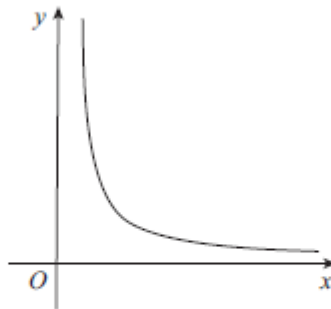
9 (b) Using a sketch, explain why the integral in part (a)(ii) does **not** give the area enclosed between the curve $y = 4x - x^3$ and the x -axis.

[2 marks]

9 (c) Find the area enclosed between the curve $y = 4x - x^3$ and the x -axis.

[2 marks]

6 A curve has equation $y = \frac{2}{x\sqrt{x}}$



The region enclosed between the curve, the x -axis and the lines $x = 1$ and $x = a$ has area 3 units.

Given that $a > 1$, find the value of a .

Fully justify your answer.

[5 marks]

8 A curve has equation

$$y = x^3 + px^2 + qx - 45$$

The curve passes through point $R(2, 3)$

The gradient of the curve at R is 8

8 (a) Find the value of p and the value of q .

[5 marks]

8 (b) Calculate the area enclosed between the normal to the curve at R and the coordinate axes.

[5 marks]