

A Level Mathematics Year 2 Exam Questions by Topic Chapter 5: Differentiation

These questions are taken from the Specimen Exam materials and the real 2018 papers for the new syllabus AS and A-level mathematics courses and arranged by chapter of the textbooks by Goldie et al (available here: <https://amzn.to/39umfr5> and <https://amzn.to/3hE8kBL>). There are a mixture of questions from OCR A, OCR B (MEI), Edexcel and AQA. Although the style of questions varies a little across the exam boards the content of the syllabus is almost identical so these are suitable for students preparing for any exam board.

Free problem sets for all other chapters, as well as video solutions, full past papers and other content for GCSE and A-level maths can be found at:

<https://mathsaurus.com/>

OCR B MEI Sample Paper 1 Question 4:

4 Differentiate the following.

(i) $\sqrt{1-3x^2}$ [3]

(ii) $\frac{x^2}{3x+2}$ [3]

Edexcel Sample Paper 2 Question 3:

3. Given $y = x(2x + 1)^4$, show that

$$\frac{dy}{dx} = (2x + 1)^n (Ax + B)$$

where n , A and B are constants to be found.

(4)

OCR B MEI 2018 Paper 3 Question 4:

4 In this question you must show detailed reasoning.

A curve has equation $y = x - 5 + \frac{1}{x-2}$. The curve is shown in Fig. 4.

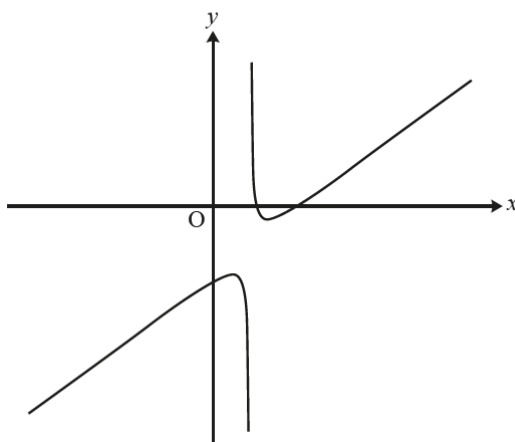


Fig. 4

- (i) Determine the coordinates of the stationary points on the curve. [5]
- (ii) Determine the nature of each stationary point. [3]
- (iii) Write down the equation of the vertical asymptote. [1]
- (iv) Deduce the set of values of x for which the curve is concave upwards. [1]

OCR B MEI Sample Paper 3 Question 11:

11 The curve $y = f(x)$ is defined by the function $f(x) = e^{-x} \sin x$ with domain $0 \leq x \leq 4\pi$.

- (i) (A) Show that the x -coordinates of the stationary points of the curve $y = f(x)$, when arranged in increasing order, form an arithmetic sequence.
(B) Show that the corresponding y -coordinates form a geometric sequence. [9]
- (ii) Would the result still hold with a larger domain? Give reasons for your answer [1]

AQA 2018 Paper 3 Question 6:

6 A function f is defined by $f(x) = \frac{x}{\sqrt{2x-2}}$

6 (a) State the maximum possible domain of f . [2 marks]

6 (b) Use the quotient rule to show that $f'(x) = \frac{x-2}{(2x-2)^{\frac{3}{2}}}$ [3 marks]

6 (c) Show that the graph of $y = f(x)$ has exactly one point of inflection. [7 marks]

6 (d) Write down the values of x for which the graph of $y = f(x)$ is convex. [1 mark]

AQA Sample Paper 1 Question 9:

9 A curve has equation $y = \frac{2x+3}{4x^2+7}$

9 (a) (i) Find $\frac{dy}{dx}$ [2 marks]

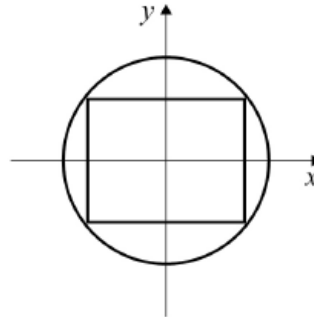
9 (a) (ii) Hence show that y is increasing when $4x^2 + 12x - 7 < 0$ [4 marks]

9 (b) Find the values of x for which y is increasing. [2 marks]

AQA 2018 Paper 1 Question 13:

- 13 A company is designing a logo. The logo is a circle of radius 4 inches with an inscribed rectangle. The rectangle must be as large as possible.

The company models the logo on an x - y plane as shown in the diagram.



Use calculus to find the maximum area of the rectangle.

Fully justify your answer.

[10 marks]