

Mathematics: analysis and approaches
Standard level
Paper 1

Assessment 6

90 minutes

Name: _____

Instruction to candidates

- Do not open this examination until instructed to do so.
- You are not permitted access to any calculator for this paper.
- Section A: answer all questions. Answers must be written within the answer boxes provided.
- Section B: answer all questions on the answer sheets provided.
- Unless otherwise stated in the question, all numerical answers should be given exactly or correct to three significant figures.
- A clean copy of the **mathematics: analysis and approaches formula booklet** is required for this paper
- The maximum mark for this examination is **[36 marks]**.

Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

PART A - Short Answer Questions

1. Determine the equation of the line tangent to the function $f(x) = x^4 - 2x^3 - \frac{1}{2}x^2 + \frac{1}{2}$ at the point where $x = -1$. [Maximum mark: 6]

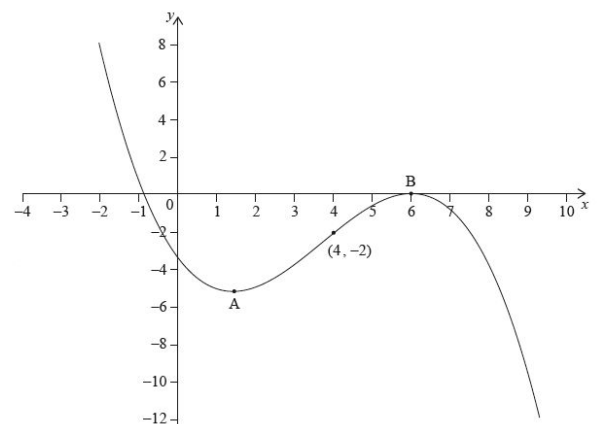
2. Determine the equation of the line normal to the function $g(x) = \frac{1}{x} - \sqrt{x} + \frac{x}{4} - 1$ at the point where $x = 4$. [Maximum mark: 7]

3. Determine the x coordinate(s) at which the function $h(x) = x^3 - x^2 - 5x - 3$ has horizontal tangent lines. [Maximum mark: 5]

4. Determine the x -coordinate(s) at which the line $x + 10y = 20$ is perpendicular to the function $k(x) = x^3 + 6x^2 - 5x + 2$. [Maximum mark: 7]

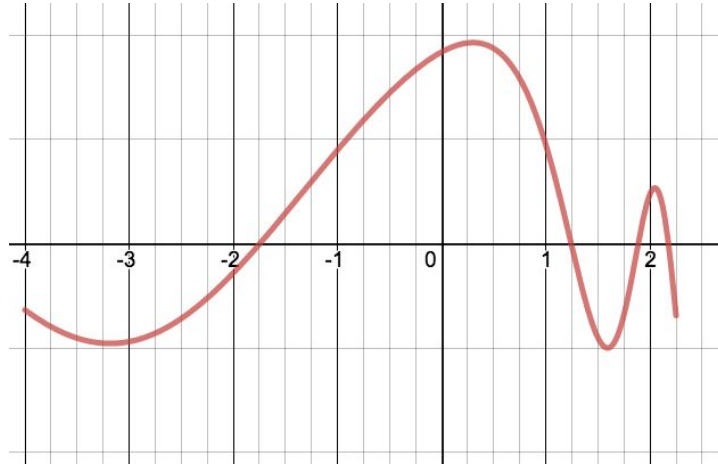
5. The point $P(4,3)$ lies on the graph of the function, f . The diagram included below shows the graph of f' , the derivative of f . [Maximum mark: 6]

- a. Write down the gradient (slope) of the curve of f at P . [1]
- b. Find the equation of the normal to the curve of f at P . [3]
- c. Determine the concavity of the graph of f when $4 < x < 5$. Justify your answer. [2]



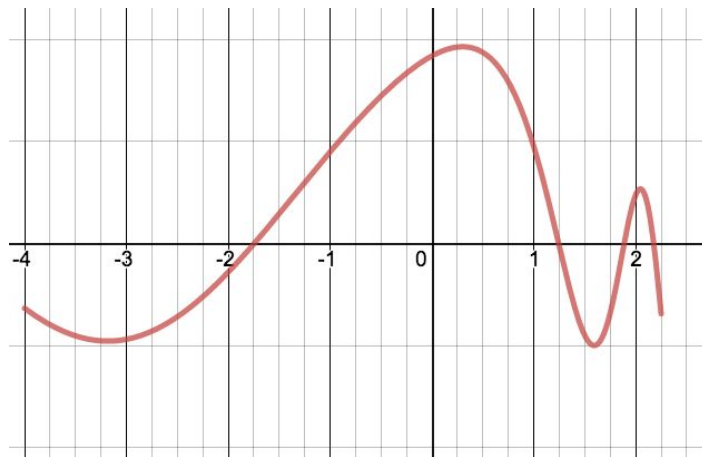
PART B - EXTENDED RESPONSE QUESTIONS

6. You are given the following sketch of a function, $y = f(x)$. [Maximum mark:10]



a. This diagram represents the graph of a function, sketch the derivative of $y = f(x)$. [5]

In a second sketch, the graph that was given to you (shown again below) actually represents a diagram of the **derivative** of another function, $g(x)$.

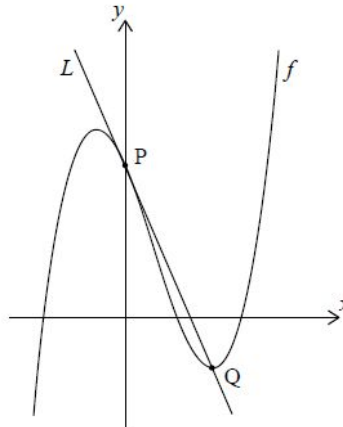


b. Using this **derivative** graph, sketch a diagram of the original function, $y = g(x)$. [5]

7. For the equation $f(x) = \frac{1}{2}x^4 - \frac{26}{3}x^3 + 12x^2 + 26$ determine: [Maximum marks: 14]

- the equation of the derivative of $f(x)$. [2]
- the x -coordinates of the stationary points of f . [5]
- the intervals of increase and decrease of f . [4]
- Sketch a graph of f . [3]

8. Let $f(x) = x^3 - 2x^2 + ax + 6$. Part of the graph of f is shown in the following diagram. The line, L , is tangent to the curve at P . [Maximum marks: 11]



- Find the coordinates of P . [2]
- Find $f'(x)$.
 - Hence, find the equation of L in terms of a . [4]
- The graph of f has a minimum at the point, Q . The line L passes through Q . Find the value of a . [5]