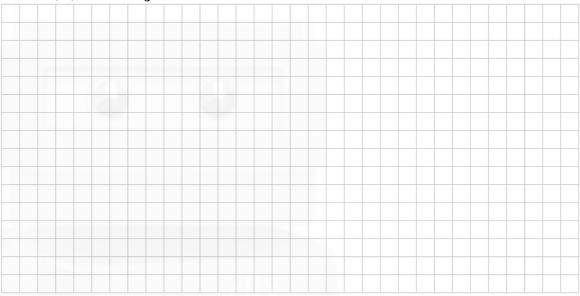
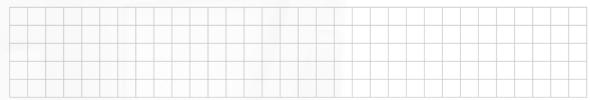
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## Question 1

(a) Write the function  $f(x) = 2x^2 - 7x - 10$ , where  $x \in \mathbb{R}$ , in the form  $a(x+h)^2 + k$ , where a, h, and  $k \in \mathbb{Q}$ .



**(b)** Hence, write the minimum point of f.



(c) (i) Explain why f must have two real roots.



(ii) Write the roots of f(x) = 0 in the form  $p \pm \sqrt{q}$ , where p and  $q \in \mathbb{Q}$ .



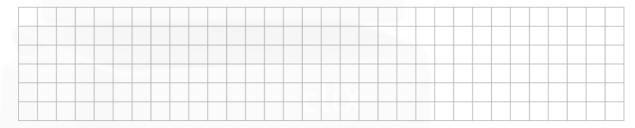
Question 6 (25 marks)

(a) (i) Write down three distinct anti-derivatives of the function  $g: x \mapsto x^3 - 3x^2 + 3$ ,  $x \in \mathbb{R}$ .





(ii) Explain what is meant by the indefinite integral of a function f.



(iii) Write down the indefinite integral of g, the function in part (i).

Answer:

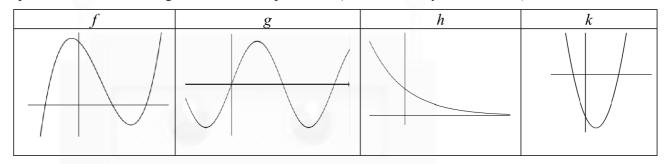
(b) (i) Let  $h(x) = x \ln x$ , for  $x \in \mathbb{R}$ , x > 0. Find h'(x).



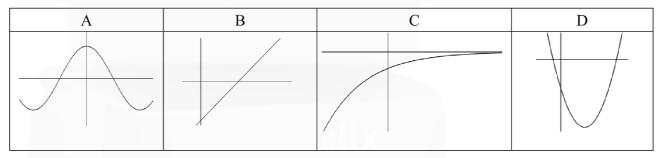
(ii) Hence, find  $\int \ln x \, dx$ .



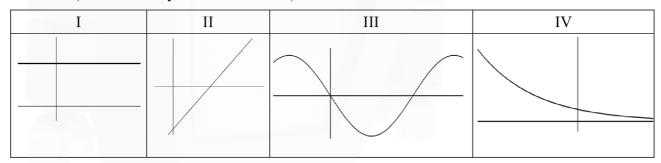
Each diagram below shows part of the graph of a function. Each of these functions is either quadratic or cubic or trigonometric or exponential (not necessarily in that order).



Each diagram below shows part of the graph of the first derivative of one of the above functions (not necessarily in the same order).



Each diagram below shows part of the graph of the second derivative of one of the original functions (not necessarily in the same order).



(a) Complete the table below by matching the function to its first derivative and its second derivative.

Type of function	Function	First derivative	Second derivative
Quadratic			
Cubic			
Trigonometric			
Exponential			

**(b)** For **one** row in the table, explain your choice of first derivative and second derivative.

