



Q1

[Maximum mark: 4]

- (a) Express $2x^2 - 8x + 9$ in the form $a(x + b)^2 + c$ where $a, b, c \in \mathbb{Z}$. [2]
- (b) If $f(x) = x - 2$ and $(g \circ f)(x) = 2x^2 - 8x + 9$, write down $g(x)$. [2]

Q2

[Maximum mark: 6]

The function f is defined by

$$f(x) = \begin{cases} 4x - 1 & \text{if } x \geq 1, \\ -x^2 + x + 3 & \text{if } x < 1. \end{cases}$$

- (a) Determine whether or not f is continuous at $x = 1$. [2]

The graph of the function g is obtained by applying the following transformations to the graph of f :

- a horizontal translation 2 units to the left, followed by
- a reflection in the x -axis, followed by
- a vertical stretch by a factor of 3.

- (b) Find $g(x)$. [4]

Q3

[Maximum mark: 5]

The quadratic equation $x^2 - kx + (k - 1) = 0$ has roots α and β . Without solving the equation, find the possible values of the real number k given that $\alpha^2 + \beta^2 = 17$.

Q4


[Maximum mark: 6]

The function f is defined by $f(x) = \sqrt[3]{2x + 1}$, $-14 \leq x \leq 13$.

- (a) Write down the range of f . [2]
- (b) Find an expression for f^{-1} . [2]
- (c) Write down the domain and range of f^{-1} . [2]




Q5

[Maximum mark: 5] 

Consider the graphs of $y = -\frac{1}{2}|x|$ and $y = 2|x| - a$, where $a \in \mathbb{Z}^+$.

- (a) Sketch the graphs on the same set of axes. [2]
(b) Given that the graphs enclose a region of area 40 square units, find the value of a . [3]

Q6

[Maximum mark: 6] 

Given that $(x - 4)$ is a factor of $f(x) = x^3 - 2x^2 + ax + b$ and that division of $f(x)$ by $(x + 2)$ leaves a remainder of 18, find the value of a and the value of b .