

Let

$$f(x) = \begin{cases} x + 1 & \text{for } 0 \leq x \leq 1; \\ 2x^2 - 6x + 6 & \text{for } 1 \leq x \leq 2. \end{cases}$$

(i) On the axes provided below, sketch a graph of $y = f(x)$ for $0 \leq x \leq 2$, labelling any turning points and the values attained at $x = 0, 1, 2$.

(ii) For $1 \leq t \leq 2$, define

$$g(t) = \int_{t-1}^t f(x) \, dx.$$

Express $g(t)$ as a cubic in t .

(iii) Calculate and factorize $g'(t)$.

(iv) What are the minimum and maximum values of $g(t)$ for t in the range $1 \leq t \leq 2$?

