

Question 10**(7 marks)**

Water flows into a bowl at a constant rate. The water level, h , measured in centimetres, increases at a rate given by

$$h'(t) = \frac{4t + 1}{2t^2 + t + 1}$$

where the time t is measured in seconds.

(a) Determine the rate that the water level is rising when $t = 2$ seconds. (1 mark)

(b) Explain why $h(t) = \ln(2t^2 + t + 1) + c$. (2 marks)

(c) Determine the total change in the water level over the first 2 seconds. (1 mark)

The bowl is filled when the water level reaches $\ln(56)$ cm.

(d) If the bowl is initially empty, determine how long it takes for the bowl to be filled. (3 marks)