

- 3 (a)** Amaya and Ben integrated $(1+x)^2$, with respect to x , using different methods, as follows.

Amaya: $\int (1+x)^2 dx = \frac{(1+x)^3}{3} + c = \frac{1}{3} + x + x^2 + \frac{1}{3}x^3 + c$

Ben: $\int (1+x)^2 dx = \int (1+2x+x^2) dx = x + x^2 + \frac{1}{3}x^3 + c$

Charlie said that, because these answers are different, at least one of them must be wrong.

Explain whether you agree with Charlie's statement.

[1]

- (b)** You are given that a is a constant greater than 1.

(i) Find $\int_1^a \frac{1}{(1+x)^2} dx$, giving your answer as a single fraction in terms of the constant a . [3]

- (ii)** You are given that the area enclosed by the curve $y = \frac{1}{(1+x)^2}$, the x -axis and the lines $x = 1$ and $x = a$ is equal to $\frac{1}{3}$.

Determine the value of a .

[2]

- (c)** In this question you must show detailed reasoning.

Find the exact value of $\int_0^{\frac{1}{12}\pi} \frac{\cos 2x}{\sin 2x + 2} dx$, giving your answer in its simplest form.

[4]