

The sheets attached to the questionnaire can be used for scratch-work—if so, write name and attach to submission

Some Formulas

$$A = \lim_{n \rightarrow \infty} \sum_{i=1}^n f(x_i^*) \Delta x_i = \int_a^b f(x) dx, \text{ for } a = x_0 < x_1 < \dots < x_n = b, x_{i-1} \leq x_i^* \leq x_i, \Delta x_i = x_i - x_{i-1}$$

$$\int \frac{dt}{t\sqrt{t^2-1}} = \sec^{-1} t + C = -\csc^{-1} t + C; \quad \int \sec^2 t dt = \tan t + C; \quad \int \csc^2 t dt = -\cot t + C;$$

$$\int \frac{dt}{t^2+1} = \tan^{-1} t + C = -\cot^{-1} t + C; \quad \int \sec t \tan t dt = \sec t + C; \quad \int \csc t \cot t dt = -\csc t + C;$$

$$\int \frac{dt}{\sqrt{1-t^2}} = \sin^{-1} t + C = -\cos^{-1} t + C; \quad \int f(g(x))g'(x) dx = \int f(u) du \text{ where } u = g(x);$$

$$\int u dv = uv - \int v du; \quad \cosh^2 t - \sinh^2 t = 1; \quad t = \tan \frac{x}{2} \Rightarrow dx = \frac{2 dt}{1+t^2}, \sin x = \frac{2t}{1+t^2}, \cos x = \frac{1-t^2}{1+t^2};$$

$$\sqrt{x^2-a^2} \Rightarrow x = a \sec \theta = a \cosh t; \quad \sqrt{a^2-x^2} \Rightarrow x = a \sin \theta = a \cos \phi; \quad \sqrt{x^2+a^2} \Rightarrow x = a \tan \theta = a \sinh t$$

VIOLATIONS WILL RESULT IN ZERO MARKS FOR THIS TEST
DO NOT TURN OVER THESE SHEETS OR VIEW TEST QUESTIONS BEFORE 09:05

Reminders

On your workdesk:

- Writing implements: pens, correction devices
- A water bottle (optional)
- Tissues (optional)

Phones, tablets or other internet enabled devices should be **turned off** (not silent mode), and **inside your bag**

No communication with other test-takers allowed: raise hand for attention and blank sheets

Bags should be placed on either side of the room

No toilet breaks during test-taking

Submit sheets to front
BEFORE clock is at 10:46:
Late sheets will NOT be accepted