

Please clearly show all your work on the following problems.

1) Find the integral below.

$$\int x \cos(x) dx = x \sin(x) - \int \sin(x) dx = x \sin(x) + \cos(x) + C$$

$$\begin{aligned} u &= x & dv &= \cos(x) dx \\ du &= dx & v &= \sin(x) \end{aligned}$$

2) Find the first 5 terms in the sequence below.

$$\left\{ \frac{2}{n} \right\}$$

$$2, 1, \frac{2}{3}, \frac{1}{2}, \frac{2}{5}, \dots$$

3) Find the first 5 terms in the series below.

$$\sum_{k=1}^{\infty} \frac{2}{k} = 2 + 1 + \frac{2}{3} + \frac{1}{2} + \frac{2}{5} + \dots$$

4) Find the integral below.

$$\begin{aligned}\int_{-1}^1 \frac{1}{\sqrt{|x|}} dx &= \int_{-1}^0 \frac{1}{\sqrt{-x}} dx + \int_0^1 \frac{1}{\sqrt{x}} dx = \lim_{t \rightarrow 0^-} \int_{-1}^t \frac{1}{\sqrt{-x}} dx + \lim_{t \rightarrow 0^+} \int_t^1 \frac{1}{\sqrt{x}} dx \\ &= \lim_{t \rightarrow 0^-} -2\sqrt{-x} \Big|_{-1}^t + \lim_{t \rightarrow 0^+} 2\sqrt{x} \Big|_t^1 = \lim_{t \rightarrow 0^-} (-2\sqrt{-t} + 2\sqrt{1}) + \lim_{t \rightarrow 0^+} (2\sqrt{1} - 2\sqrt{t}) = -0 + 2 + 2 - 0 = 4\end{aligned}$$