

1. Q) Convergent/Divergent?  $\int_0^\infty \frac{x^2}{\sqrt{6+x^3}} dx$

$$\text{A)} = \lim_{t \rightarrow \infty} \int_0^t \frac{x^2}{\sqrt{6+x^3}} dx$$

$$\int \frac{x^2}{\sqrt{6+x^3}} dx = \frac{1}{3} \int \frac{du}{\sqrt{u}}, \text{ for } u = 6 + x^3 \text{ and } x^2 dx = du/3$$

$$= \frac{1}{3} \int u^{-1/2} du = \frac{u^{1/2}}{3/2} + C = \frac{2\sqrt{u}}{3} + C = \frac{2\sqrt{6+x^3}}{3} + C$$

$$\therefore \left[ \frac{2\sqrt{6+x^3}}{3} + C \right]_0^t$$

$$= \left[ \frac{2\sqrt{6+t^3}}{3} - \frac{2\sqrt{6}}{3} \right]$$

$$\therefore \lim_{t \rightarrow \infty} \left[ \frac{2\sqrt{6+t^3}}{3} - \frac{2\sqrt{6}}{3} \right]$$

$$= \lim_{t \rightarrow \infty} \left[ \frac{2\sqrt{6+t^3}}{3} \right] - \frac{2\sqrt{6}}{3}$$

$$= \infty$$