FUNDAMENTAL THEOREM OF CALCULAS (AREA) EXAMPLES

EX. 1

$$\int_1^3 x^2\,dx = \frac{1}{3}x^3\Big]_1^3 = \frac{1}{3}(3)^3 - \frac{1}{3}(1)^3$$

DO INTEGRAL

SUB IN 3 AND 1 THEN SUBTRACT

$$= \left(\frac{27}{3}\right) - \left(\frac{1}{3}\right)$$

$$= \frac{26}{3} \text{ UNITS}^2 \text{ AREA!}$$

EX. 2

$$\int_1^3 x^2 - 4x + 3\,dx$$

$$= \frac{1}{3}x^3 - 2x^2 + 3x\Big]_1^3$$

$$= \left(\frac{27}{3} - 18 + 9\right) - \left(\frac{1}{3} - 2 + 3\right)$$

$\frac{6}{3}$ $\frac{9}{3}$

$$= 0 - \frac{4}{3}$$

$$= -\frac{4}{3} \text{ UNITS}^2 \text{ AREA!}$$

EX. 3

$$\int_1^3 x^2 + x + 4 \, dx$$

$$= \frac{1}{3}x^3 + \frac{1}{2}x^2 + 4x \Big]_1^3$$

$$= \left(\frac{27}{3} + \frac{9}{2} + 12\right) - \left(\frac{1}{3} + \frac{1}{2} + 4\right)$$

$$= \left(\frac{54}{6} + \frac{27}{6} + \frac{72}{6}\right) - \left(\frac{2}{6} + \frac{3}{6} + \frac{24}{6}\right)$$

$$= \left(\frac{153}{6}\right) - \left(\frac{29}{6}\right) = \boxed{\frac{124}{6} \text{ UNITS}^2}$$

EX. 4

$$\int_{-1}^{1} e^{-2x} \, dx = -\frac{1}{2}e^{-2x} \Big]_{-1}^{1}$$

$$= \left(-\frac{1}{2}e^{-2(1)}\right) - \left(-\frac{1}{2}e^{-2(-1)}\right)$$

$$= \left(\frac{-1}{2e^2} + \frac{e^2}{2}\right)$$

$$= \frac{-1}{2e^2} + \frac{e^2 \cdot e^2}{2e^2}$$

$$= \frac{-1 + e^4}{2e^2} = \frac{(e^4 - 1)}{2e^2} \text{ UNITS}^2$$

Ex. 5

$$\int_0^{\pi} \sin\left(\frac{x}{2}\right) dx = -2\cos\left(\frac{x}{2}\right)\Big]_0^{\pi}$$

$$= \left(-2\cos\left(\frac{\pi}{2}\right)\right) - \left(-2\cos(0)\right)$$

$$= 0 + 2$$

$$= 2 \text{ UNIT}^2 \text{ AREA!}$$ ☺