1. The radius of a sphere is increasing at a rate of 5 cm/s. How fast is the volume increasing when the diameter is 20 cm? Include appropriate units.

+8

$$V = \frac{4}{3}\pi r^3$$

$$\frac{dV}{dt} = 4\pi r^2 \cdot \frac{dr}{dt} = 4\pi \cdot 10^2 \cdot 5 = 2000\pi \text{ cm}^3/\text{s}$$

$r = 10$ since the diameter is 20

given as 5 cm/s

−1 if no units

2. If A is the area of a square with edge length x and the square expands as time passes, find $\frac{dA}{dt}$ in terms of $\frac{dx}{dt}$.

+4

$$A = x^2$$

$$\frac{dA}{dt} = 2x\frac{dx}{dt}$$

3. Find the most general antiderivative of $\sqrt[4]{x^3} + x^2\sqrt{x}$.

+4

$$x^{\frac{3}{4}} + x^{\frac{5}{2}}$$

$$\frac{4}{7}x^{\frac{7}{4}} + \frac{2}{7}x^{\frac{7}{2}} + C$$

4. Find $f(x)$, if $f'(x) = 2 - 6\sqrt{x}$ and $f(4) = 0$.

+4

$$f'(x) = 2 - 6x^{\frac{1}{2}}$$

$$f(x) = 2x - 6\cdot\frac{2}{3}x^{\frac{3}{2}}$$

$$= 2x - 4x^{3/2} + C$$

$$f(4) = 0 = 2\cdot 4 - 4\cdot 4^{\frac{3}{2}} + C$$

$$0 = 8 - 32 + C$$

$$24 = C$$

$$f(x) = 2x - 4x^{\frac{3}{2}} + 24$$

5. Find $f(\theta)$, if $f''(\theta) = \sin(\theta) - \cos(\theta)$, $f(0) = 2$, and $f'(0) = 6$.

+6

$$f'(\theta) = -\cos(\theta) - \sin(\theta) + C$$

$$6 = -\cos(0) - \sin(0) + C = -1 + C$$

$$7 = C$$

$$f'(\theta) = -\cos(\theta) - \sin(\theta) + 7$$

$$f(\theta) = -\sin\theta + \cos\theta + 7\theta + C$$

$$2 = -\sin(0) + \cos(0) + 7(0) + C = 1 + C$$

$$1 = C$$

$$f(\theta) = -\sin(\theta) + \cos(\theta) + 7\theta + 1$$