Calculus II - Important Formulas

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(Note: There is separate document for series and convergence tests.)

1 Surface Area

Arc Length

$$\int_a^b \sqrt{1 + [f'(x)]^2} dx$$

Surface Area

$$2\pi \int_a^b f(x)\sqrt{1 + [f'(x)]^2} dx$$

2 Polar Conversions

$$(x, y) \rightarrow (r, \theta)$$

$$r = \sqrt{(x^2 + y^2)}$$
$$\theta = \tan(\frac{y}{x})$$

$$(r, \theta) \rightarrow (x, y)$$

$$x = r\cos\theta$$
$$y = r\sin\theta$$
$$\frac{dx}{d\theta} = \frac{d}{d\theta}[f(\theta)\cos(\theta)] = f'(\theta)\cos(\theta) - f(\theta)\sin(\theta)$$
$$\frac{dy}{d\theta} = \frac{d}{d\theta}[f(\theta)\sin(\theta)] = f'(\theta)\sin(\theta) + f(\theta)\cos(\theta)$$
$$\frac{dy}{dx} = \frac{dy/d\theta}{dx/d\theta}$$

3 Derivatives of Parametric Equations

$$\frac{dy}{dx} = \frac{dy/dt}{dx/dt}$$

$$\frac{d^2y}{dx^2} = \frac{(d/dt)(dy/dx)}{dx/dt}$$

$$x = x(t), y = y(t), a \leq t \leq b$$

$$A = \int_a^b y(t)x'(t)dt$$

Arc Length

$$s = \int_{t_1}^{t_2} \sqrt{(\frac{dx}{dt})^2 + (\frac{dy}{dt})^2}dt$$

Surface Area (Revolving around x axis)

$$s = 2\pi \int_{t_1}^{t_2} y(t)\sqrt{(\frac{dx}{dt})^2 + (\frac{dy}{dt})^2}dt$$

Surface Area (Revolving around y axis)

$$s = 2\pi \int_{t_1}^{t_2} x(t)\sqrt{(\frac{dx}{dt})^2 + (\frac{dy}{dt})^2}dt$$

4 Series

Taylor Series

$$\sum_{n=0}^{\infty} \frac{f^{(n)}(a)(x-a)^n}{n!}$$

MacLaurin Series

$$\sum_{n=0}^{\infty} \frac{f^{(n)}(0)(x)^n}{n!}$$

Power Series

$$\sum_{n=0}^{\infty} c_n(x-a)^n$$

Geometric Series Expansion

$$\frac{1}{1-x} = \sum_{n=0}^{\infty} x^n$$