MATH 101 Chapter 10 Formulas

The essentials you should know

The following formulas are the most important formulas you should know from sections 10.1-10.5.

$$
\begin{aligned}
y = a(x-h)^2 + k &\quad \text{(parabola with vertical axis)} \\
x = a(y-k)^2 + h &\quad \text{(parabola with horizontal axis)} \\
(x-h)^2 + (y-k)^2 = r^2 &\quad \text{(circle)} \\
\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1 &\quad \text{(ellipse)} \\
\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1 &\quad \text{(hyperbola with horizontal transverse axis)} \\
\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1 &\quad \text{(hyperbola with vertical transverse axis)}
\end{aligned}
$$

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

$$x = r\cos\theta, \qquad y = r\sin\theta, \qquad \tan\theta = \frac{y}{x}, \qquad r^2 = x^2 + y^2$$

$$\text{Arc Length: } s = \int_{t_0}^{t_1} \sqrt{\left[\frac{dx}{dt}\right]^2 + \left[\frac{dy}{dt}\right]^2}\, dt \quad \text{or} \quad \int_{\alpha}^{\beta} \sqrt{r^2 + \left[\frac{dr}{d\theta}\right]^2}\, d\theta$$

$$\text{Surface Area: } S = 2\pi \int_{t_0}^{t_1} R(t)\sqrt{\left[\frac{dx}{dt}\right]^2 + \left[\frac{dy}{dt}\right]^2}\, dt \quad \text{or} \quad 2\pi \int_{\alpha}^{\beta} R(\theta)\, \sqrt{r^2 + \left[\frac{dr}{d\theta}\right]^2}\, d\theta$$

$$\text{Area: } A = \frac{1}{2}\int_{\alpha}^{\beta} r^2\, d\theta$$