Useful formulas (continued on next page): (To be given on the final exam)

Trigonometry:

$$\cos^2 x = \frac{1+\cos 2x}{2} \quad \sin^2 x = \frac{1-\cos 2x}{2}$$

Moments and center of mass:

$$M_x = \int_a^b \frac{1}{2}((f(x))^2 - (g(x))^2)dx, \quad M_y = \int_a^b x(f(x) - g(x))dx$$

$$\overline{x} = \frac{M_y}{M}, \quad \overline{y} = \frac{M_x}{M},$$

Arc length

$$L = \int_a^b \sqrt{1 + (f'(x))^2}\, dx \quad \text{or}$$

$$L = \int_a^b \sqrt{(x'(t))^2 + (y'(t))^2}\, dt.$$

Area of a surface of revolution

$$S = \int_a^b 2\pi f(x)\sqrt{1 + (f'(x))^2}\, dx \quad \text{or}$$

$$S = \int_a^b 2\pi y(t)\sqrt{(x'(t))^2 + (y'(t))^2}\, dt$$

Area in polar coordinates

$$\text{Area} = \frac{1}{2}\int_{\alpha}^{\beta} (r(\theta))^2 d\theta$$

Length in polar coordinates

$$L = \int_{\alpha}^{\beta} \sqrt{r(\theta)^2 + (r'(\theta))^2}\, d\theta,$$

Conic sections in polar coordinates

$$r = \frac{ed}{1 \pm e\cos\theta} \quad \text{or} \quad r = \frac{ed}{1 \pm e\sin\theta}$$

Taylor series

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

Some power series

$$\begin{aligned} e^x &= \sum_{n=0}^{\infty} \frac{x^n}{n!}, \\ \frac{1}{1-x} &= \sum_{n=0}^{\infty} x^n, \\ \cos x &= \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n}}{(2n)!}, \\ \sin x &= \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n+1}}{(2n+1)!}. \end{aligned}$$

Simpson's rule

$$\begin{aligned} S_n = \frac{\Delta x}{3}[f(x_0) + 4f(x_1) + 2f(x_2) + 4f(x_3) + \ldots \\ + 2f(x_{n-2}) + 4f(x_{n-1}) + f(x_n)] \end{aligned}$$