Formulas that you need to know in Calculus II :

1) FTC #1: $\int_a^b f(x)\ dx = F(b) - F(a)$

FTC #2: $\frac{d}{dx}\int_a^x f(t)\ dt = f(x)$; Chain Rule Version: $\frac{d}{dx}\int_a^{h(x)} f(t)\ dt = f(h(x)) \cdot h'(x)$

2) $\mathrm{Si}(x) = \int_0^x \frac{\sin(t)}{t}\ dt$

3) $\mathrm{erf}(x) = \frac{2}{\sqrt{\pi}} \cdot \int_0^x e^{-t^2}\ dt$

4) $\int_a^b f(x)\ dx \approx \frac{b-a}{n}\left(f\left(x_1\right) + f\left(x_2\right) + \ldots + f\left(x_n\right)\right)$; MIDPOINT RULE

(each x_n is the midpoint of the subinterval)

5) $\int_a^b f(x)\ dx \approx \frac{b-a}{2n} \cdot \left(f\left(x_1\right) + 2 \cdot f\left(x_2\right) + 2 \cdot f\left(x_3\right) + \ldots + 2 \cdot f\left(x_{n-1}\right) + f\left(x_n\right)\right)$; TRAPEZOID RULE

(each x_n is an endpoint of the subinterval)

6) $\int_a^b f(x)\ dx \approx \frac{b-a}{3n} \cdot \left(f\left(x_1\right) + 4 \cdot f\left(x_2\right) + 2 \cdot f\left(x_3\right) + \ldots + 2 \cdot f\left(x_{n-2}\right) + 4 \cdot f\left(x_{n-1}\right) + f\left(x_n\right)\right)$; SIMPSON'S RULE

(each x_n is an endpoint of the subinterval) Note that the above result is valid only for ane <u>even</u> number of subintervals!

For Trig Subs: For integrands involving:

$\sqrt{x^2 - a^2}$ .... $x = a \cdot \sec(\theta)$

$\sqrt{a^2 - x^2}$ .... $x = a \cdot \sin(\theta)$

$\sqrt{a^2 + x^2}$ .... $x = a \cdot \tan(\theta)$

7) $V = \int_a^b A(x)\ dx$

8) $V = \int_a^b \pi \cdot (f(x))^2\ dx$

9) $V = \int_a^b \pi \cdot \left[\left(y_{u(x)}\right)^2 - \left[y_l(x)\right]^2\right]\ dx$

10) $V = \int_c^d \pi\left[\left[x_r(y)\right]^2 - \left[x_l(y)\right]^2\right]\ dy$

11) $V = \int_a^b 2\pi x \cdot f(x)\ dx$

12) $SA = \int_a^b 2\pi f(x) \cdot \sqrt{1 + (f'(x))^2}\ dx$

13) $L = \int_a^b \sqrt{1 + (f'(x))^2}\; dx$

14) $L = \int_{T_0}^{T_1} \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\; dt$

15) $L = \int_\alpha^\beta \sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2}\; d\theta$

16) $A = \int_\alpha^\beta \frac{1}{2} \cdot r^2 \; d\theta$

17) $x^* = \dfrac{\sum_{k=1}^{n} (m_k \cdot x_k)}{\sum_{k=1}^{n} m_k}$

18) $M = \int_a^b \delta(x) \; dx$

19) $x^* = \dfrac{\int_a^b x \cdot \delta(x) \; dx}{\int_a^b \delta(x) \; dx}$

20) $x^* = \dfrac{\int_a^b x(f(x) - g(x)) \; dx}{\int_a^b (f(x) - g(x)) \; dx}$, $y^* = \dfrac{\int_a^b \frac{1}{2} \cdot \left(f(x)^2 - g(x)^2\right) \; dx}{\int_a^b (f(x) - g(x)) \; dx}$

21) $W_k = F_k \cdot D_k =$ (weight density) $V_k \cdot D_k$ ..... work done in pumping liquids out of tanks.

22) $F_k = P_k \cdot A_k$ where $P_k = \delta \cdot g \cdot h_k$ ..... force acting on a 2–D plate subject to hydrostatic pressure.

23) $m_t = \dfrac{dy}{dx} = \dfrac{\frac{dy}{dt}}{\frac{dx}{dt}} = \dfrac{\frac{dr}{d\theta} \cdot \sin(\theta) + r \cdot \cos(\theta)}{\frac{dr}{d\theta} \cdot \cos(\theta) - r \cdot \sin(\theta)}$