

MTH 112 : Spring 2021

Formula Sheet for Exam 2

- Important Area Formulas

- The area of a disk of radius r is given by $A = \pi r^2$.
- The area of an annulus (or washer) with outer radius R and inner radius r is given by

$$A = \pi [R^2 - r^2].$$

- The surface area of a cylindrical shell with radius r and height h is given by

$$A = 2\pi r h.$$

- Arc Length and Surface Area

- The **arc length**, L , of a curve $y = f(x)$ on an interval $[a, b]$ is given by

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

provided the derivative is continuous on (a, b) .

- The **surface area**, S , generated by revolving the graph of $y = f(x)$ (for $f(x) \geq 0$) on an interval $[a, b]$ about the x -axis is given by

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

provided the derivative is continuous on (a, b) .

- Work

- The total work done by a variable force $F = F(x)$ moving an object from $x = a$ to $x = b$ is

$$W = \int_a^b F(x) dx.$$

- The work done against gravity (near the surface of a planet) in moving an object with mass m vertically upward a distance h is $W = mgh$ where g is the acceleration due to gravity near the surface.

- Center of Mass

- The center of mass for a planar figure is the point (\bar{x}, \bar{y}) where

$$\bar{x} = \frac{M_y}{M},$$
$$\bar{y} = \frac{M_x}{M}.$$

- In the formulas above,

$$M = \int_a^b dm,$$
$$M_y = \int_a^b \tilde{x} dm,$$
$$M_x = \int_a^b \tilde{y} dm,$$

where dm is the mass of an (infinitesimal) strip and (\tilde{x}, \tilde{y}) is the center of the strip.

- Half Angle Formulas

- $\sin^2(x) = \frac{1}{2}(1 - \cos(2x))$
- $\cos^2(x) = \frac{1}{2}(1 + \cos(2x))$
- $\sinh^2(x) = \frac{1}{2}(\cosh(2x) - 1)$
- $\cosh^2(x) = \frac{1}{2}(\cosh(2x) + 1)$