### AREAS OF PLANE FIGURES

#### 12. SECTOR of CIRCLE

\[ \ell = \pi r \theta = r \theta \cdot \frac{180}{57.3} = 0.01745 r \theta \]

\[ A = \frac{\ell r}{2} = \frac{\pi r^2 \theta}{2} \cdot \frac{180}{360} = \frac{\pi r^2 {\theta}}{2} \]

\[ \ell = 2A \]

#### 13. SEGMENT of CIRCLE

For \( \theta < 90 \)

\[ A = \frac{r^2}{2} \left( \frac{\pi \theta}{180} - \sin \theta \right) \]

For \( \theta > 90 \)

\[ A = \frac{r^2}{2} \left( \frac{\pi \theta}{180} - \sin (180 - \theta) \right) \]

for chord rise, etc. see “Properties of Circle”

#### 14. SECTOR of HOLLOW CIRCLE

\[ A = \frac{r_1^2 \theta (r_1^2 - r_2^2)}{360} \]

\[ A = r_1^2 - r_2^2 (\ell_1 - \ell_2) \]

#### 15. FILLET

\[ A = r^2 - \frac{\pi r^2}{4} \]

\[ A = r^2 \left( 1 - \frac{\pi}{4} \right) \]

\[ A = 0.215 r^2 \]

#### 16. ELLIPSE

\[ P = \pi (a + b) \text{ approximately } = \pi \left(1.5(a + b) - \sqrt{ab}\right) \]

More Accurate

\[ A = \pi ab \]

#### 17. PARABOLA

\[ A = \frac{2}{3} ab \]

### AREAS & VOLUMES OF SOLIDS

#### Nomenclature

- \( a, b, c, d \): Length of Sides
- \( C \): Length of Chord
- \( A \): Total area
- \( A_B \): Area of Base
- \( A_L \): Area of Lateral Convex surfaces
- \( A_N \): Area Perpendicular to Vertical
- \( A_R \): Area Perpendicular to Slant
- \( A_T \): Area of Top Section
- \( h, h_1, h_2 \): Vertical Height
- \( h_G \): Vertical Distance between Centers of Gravity of Areas
- \( L, L_1, L_2 \): Lateral Length or Slant Height
- \( L_G \): Slant Height between Centers of Gravity of Areas
- \( P \): Perimeter
- \( P_B \): Perimeter of Base
- \( P_R \): Perimeter of Right Section
- \( R, r, r_1 \): Radius
- \( V \): Volume

#### 18. CUBE

\[ A = 6a^2 \]

\[ V = a^3 \]

#### 19. PARALLELOPiped

\[ A = 2(ab + bc + ac) \]

\[ V = abc \]

#### 20. GENERAL PRISM AND RIGHT REGULAR PRISM

\[ A_L = P_B L = P_B h \]

\[ A = A_L + 2A_B \]

\[ V = A_B L = A_B H \]

#### 21. FRUSTUM OF PRISM

\[ V = A_B h_G \]

\[ V = A_N L_G \]

#### 22. RIGHT REGULAR PYRAMID or CONE

\[ A_L = \frac{1}{2} P_B L \]

\[ V = \frac{1}{3} A_B h \]