STATICS FORMULAS

CHAPTER 2

$$\frac{a}{\sin a} = \frac{b}{\sin b} = \frac{c}{\sin c} \quad \text{(Law of sines)}$$

$$a^2 = b^2 + c^2 - 2bc\cos\theta \quad \text{(Law of cosines)}$$

$$F_x = F\cos\theta_x \quad F_y = F\cos\theta_y \quad F_z = F\cos\theta_z$$

$$\vec{F} = F_x\vec{i} + F_y\vec{j} + F_z\vec{k}$$

$$\vec{F} = F\vec{\lambda} = F\cos\theta_x\vec{i} + F\cos\theta_y\vec{j} + F\cos\theta_z\vec{k}$$

$$\vec{F} = \frac{F}{d}\left(d_x\vec{i} + d_y\vec{j} + d_z\vec{k}\right); \quad F = \sqrt{F_x^2 + F_y^2 + F_z^2}$$

$$R_x = \Sigma F_x \quad R_y = \Sigma F_y \quad R_z = \Sigma F_z$$

Equilibrium: $\Sigma F_x = 0 \quad \Sigma F_y = 0 \quad \Sigma F_z = 0$

CHAPTER 3

$$M_x = y \cdot F_z - z \cdot F_y; \quad M_y = z \cdot F_x - x \cdot F_z;$$

$$M_z = x \cdot F_y - y \cdot F_x$$

$$\vec{M}_o = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ x & y & z \\ F_x & F_y & F_z \end{vmatrix} \qquad \vec{M}_B = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ \Delta x & \Delta y & \Delta z \\ F_x & F_y & F_z \end{vmatrix}$$

$$M_{oL} = \begin{vmatrix} \lambda_x & \lambda_y & \lambda_z \\ x & y & z \\ F_x & F_y & F_z \end{vmatrix} \qquad M_{BL} = \begin{vmatrix} \lambda_x & \lambda_y & \lambda_z \\ \Delta x & \Delta y & \Delta z \\ F_x & F_y & F_z \end{vmatrix}$$

$$F_{OL} = \vec{F} \bullet \vec{\lambda}_{OL} \qquad \cos\theta = \left(P_xQ_x + P_yQ_y + P_zQ_z\right)/PQ$$

CHAPTER 4

Equilibrium: $\Sigma\vec{F} = 0 \quad \Sigma\vec{M} = 0$

CHAPTER 5

$$\bar{X}L = \int x_{el}\,dl = \Sigma x_{part}L_{part} \qquad \bar{X}A = \int x_{el}\,da = \Sigma x_{part}A_{part}$$

$$\bar{X}V = \int x_{el}\,dv = \Sigma x_{part}V_{part}$$

Pappus-Guldinus: $A = 2\pi\bar{y}L \qquad V = 2\pi\bar{y}A$

$$\rho_{water} = 1000^{kg/m^3} \qquad \gamma_{water} = 62.4^{lb/ft^3}$$

CHAPTER 6

Method of joints, Method of sections

CHAPTER 7

$$\frac{dv}{dx} = -w; \quad \frac{dm}{dx} = V; \quad \Delta V = -w\Delta x; \quad \Delta M = V\Delta x$$

Positive shear: Clockwise rotation

Positive moment: Holds water or happy face

CHAPTER 8

$$F_s = \mu_s N; \quad F_k = \mu_k N; \quad \tan\phi_s = \mu_s; \quad \tan\phi_k = \mu_k$$

Where $\phi_{s,k}$ are measured from the normal.

$$\ln\frac{T_2}{T_1} = \mu_s\beta; \qquad \frac{T_2}{T_1} = e^{\mu_s\beta}$$

$M = Wr\tan(\phi_s - \theta)$ (self-locking)

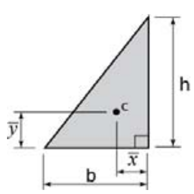
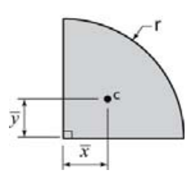
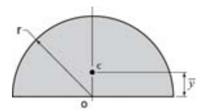
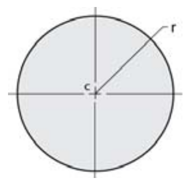
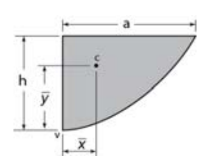
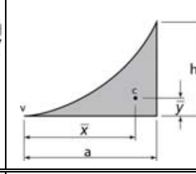
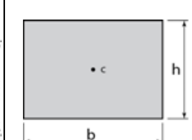
$M = Wr\tan(\theta + \phi_s)$ (tightening)

$M = Wr\tan(\theta - \phi_s)$ (loosening)

CHAPTER 9

$$I_{x(new)} = \int y^2 dA = \Sigma\left(I_{x(centroid)} + Ad_y^2\right)$$

$$I_{y(new)} = \int x^2 dA = \Sigma\left(I_{y(centroid)} + Ad_x^2\right)$$

					Parabola 	Parabola 	
$\bar{x}$	$b/3$	$4r/3\pi$	0	--	$3a/8$	$3a/4$	$b/2$
$\bar{y}$	$h/3$	$4r/3\pi$	$4r/3\pi$	--	$3h/5$	$3h/10$	$h/2$
A	$bh/2$	$\pi r^2/4$	$\pi r^2/2$	πr^2	$2ah/3$	$ah/3$	bh
I_{xc}	$bh^3/36$	$\left(\pi/16 - 4/9\pi\right)r^4$	$\left(\pi/8 - 8/9\pi\right)r^4$	$\pi r^4/4$	--	--	$bh^3/12$
I_{yc}	$hb^3/36$	$\left(\pi/16 - 4/9\pi\right)r^4$	$\pi r^4/8$	$\pi r^4/4$	--	--	$hb^3/12$
$I_{x(base)}$	$bh^3/12$	$\pi r^4/16$	$\pi r^4/8$	--	$2ah^3/7$	$ah^3/21$	$bh^3/3$
$I_{y(base)}$	$hb^3/12$	$\pi r^4/16$	$\pi r^4/8$	--	$2ha^3/15$	$ha^3/5$	$hb^3/3$