

Answers to Selected Problems: Chapter 3

3.1

1. (a) $F = 0.8\text{N}$, (b) $M = 0.0213\text{Nm}$, (c) $M = 0.0053\text{Nm}$
2. $F = 0$, $M = 0.0053\text{Nm}$
3. $R_A = 2000\text{N/m}$, $R_B = 1600\text{N/m}$
4. 2kPa

3.2

1. $x_c = \frac{1}{3}$, $y_c = \frac{1}{3}$

3.3

2. $\sigma_N = -S/l$, $\sigma_s = 0$

3. at A:  No stress at B.

4. σ_{yz} is negative

5. σ_{yz} (positive)

6. bottom left: σ_{xz} (negative), top: σ_{zx} (negative), bottom right: σ_{yz} (positive)

7. bottom left: σ_{xx} (positive), top: σ_{zz} (positive), bottom right: σ_{yy} (positive)

3.4

2. $\sigma'_{xx} \approx 0.884$, $\sigma'_{yy} \approx 2.116$, $\sigma'_{xy} \approx -0.933$

3.5

2. (a) $\sigma_1 = \sigma_{xx}$, $\sigma_2 = 0$, (b) $\sigma'_{xx} = \sigma'_{yy} = \sigma_{xx}/2$, $\sigma'_{xy} = -\sigma_{xx}/2$

3. (b) $\theta \approx -32^\circ$, (c) $\sigma_1 = +3.85$, $\sigma_2 = -2.85$

4. $\sigma_1 = 2\alpha$, $\sigma_2 = 0$, $\sigma_3 = 0$, Max shear is α , the original planes are planes of maximum shearing stress.

5. (b) $\sigma_1 = \tau$, (c) Max shear is τ , acts on planes oriented at 45° to the principal planes acting in the 1-2 (x-y) plane.

8. $\sigma_{xx}^{(2)} = \sigma_{xx}^{(w)}$, $\sigma_{xy}^{(2)} = \sigma_{xy}^{(w)}$

$$-t \int_{-b}^{+b} \sigma_{xy}(x,0)dx = 0, \quad -t \int_{-b}^{+b} \sigma_{yy}(x,0)dx - t \int_{-a}^{+a} p(x)dx = 0$$

9.
$$-t \int_{-b}^{+b} (x+b)\sigma_{yy}(x,0)dx - t \int_{-a}^{+a} (x+b)p(x)dx = 0$$