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Roots are: 9, 0, 0 kpsi



$r_{12} = 0$, $r_{13} = r_{23} = r_{max} = \frac{d}{2} = 4.5$ kpsi. Ans.

4-20

$$(a) R_1 = \frac{c}{r} F \quad M_{max} = R_1 r = \frac{c}{r} F r$$

$$\sigma = \frac{\Delta M}{I} = \frac{6}{32} \frac{c}{r} F \Rightarrow F = \frac{32 \sigma r}{6c} \quad \text{Ans.}$$

$$(b) \frac{F_{c1}}{F} = \frac{(c_{c1}/r)(h_{c1}/b)(h_{c1}/b)^2 (h_{c1}/r)}{(c_{c2}/r)(h_{c2}/b)} = \frac{11(9)(2)^3}{(3)(3)} = 1^2 \quad \text{Ans.}$$

For equal stress, the model load varies by the square of the scale factor.

4-21

$$R_1 = \frac{w l}{2}, \quad M_{max(a)} = \frac{w l^2}{2} \left(\frac{l}{2} \right) = \frac{w l^3}{8}$$

$$\sigma = \frac{\Delta M}{I} = \frac{6}{32} \frac{w l^3}{8} = \frac{3 w l^3}{400} \Rightarrow w = \frac{400 \sigma^2}{3 l^3} \quad \text{Ans.}$$

$$\frac{W_{c1}}{W} = \frac{(c_{c1}/r)(h_{c1}/b)(h_{c1}/b)^2 (h_{c1}/r)}{(c_{c2}/r)(h_{c2}/b)} = \frac{11(9)(2)^3}{(3)(3)} = 1^2 \quad \text{Ans.}$$

$$\frac{W_{c1} l_{c1}}{w l} = 1^2 \Rightarrow \frac{W_{c1}}{w} = \frac{l^2}{l} = l \quad \text{Ans.}$$

For equal stress, the model load w varies linearly with the scale factor.

4-22

(a) Can solve by iteration or derive equations for the general case. Find maximum moment under wheel W_1 .

$$W_2 = \sum W \text{ at centroid of } W_1$$

$$R_A = \frac{l - s_2 - d_1}{l} W_2$$

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