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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

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

$$\sigma = \frac{\Delta M}{I} = \frac{6 c F}{32 l^2} \Rightarrow F = \frac{32 \sigma l^2}{6 c}$$

$$(b) \frac{F_{act}}{F} = \frac{(c_{act}/R)(h_{act}/l)(h_{act}/l)}{(c/l)(h/l)(h/l)} = \frac{11(0.9)^2}{(0.9)^2} = 1^2 \quad \text{Ans.}$$

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

4-21

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

$$\sigma = \frac{\Delta M}{I} = \frac{6 W l^2}{32 l^3} = \frac{3 W l}{4 I} \Rightarrow W = \frac{4 \sigma I l}{3}$$

$$\frac{W_{act}}{W} = \frac{(c_{act}/R)(h_{act}/l)}{(c/l)(h/l)} = \frac{11(0.9)^2}{(0.9)^2} = 1^2 \quad \text{Ans.}$$

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

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  $W_1$ :  $W_2 = \sum W$  at centroid of  $W$ 's.



$$R_4 = \frac{l - x_2 - d_1}{l} W_2$$

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