Problem 3.

You are designing a support structure to suspend a 200-lb weight from point D. The L-shaped bar is pinned at A and supported by two cables at B and C made of steel ($E = 27\,000$ ksi). The maximum allowable stress in the cable is 24 ksi. Assume that that L-shaped bar is rigid.

If both cables must be the same size, determine the minimum cable diameter required.

$A = \frac{\pi}{4}d^2$

$\tau = \frac{FL}{AE}$

$\overline{DC} = \sqrt{7^2 + 5^2}$

$\overline{DC} = 8.6 \text{ in}$

$\overline{DB} = \sqrt{3^2 + 5^2}$

$\overline{DE} = 5.83$

$24000 = \frac{(175)(8.6)}{\frac{1}{4}\pi d^2 (27000000)}$

$5.09 \times 10^{11} \, d^2 = (175)(8.6)$

$\boxed{d = 5.44 \times 10^{-5} \text{ in.}}$

$5.09 \times 10^{11} \, d^2 = (100)(5.83)$

$d = 3.38 \times 10^{-5} \text{ in.}$

200 lb

$\sum M_A = -B(3) - B(7) + 200(5) = 0$

$B = 100 \text{ lbs}$

$C = \frac{7}{4}100 = 175 \text{ lbs}$

$A = \frac{7}{3}100 = 233.33 \text{ lbs}$

10 in.

C

4 in.

B

3 in.

A

5 in.