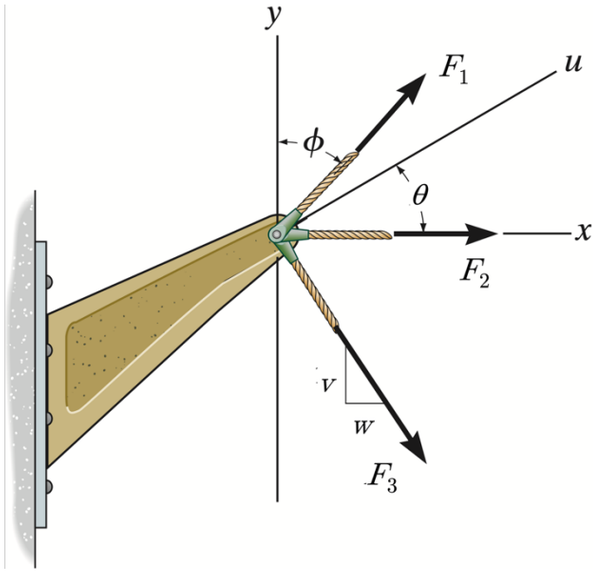
Problem Set 4 *and* **Quiz 4**

for the ENS161 B5-1 and B6 classes *offered in A.Y. 2025-2026, S1*

Problem 1. The bracket must be subject to a net force acting along the u-axis when $\theta = 40°$, $F_2 = 500$ lb, $F_3 = 5$ kip, $v = 5$, and $w = 3$.



If the net force is to be a minimum, determine:

a. (10 pts) F_1 and

b. (5 pts) ϕ.

If the net force must be no more than 10 kips, determine the limiting values

c. (5 pts) of F_1 and

d. (5 pts) of ϕ?

If the F_1 is to be minimized, determine:

e. (5 pts) ϕ,

f. (5 pts) the minimum value of F_1, and

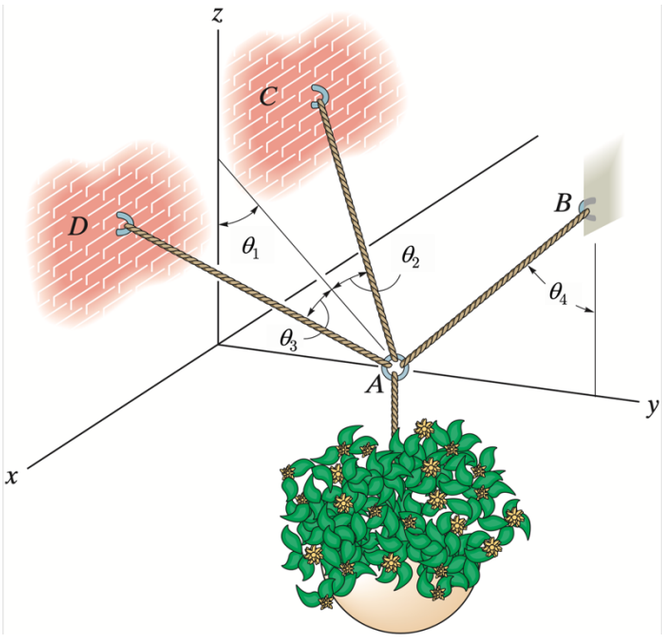
g. (5 pts) the magnitude of the net force.

Note: Forces are in kips and angle measures are in degrees.

Problem Set 4 *and* **Quiz 4**

for the ENS161 B5-1 and B6 classes *offered in A.Y. 2025-2026, S1*

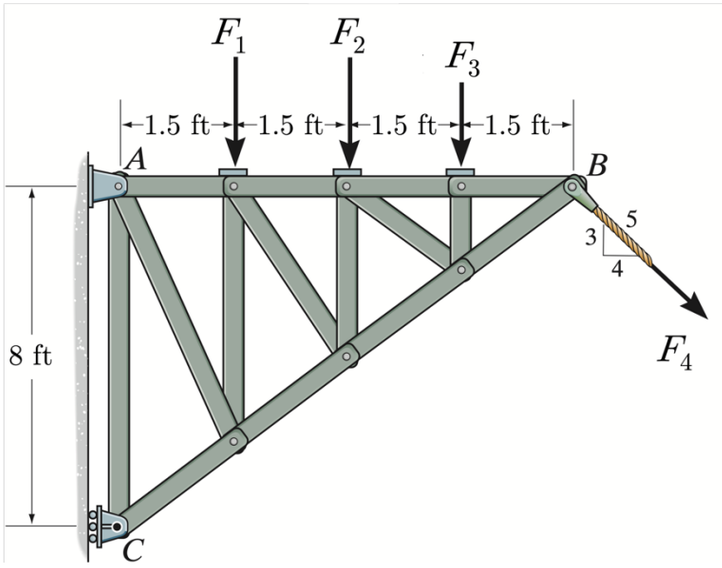
Problem 2. (20 pts) A pot hangs through cords AB, AC, and AD, which can sustain tensions of up to 60, 50, and 35 N, respectively. Up to how many kilograms must the pot weigh if $\theta_1 = 40°$, $\theta_2 = 20°$, $\theta_3 = 30°$, and $\theta_4 = 50°$? Take AB to lie in the yz-plane.



Problem Set 4 *and* **Quiz 4**

for the ENS161 B5-1 and B6 classes *offered in A.Y. 2025-2026, S1*

Problem 3. The truss is expected to be loaded with four concentrated forces: $F_1 = 0.15$ kip, $F_2 = 2$ kip, $F_3 = 0.5$ kip, and $F_4 = 0.1$ kip.



For a force-couple equivalent of the loads at C, determine:

a. (3 pts) the magnitude of the resultant force,
b. (2 pts) the direction of the resultant force, and
c. (5 pts) the couple moment.

For a single-force equivalent of the loads, determine

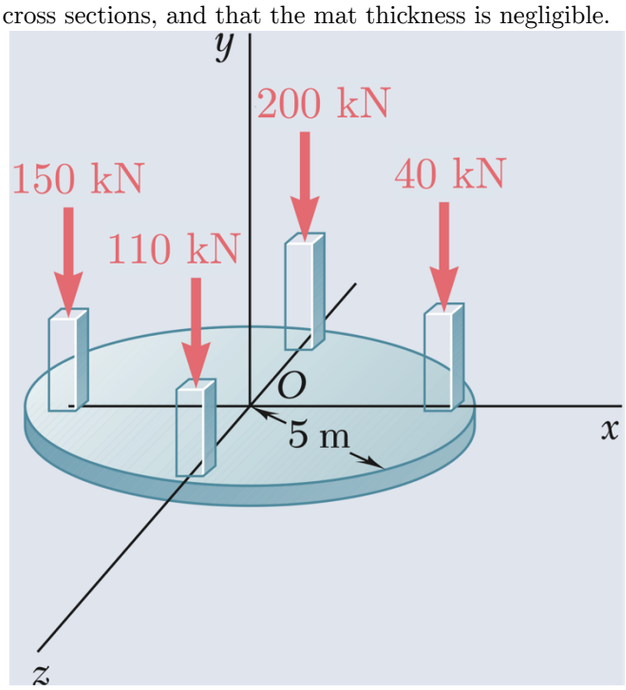
d. (5 pts) how far (in ft) from C will it intersect the line containing segment BC.

Note: Forces are in kips. Vector direction is measured in degrees, with clockwise from the horizontal being negative. Moments are in kip-ft, with those having a clockwise sense being negative.

Problem Set 4 *and* **Quiz 4**

for the ENS161 B5-1 and B6 classes *offered in A.Y. 2025-2026, S1*

Problem 4. An initial design for a concrete foundation features a circular mat supporting four square columns, equally spaced around the center of the mat. Each column has a cross-sectional area of 90000 mm^2 and is so positioned such that its innermost face is 3.7 m from the center of the mat. The design also assumes that the loads transmitted by the columns pass through the centers of their cross sections, and that the mat thickness is negligible.



For a force-couple equivalent of the loads at C, determine:

a. (1 pts) the x-component of the resultant force,
b. (1 pts) the y-component of the resultant force,
c. (1 pts) the z-component of the resultant force,
d. (4 pts) the x-component of the couple moment,
e. (4 pts) the y-component of the couple moment, and
f. (4 pts) the z-component of the couple moment.

For a single-force equivalent of the loads, determine:

g. (2 pts) the x-coordinate,
h. (1 pts) the y-coordinate, and
i. (2 pts) the z-coordinate

of the point where the resultant force intersects the mat.

Note: Forces are in kilonewtons, moments are in kilonewton-meters, and positions are in meters.