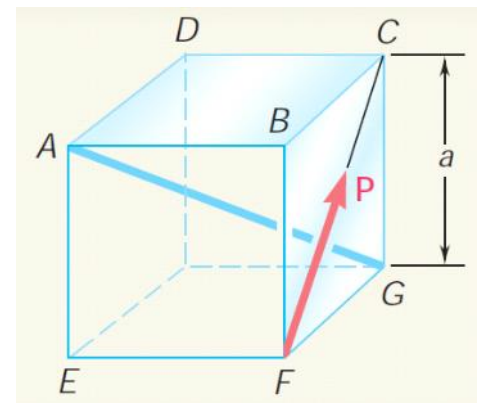


Assignment-1
ID1130: Engineering Statics
Due: Monday, 2nd September 2019, before class
Note: Bonus points will be awarded for neat assignments

①

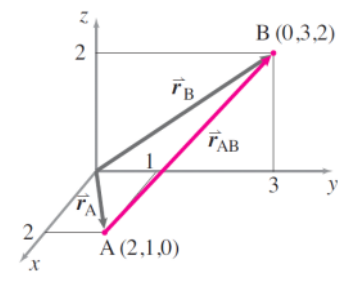
A cube of side a is acted upon by a force \vec{P} as shown. Determine the moment of \vec{P}



- (a) about A,
- (b) about the edge AB,
- (c) about the diagonal AG of the cube.
- (d) Using the result of part (c), determine the perpendicular distance between AG and FC.

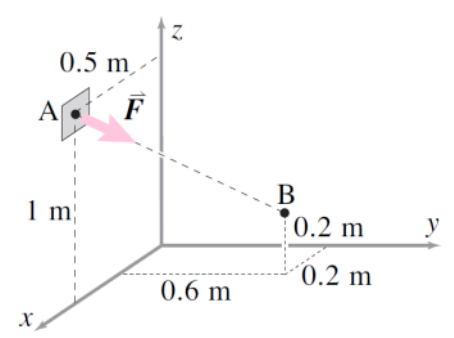
②

Relative Position Vector:- Let $A(2m, 1m, 0)$ and $B(0, 3m, 2m)$ be two points in the xyz coordinate system. Find the position vector of point B with respect to point A; find \vec{r}_{AB} ?



③

A string is pulled with a force of 100N as shown in the figure. Write the force \vec{F} as a vector in the xyz coordinate system shown in the figure.

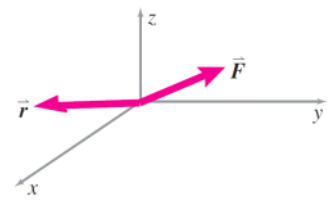


4

force acting at some point is given as $\vec{F} = 5N\hat{i} + 3N\hat{j} + 2N\hat{k}$.

(i) Find the y-component of \vec{F} .

(ii) Find the component of \vec{F} along the vector $\vec{r} = 3m\hat{i} - 4m\hat{j}$.

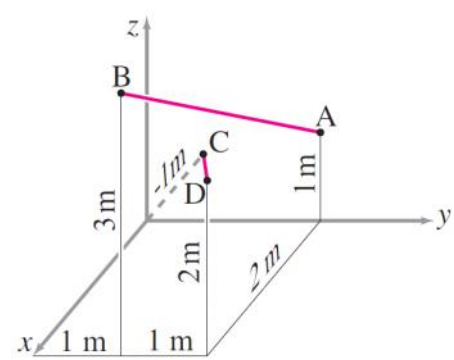


5

Find a unit vector perpendicular to the vectors $\vec{r}_A = \hat{i} - 2\hat{j} + \hat{k}$ and $\vec{r}_B = 3\hat{j} + 2\hat{k}$.

6

Two lines, AB and CD, in 3-D space are defined by four specified points: $A(0, 2m, 1m)$, $B(2m, 1m, 3m)$, $C(-1m, 0, 0)$, $D(2m, 2m, 2m)$ as shown in the figure. Find the shortest distance between the two lines (which are infinite extensions of the line segments shown in pink).

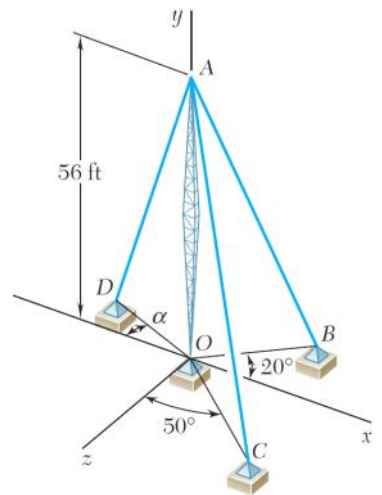


7

Cable AB is 65m long, and the tension in that cable is 3900N.

Determine:

- (a) the x, y, z components of the force exerted by the cable on the anchor B
- (b) the angles θ_x , θ_y and θ_z defining the direction of that force.



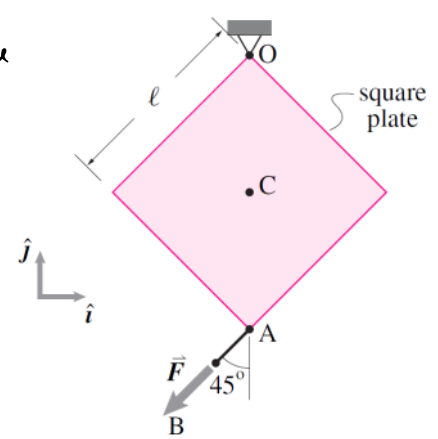
8

A 2m x 2m square plate hangs from one of its corners as shown in the figure.

At the diagonally opposite end, a force of 50N is applied by pulling on the string AB. Find the moment of the applied force about the centre C of the plate using

(i) The component of force perpendicular to \vec{r}_{AC} ?

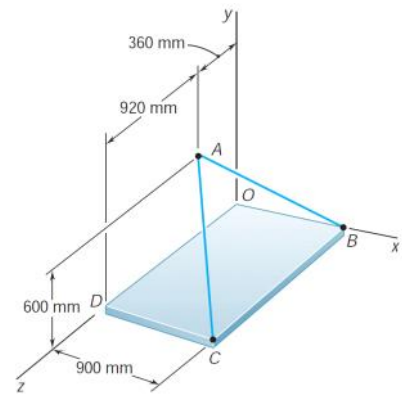
(ii) The lever arm (the perpendicular distance from C to the



(iii) The vectors \vec{F} and $\vec{r}_{A/C}$.

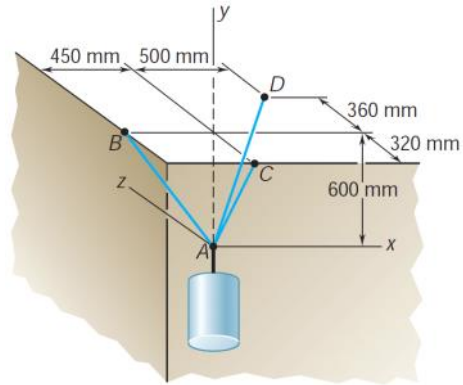
9

If you know the tension in cable AB is 1425 N, determine the components of the force exerted on the plate at B.



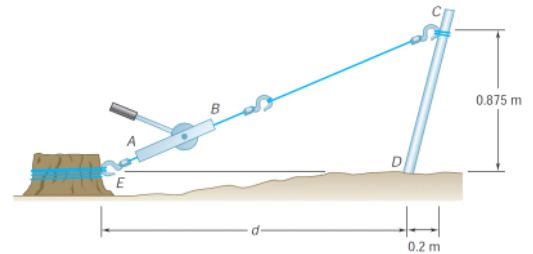
10

Container is supported by three cables that are attached to a ceiling as shown. Determine the weight W of the container, knowing that the tension in cable AB is 6 kN.



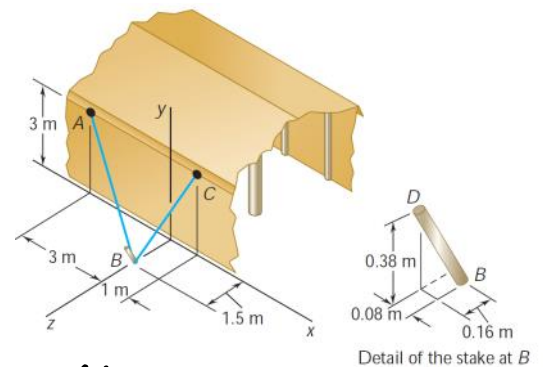
11

It is known that a force with a moment of 960 N·m about D is required to straighten the fence post CD. If the capacity of winch AB is 2400 N, determine the minimum value of distance d to create the specified moment about point D.



12

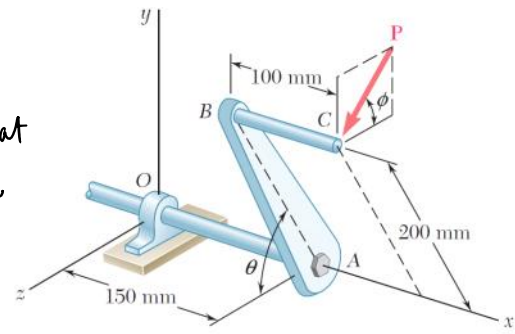
Ropes AB and BC are two of the ropes used to support a tent. The two ropes are attached to a stake at B. If the tension in the rope AB is 540 N, determine



- the angle between the rope AB and the stake
- the projection on the stake of the force exerted by rope AB at point B.

13

A single force \vec{P} acts at C in a direction perpendicular to the handle BC of the crank shown. Knowing that $M_x = +20 \text{ N}\cdot\text{m}$ and $M_y = -8.75 \text{ N}\cdot\text{m}$, and $M_z = -30 \text{ N}\cdot\text{m}$, determine the magnitude of \vec{P} and the values of ϕ and θ .



14

A regular tetrahedron has six edges of length 'a'. A force \vec{P} is directed along edge BC. Determine the moment of \vec{P} about edge OA.

