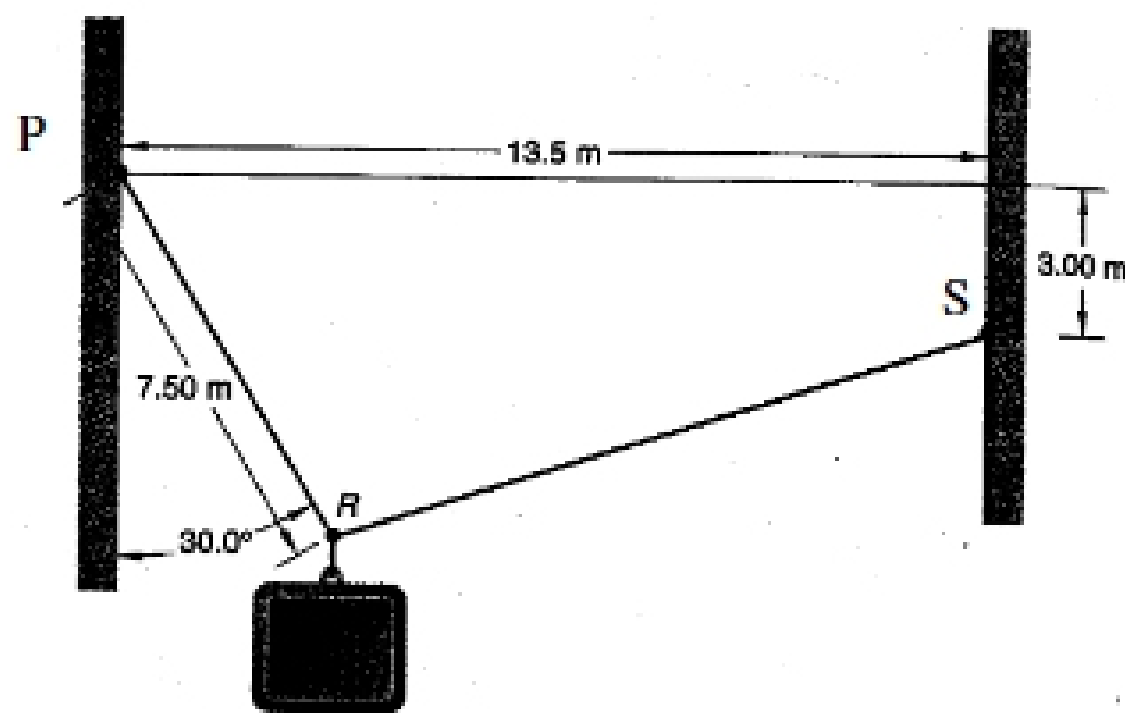


**Homework 4.****Due: 3:35pm, Monday October 10, 2005.**

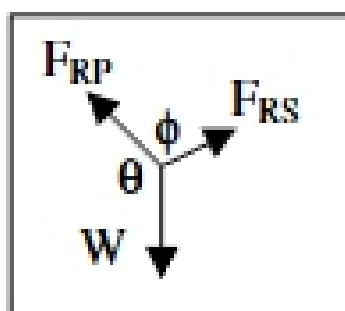
Please use a word processor for preparing your answers to Problems 3 and 4. For Problem 1 and 2, please use free sheets of paper (i.e. NOT paper torn from your notebook) and present your answers neatly, clearly and understandably. Follow the guidelines given on 9/12/05. Again, I would prefer you to get into the habit of using engineering paper, but that is not a requirement. For Problem 2 you will turn in a printout of your spreadsheet. You should include comments to explain clearly and concisely what you have done.

**QUESTION 1.**

Consider Question 3 from homework 3 as shown below. Answer the following multiple choice questions for parts a and b. and then complete part c using your answers for parts a. and b.



a. The free body diagram for R is:



i)  $\theta = 30, \phi = 90$

ii)  $\theta = 150, \phi = \tan^{-1} (13.5 - 7.5 \sin 30) / (7.5 \cos 30 - 3)$

iii)  $\theta = 150, \phi = 90$

b. The equilibrium equations are:

a.  $F_{RP} \cos \theta + F_{RS} \cos \phi = W, F_{RP} \sin \theta + F_{RS} \sin \phi = W,$

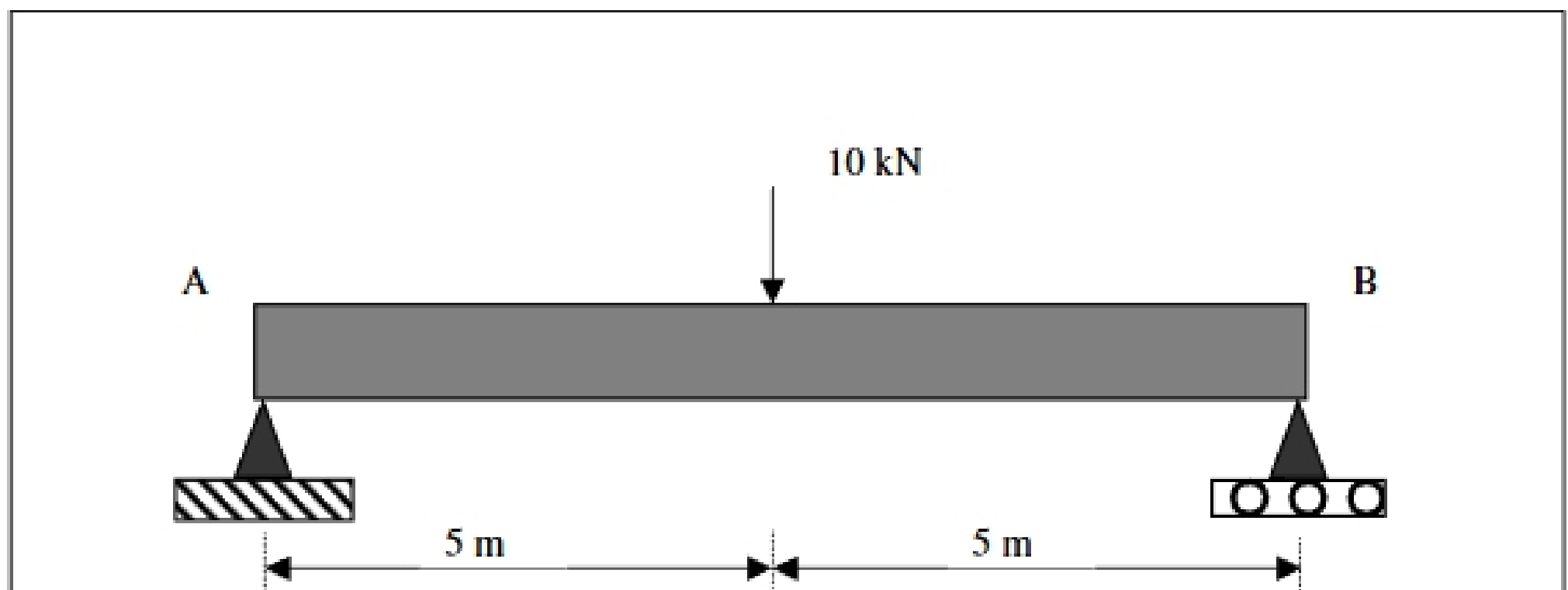
b.  $F_{RP} \cos (180 - \theta) + F_{RS} \cos (\phi + \theta - 180) = W, -F_{RP} \sin (\theta - 90) + F_{RS} \sin (270 - \theta - \phi) = W,$

$$c. F_{RP} \cos (180-\theta) + F_{RS} \cos (\phi+\theta-180) = W, -F_{RP} \sin (\theta-90) + F_{RS} \sin (270-\theta-\phi) = W,$$

$$d. F_{RP} \cos (180-\theta) + F_{RS} \cos (\phi+\theta-180) = W, -F_{RP} \cos (\theta-90) + F_{RS} \cos (270-\theta-\phi) = 0,$$

c. Determine  $F_{RP}$  and  $F_{RS}$  if  $W$  is 10 kN.

## QUESTION 2.



a) Assume the beam above is weightless.

a. Draw the free body diagram for the beam.

b. Write the equilibrium equations for

i. The forces in the vertical direction.

ii. The forces in the horizontal direction

iii. Moments about the joint A.

c. Compute the reactions at A and B by solving the equations in 1 a) b).

b) Now assume the beam in the above diagram has a mass of 200 kg per meter.

a. Compute the equivalent force to the weight of the applied at the center.

b. Draw the free body diagram for the beam including the equivalent force for the weight of the beam.

- c. Write the equilibrium equations for
  - i. The forces in the vertical direction.
  - ii. The forces in the horizontal direction
  - iii. Moments about the joint A.
- d. Compute the reactions at A and B by solving the equations in 1 a) b.

### QUESTION 3.

Read the article titled “Indian River Inlet Bridge: A Community’s Vision in Harmony with Nature” that describes the recently designed Indian River Inlet bridge and answer the following questions:

- a. Why did the Delaware Department of Transportation decide to build a new bridge over the Indian River Inlet?
- b. What type of bridge form was selected, how did it get selected, and what were the reasons for the final choice?
- c. If you were going to monitor the bridge with equipment, what would you monitor and why?

### QUESTION 4.

- a. Using data on the web at <http://www.hut.fi/Units/Departments/R/Bridge/chronological.html> plot a curve using Excel showing the evolution of bridge spans (in meters) over time from 1850 to the present. Your plot should include a title, and labels on the x and y axes. Your plot from excel should be “cut and pasted” into your word document and clearly labeled.
- b. In two or three sentences, describe the trend?
- c. In two or three sentences, describe what the plot tells you about what we might expect to see in the future?