UNIVERSITY of ARKANSAS
1871

MEEG 2003 **Name:** _____

(Underline your **last name**.)

Test I ( ) **ID#:** _____

1. (30%) The weights of collars *A* and *B* are W_A = 75 lb and W_B = 90 lb, respectively. If the effect of friction is negligible and equilibrium of the system as shown exists, determine *(a)* the tension T_{AB} in the connecting cable *AB*, *(b)* the reaction **A** exerted on collar *A* by the rod, *(c)* the reaction **B** exerted on collar *B* by the rod, *(d)* the magnitude of the applied force **P**.

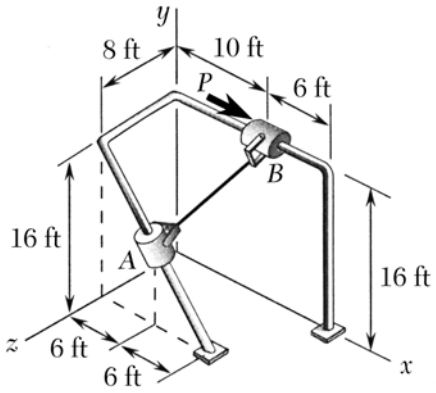

Fig. P1

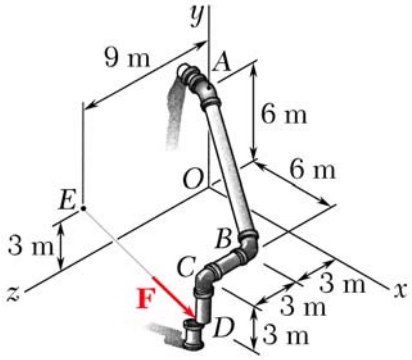

Fig. P2

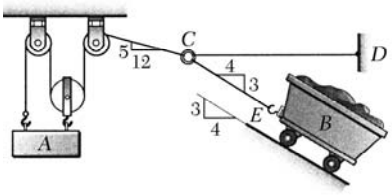

Fig. P3 *A*, *B*, *C*

2. (30%) A 48-N force **F** acts at the end *D* of a pipeline as shown. Determine *(a)* the moment $\mathbf{M}_A$ of the force **F** about the joint at *A*, *(b)* the moment M_{AB} of **F** about the axis of the pipe *AB*, *(c)* whether the action of **F** tends to tighten or loosen the joint at *A* where the threads are right-handed, *(d)* the shortest distance d_{s1} between point *A* and the line of action of **F**, *(e)* the shortest distance d_{s2} between the *x* axis and the line of action of **F**.

3. The system shown is in equilibrium, and the tension in the cable *CD* is known to be 288 lb. *Circle on this test sheet* the nearest item for each of the following:

A. (5%) The tension in the cable *CE* is
(a) 75 lb. *(b)* 150 lb. *(c)* 225 lb. *(d)* 300 lb. *(e)* 375 lb. *(f)* 450 lb. *(g)* 525 lb.

B. (5%) The weight of cart *B* is
(a) 875 lb. *(b)* 750 lb. *(c)* 625 lb. *(d)* 500 lb. *(e)* 375 lb. *(f)* 250 lb. *(g)* 125 lb.

C. (5%) The weight of block *A* is
(a) 702 lb. *(b)* 1053 lb. *(c)* 1228 lb. *(d)* 1404 lb *(e)* 1580 lb. *(f)* 1755 lb. *(g)* 2106 lb.

D. (5%) The critical load for a cantilevered column is $P_{cr} = (\pi^2 EI)/(4L^2)$. For $E = 20\times10^6$ lb/in^2, $I = 1.5\times10^3$ mm^4, L = 3.5 ft, and 1 lbm = 0.4536 kg, the largest mass m (in kg) of a block which may be placed on the top of the column without causing the column to buckle is
(a) 45.7 kg. *(b)* 43.2 kg. *(c)* 40.9 kg. *(d)* 38.8 kg. *(e)* 36.8 kg. *(f)* 35.0 kg. *(g)* 33.3 kg.

4. Non-numerical problem.

A. (5%) Describe the **rigid-body principle**.

B. (5%) Define the vectors $\boldsymbol{\lambda}_{BC}$ and **r** in the formula $M_{BC} = \boldsymbol{\lambda}_{BC} \cdot (\mathbf{r} \times \mathbf{F})$ for computing the moment of a force **F** about the axis *BC*.

C. (5%) Describe **Varignon's theorem**.

D. (5%) The moment of a force **F** about a point *P* is actually the same as the moment of this force **F** about a specific axis. Describe the *location* and the *orientation* of this **specific axis**.