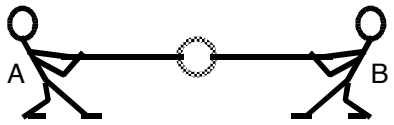
PhyzJob: Operation "Libra"

1. A ring has two ropes attached to it. Two people pull the ropes as shown, but the ring does not move.



a. If person A is pulling with a force of 100 N, how much force must person B be pulling with?

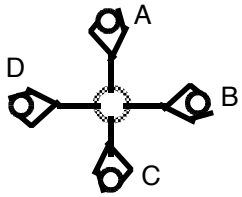
b. Write the force exerted by person A in rectangular vector form: $\mathbf{F_A}$ = (,).
(Remember, left on the *x*-axis is considered negative.)

Write the force exerted by person B in rectangular vector form: $\mathbf{F_B}$ = (,).

c. Add the vectors $\mathbf{F_A}$ and $\mathbf{F_B}$.

d. If the forces were such that the sum was not equal to zero, what would that mean?

2. Consider a ring with four ropes attached to it. Four people pull on the ropes as shown, but the ring does not move.



TOP VIEW

a. If A and B pull with 100 N of force, how hard are C and D pulling?

Force exerted by C = _____ Force exerted by D = _____

b. Suppose A pulled with 25 N and B pulled with 150 N. How hard must C and D pull to maintain balance?

Force exerted by C = _____ Force exerted by D = _____

c. Write out all the forces in part b in rectangular vector form. (DON'T FORGET SIGNS!)

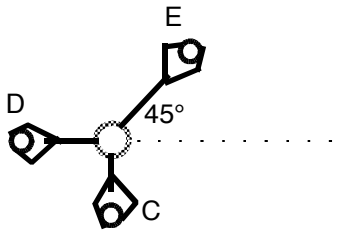
$\mathbf{F_A}$ = (,) $\mathbf{F_B}$ = (,)

$\mathbf{F_C}$ = (,) $\mathbf{F_D}$ = (,)

d. Add the vectors $\mathbf{F_A}$, $\mathbf{F_B}$, $\mathbf{F_C}$, and $\mathbf{F_D}$.

e. What can you conclude about the vector sum of the forces when the ring is held stationary?

3. Suppose that the situation described in question 2 was changed in the following way. Persons A and B (and their ropes) are removed. Person E attaches a rope to the ring. Person C pulls with 100 N, person D pulls with 100 N, and person E pulls with $\mathbf{F_E}$ = (100 N, 100 N).



a. Compare the *x*-components of $\mathbf{F_D}$ and $\mathbf{F_E}$. Do you notice any relation? If so, what is it?

Compare the *y*-components of $\mathbf{F_C}$ and $\mathbf{F_E}$. Do you notice any relation? If so, what is it?

b. Add the vectors.

c. Why can you conclude that the ring will remain stationary?

4. Suppose C pulled with $\mathbf{F_C}$ = (0, –30 N), D pulled with $\mathbf{F_D}$ = (–40 N, 0), and E pulled with $\mathbf{F_E}$ = (40 N, 30 N). Would the ring move or remain stationary? Explain your reasoning.

5. If C pulled with $\mathbf{F_C}$ = (0, –83 N), and D pulled with $\mathbf{F_D}$ = (–57 N, 0), what force would E have to pull with to keep the ring from moving?

6. Suppose E pulled with $\mathbf{F_E}$ = (66 N, 33 N). With what force would C and D have to pull to keep the ring from moving? (Remember that C can only pull downward and D can only pull to the left.)

7. Consider another ring which is being pulled in different directions by persons J, K, L, and M. The forces exerted by J, K, and L are as follows:

$\mathbf{F_J}$ = (10 N, –20 N) $\mathbf{F_K}$ = (–20 N, –10 N) $\mathbf{F_L}$ = (30 N, 40 N)

a. What must M's force be to keep the ring in balance?

b. Sketch a diagram of this situation.