Unit 17 · Statics

HARDER PRACTICE QUESTIONS

Full marks 19

Write your answers on separate paper. Show your working, with a sketch of the forces for each problem.

1 The angles of three forces [4]

Forces of 3 N, 5 N and 7 N act at a point and are in equilibrium.

a. Find the angle between the 3 N and 5 N forces. Mausami says it is 120°, "because the triangle of forces has an angle of 120°". Is she right?

b. Find the other two angles between the forces, and check them with Lami's theorem.

2 The least force [5]

A lamp of weight 50 N hangs on a string. A second force P pulls the lamp aside so that the string makes 30° with the vertical.

a. If P is horizontal, find P and the tension.

b. Let P make an angle θ with the string. Use Lami's theorem to show that $P = \dfrac{25}{\sin\theta}$.

c. Find the least P that can hold the lamp there, its direction, and the tension then.

3 A ring on a string [5]

A string 5 m long is tied to two hooks 4 m apart on the same level. A smooth ring carrying a weight of 30 N slides along the string and comes to rest.

a. Explain why the two parts of the string make equal angles with the vertical.

b. Find that angle and the tension.

c. One hook is moved 1 m lower, still 4 m from the other across. Sushila says the ring will now hang with unequal angles and a larger tension. Find the angle and the tension, and say where the ring settles.

4 Two porters and a plank [5]

Two porters carry a uniform plank 4 m long weighing 200 N, with a sack of 100 N tied 1 m from end A. They hold it level, porter 1 at A and porter 2 at end B.

a. Find the force each porter supports.

b. Porter 2 moves in towards A so that the two carry equal loads. Where should he hold the plank?

c. Find the single force equivalent to the plank's weight and the sack together, and where it acts.