TUTORIAL ANSWERS_FORCES

1.) Take moment about the centre of uniform plank

$F_1 (3L / 8) = F_2 (L/4)$

$F_1 / F_2 = (8/3)(1/4) = 2/3$

$F_1 : F_2 = 2 : 3$ **(Answer: D)**

2.) Take moment about Y,

(2) $F_x = (3)(600)$

$F_x = 900$ N

Take moment about X,

(2) $F_y = (5)(600)$

$F_x = 1500$ N **(Answer: E)**

3.)

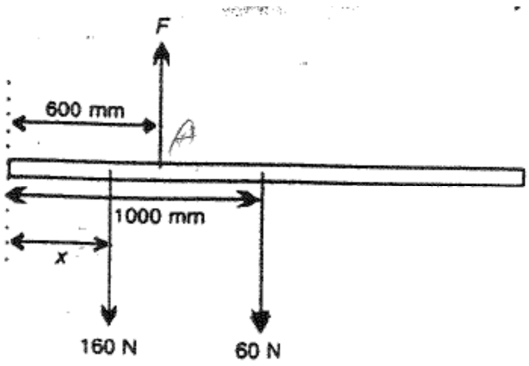
The 160 N weight should be placed to the left of the pivot in order to balance the plank. Let x be the distance from E that the 160 N should be placed.

For plank to be balanced,

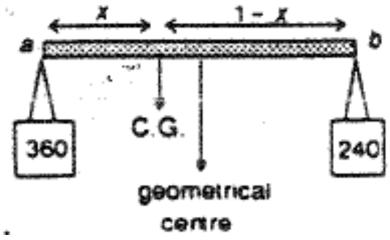
Total C/W moments = total Anti-C/W moments

60 (1000 – 600) = 160 (600 – x)

x = 450 mm (Answer: D)



4.) Let centre of gravity of rod be at x m away from the balance with reading at 360 g.



Taking moment about centre of gravity,

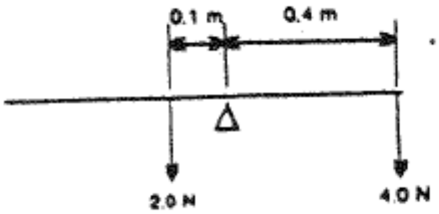
360 x = 240 (1 – x)

x = 240 / (360 + 240) = 0.4 m

Geometrical centre of the rod is ½ m from a.

So difference =1/2 - 2/5 = **1/10 m (to the left of rod's geometrical centre.) (Answer: A)**

5.) From the diagram, the turning effect about the pivot is



(0.4)(4) – (0.1)(2.0) = **1.4 Nm (clockwise)** **(Answer: B)**

6.) The centre of gravity of the beam is at the centre of the beam. Taking moment about this point,

$T_1 (L/2) = T_2 (2L/3 – L/2)$

$T_1 (L/2) = T_2 (L/6)$

$T_1 / T_2 = 1/3$ **(Answer: A)**

7.) The three forces are said to be equilibrium if the resultant force is ZERO.
Only **answer in A** satisfies the condition.

8.) For object in equilibrium, the vector triangle must be a closed polygon and all arrows must point in one direction. (i.e: clockwise or anti-clockwise) **(Answer: C)**

9.) For zero linear movement, total forces acting upwards must be equal to total forces acting downwards. (no horizontal force is involved here). So the only possible answers are A & D. However, diagram A shows no rotational motion whereas diagram D shows a net rotational moment.
(Answer: D)

10.) Torque produced by a couple = one of the force x perpendicular distance between the forces
= 2.0 x 0.30 sin 50° = **0.46 Nm** **(Answer: C)**

11.) The rod is in equilibrium when the three forces are directed such that they do not produce a net torque and the resultant force is zero. **(Answer: B)**