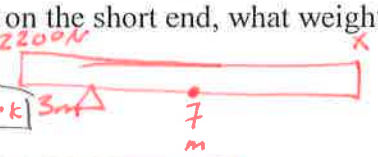
$\Sigma\tau = 0$ N·m

Torque

1. A 32 kg plank, with a uniformly distributed mass, is 14 meters in length. A fulcrum is placed 3 meters from the end. If a weight of 2200 N is placed on the short end, what weight must be placed at the long end to ensure equilibrium?



$2200\,N \cdot 3m = 4m \cdot 32kg \cdot 9.8\frac{m}{s^2} + 11m \cdot 9.8 \cdot k$

$x = \frac{6600\,N\cdot m - 1254.4\,N\cdot m}{10 - 7.8} = 49.6\,N$

2. teeter-totter (55kg) that is 10 meters long has a fulcrum directly in the middle of it (for maximum see-sawing action). A 30 kg girl sits on the end and a 25 kg girl sits on the same side of the fulcrum, but 2 meters in from the end. What must the mass be of a boy who is to sit on the opposite side of the fulcrum, but on the end of the teeter-totter, so the system is in equilibrium?

$294\,N \cdot 5m + 245\,N \cdot 3m = 5m \cdot 9.8 \cdot x$

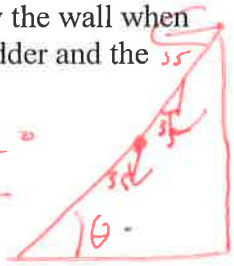
$x = 45\,kg$

3. A firefighter (71 kg) climbs a ladder (22 kg) that is 12 meters long. If the ladder makes a 55° angle with the ground (don't try this at home), determine the force applied by the wall when she is ¾ of the way up the ladder (ignore the effect of friction between the ladder and the wall).

$\tau_n = \tau_1 + \tau_2$

$F_n = \frac{22kg \cdot 9.8\frac{m}{s^2} \cdot 6m \sin 35^\circ + 71kg \cdot 9.8 \cdot 9m \cdot \sin 35^\circ}{\sin 55^\circ}$

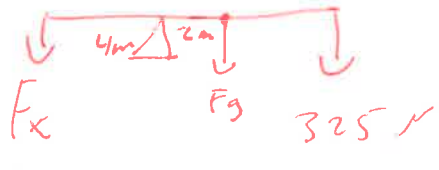
$F_n = 441\,N$



4. A 12 meter long board has a fulcrum placed 4 meters from its end. If the board has a mass of 10 kg (uniformly distributed) and a force is applied perpendicularly to the long end that is 325 N, determine the perpendicular force necessary on the short end to keep the board in equilibrium.

$\tau_x = \tau_g + \tau_{app}$

$F = \frac{325\,N \cdot 8m + 49\,N \cdot 2m}{4m} = 674.5\,N$



5. A plank, 9 meters in length, has a fulcrum placed 3 metes from its end. The plank has a uniformly distributed mass of 18 kg. If a 77 kg man sits on the short side of the plank, determine where on the plank a 45 kg man must sit to establish equilibrium.

$754.6\,N \cdot 3m = 176.4\,N \cdot 1.5m + 441\,N \cdot x$

$x = 4.5\overline{3}\,m$ from fulcrum

@ $7.5\overline{3}\,m$ from the end