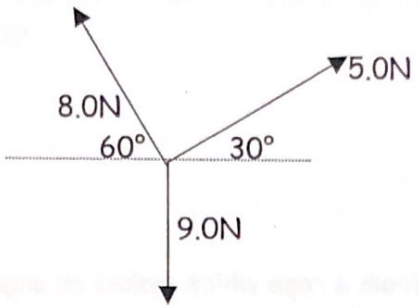
Equilibrium Worksheet#1

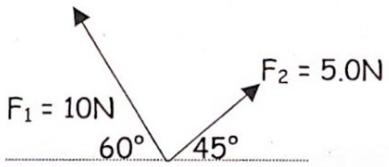
_____
(name)

1. What is the magnitude and direction of the force necessary to produce equilibrium in the following?



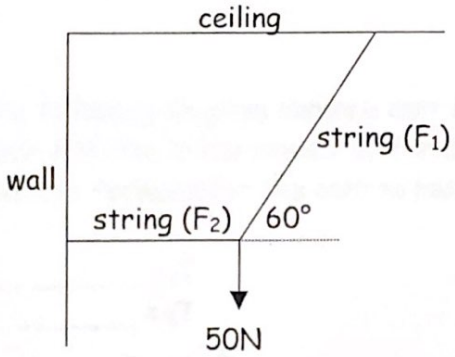

F = _____.

2. What is the magnitude and direction of the force needed to produce equilibrium with $F_1$ and $F_2$ ?




F = _____.

3. An object on which the force of gravity is 50 N is supported by two strings as shown below. Calculate the magnitude of the force of tension exerted by each string.



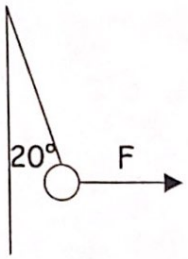

$F_1$ = _____.

$F_2$ = _____.

4. A boy weighing 400 N hangs on the middle of a rope stretched between two trees. The rope sags in such a way that it makes an angle of 170° at the boy's hands. What is the tension in each rope?

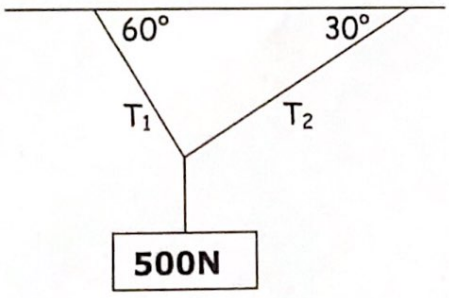
T = _____.

5. A 660 N object is suspended from a rope which makes an angle of 20° with the wall as shown below. What is the magnitude of the horizontal force necessary to produce equilibrium?




F = _____.

6. A 500 N crate is suspended from a cable in such a manner that the cable makes an angle of 30° with the ceiling at one end and an angle of 60° with the ceiling at the other end. Calculate the tension force exerted by each cable on the crate.



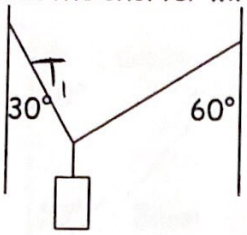

$T_1$ = _____.
$T_2$ = _____.

Answers: 1. 0.54N, 53° S of W 2. 12.3N, 83° S of E 3. 29N, 58N
4. $2.29*10^3$N 5. 240N 6. $T_1$ = 433N, $T_2$ = 250N

**Equilibrium Worksheet#2**

_____
(name)

1. A lamp is supported between two vertical poles with two wires attached to the poles as shown. The lamp hangs from a short chain. If the lamp has a mass of 11 kg, what is the tension in the shorter wire?




$T_1$ = _____.

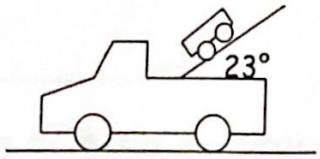
2. As an airplane accelerates along a horizontal runway, a pendulum hanging from its ceiling is displaced 12° from the vertical. Calculate the acceleration of the plane.

a = _____.

3. A uniform ladder has a mass of 16 kg and a length of 8.5 m. It stands on the ground and leans against a vertical wall, making an angle of 62° with the ground. The friction between the ladder and the wall is not significant. What is the smallest force of friction between the ladder and the ground which will just prevent the ladder from slipping?

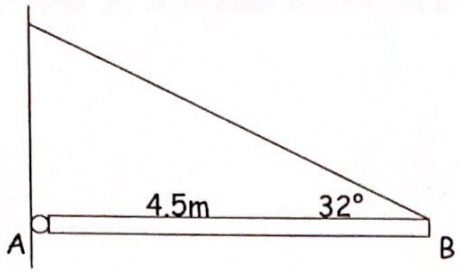
Ff = _____.

4. The following diagram shows a cart on a ramp which is fixed to the floor in the back of a truck. Friction in the wheels of the cart is negligible. At what rate must the truck accelerate forward for the cart to remain stationary with respect to the ramp?



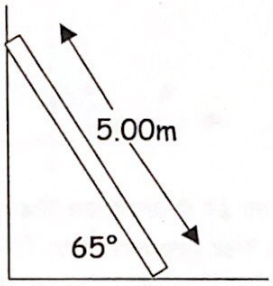

a = _____.

5. The following diagram shows a uniform 24 kg beam hinged to the wall at A and supported by a cable from B. What is the magnitude of the horizontal force exerted by the wall on the beam?



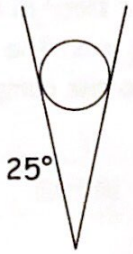

$F_x$ = _____.

6. A uniform ladder with a mass of 15 kg rests against a wall as shown. If the friction from the wall is not significant, what is the minimum coefficient of friction between the ladder and the floor that will keep the ladder from slipping?




$\mu$ = _____.

7. A steel ball of mass 1.7 kg rests in the V-shaped wedge formed by two steel plates as shown in the diagram. Find the magnitude of the force exerted on each plate by the ball if the friction between the ball and the plates is not significant.



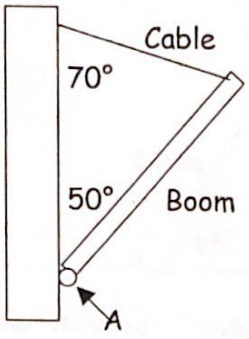

F = _____.

Answers: 1. 93N 2. 2.1m/s$^2$ 3. ~~41.7~~ 42N 4. ~~4.16~~ 4.2m/s$^2$ 5. ~~188~~ 190 N 6. 0.23 7. 38N

## Equilibrium Worksheet#3

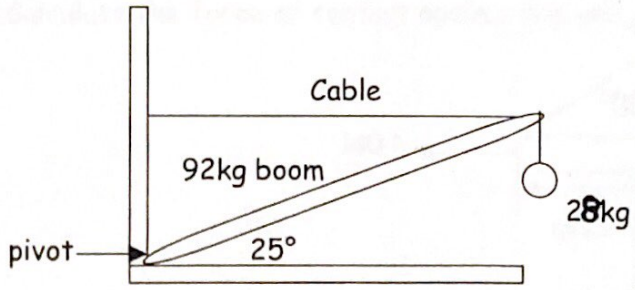
_____
(name)

1. The following diagram shows a uniform boom of length 2.6 m and mass 53 kg. The boom is hinged to the wall at point A and supported by a cable as shown. What is the vertical component of the force acting at point A?



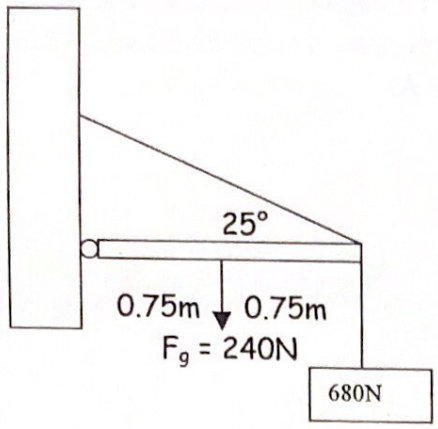

F = _____.

2. A uniform boom of length 3.6 m and mass 92 kg supports a load of 28 kg as shown. What is the tension in the horizontal cable supporting the boom'?



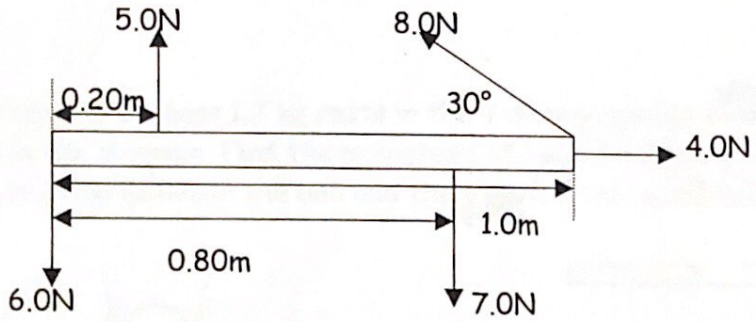

F = _____.

3. What is the tension in the cable shown in the following diagram?




F = _____.

4. A bar 1.0 m long has five forces acting on it as shown in the following diagram. What are the magnitude, direction, and location of the single force required to produce static equilibrium 'um? The weight and thickness of the bar are not significant.




F = _____.

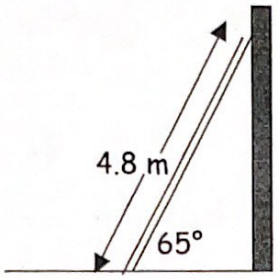
Answers: 1. 440N 2. ~~2.5*10³N~~ $1.6\times10^3$N 3. $1.9*10^3$N

4. ~~4.96~~5.0N, 54° N of E, 0.15m from left end

**Equilibrium Worksheet#4**

_____
(name)

1. A uniform 4.8 m long ladder of mass 16 kg leans against a frictionless vertical wall as shown in the diagram below. a) Draw and label a free body diagram showing the forces acting on the ladder.




b) What minimum force of friction is needed at the base of the ladder to keep it from sliding?

F = _____.

2. A uniform 5.0 m ladder of mass 25 kg leans against a frictionless wall. The ladder makes an angle of 60° with the floor.
a) Calculate the force of contact against the wall

F = _____.

b) Calculate the force normal that the floor exerts on the ladder.

F = _____.

c) Calculate the friction force exerted by the floor.

F = _____.

d) Calculate the minimum coefficient of friction needed for the ladder not to slide.

μ = _____.

3. For the same ladder as above, what is the minimum angle at which the ladder will not slide out, if the coefficient of friction is 0.40?

° = _____.

Answers:

1. (b) 37N 2. (a) 71N (b) ~~245~~ 250N (c) 71N (d) 0.29 3. 51°