

## CONCEPT: EQUILIBRIUM IN 2D

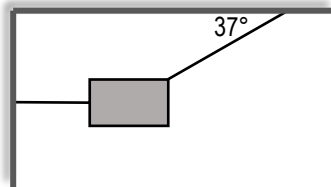
- 2D Equilibrium: all forces cancel out to ZERO in the \_\_\_\_ AND \_\_\_\_ axes.

$$F_{net,x} = \Sigma F_x = \underline{\hspace{2cm}}$$

$$F_{net,y} = \Sigma F_y = \underline{\hspace{2cm}}$$

- Remember to decompose all 2D forces!

EXAMPLE: A 5kg box is suspended in place by 2 cables. Calculate the tension forces of both cables.



### 2D FORCES

- 1) Draw FBD: **W, F<sub>A</sub>, T, N, f**
- 2) Decompose 2D Forces
- 3) Write  **$\Sigma \mathbf{F} = m\mathbf{a}$**  in x & y
- 4) Solve

- If you get stuck when solving X & Y axis equations, go to the other axis.

**PROBLEM:** A chandelier is supported from the ceiling by 2 chains. Both chains make a  $30^\circ$  angle with the **vertical**. The tension in each chain is the same because of symmetry:  $T_1 = T_2 = 50 \text{ N}$ . What is the mass of the chandelier?

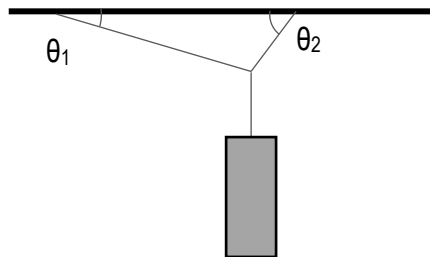
- A) 2.6 kg
- B) 8.8 kg
- C) 5.1 kg
- D) 4.4 kg

#### 2D FORCES

- 1) Draw FBD
- 2) Write  $\Sigma \mathbf{F} = m\mathbf{a}$  in x & y
- 3) Solve

**PROBLEM:** A traffic signal is suspended from 3 cables as shown. The angles of the upper cables are  $\theta_1 = 22^\circ$  and  $\theta_2 = 60^\circ$ . If the mass of the traffic signal is 8kg, what is the tension in cable 1?

- E) 4.0 N
- F) 39.6 N
- G) 73.4 N
- H) 210 N



#### 2D FORCES

- 1) Draw FBD
- 2) Write  $\Sigma \mathbf{F} = m\mathbf{a}$  in x & y
- 3) Solve

PROBLEM: A sphere hangs suspended by a light string, resting against a vertical wall. The sphere has a mass of 2 kg and the string makes an  $80^\circ$  angle with the horizontal. What is the force from the wall against the ball?

- A) 2.2 N
- B) 176 N
- C) 3.5 N
- D) 111 N



### 2D FORCES

- 1) Draw FBD
- 2) Write  $\Sigma F = ma$  in x & y
- 3) Solve