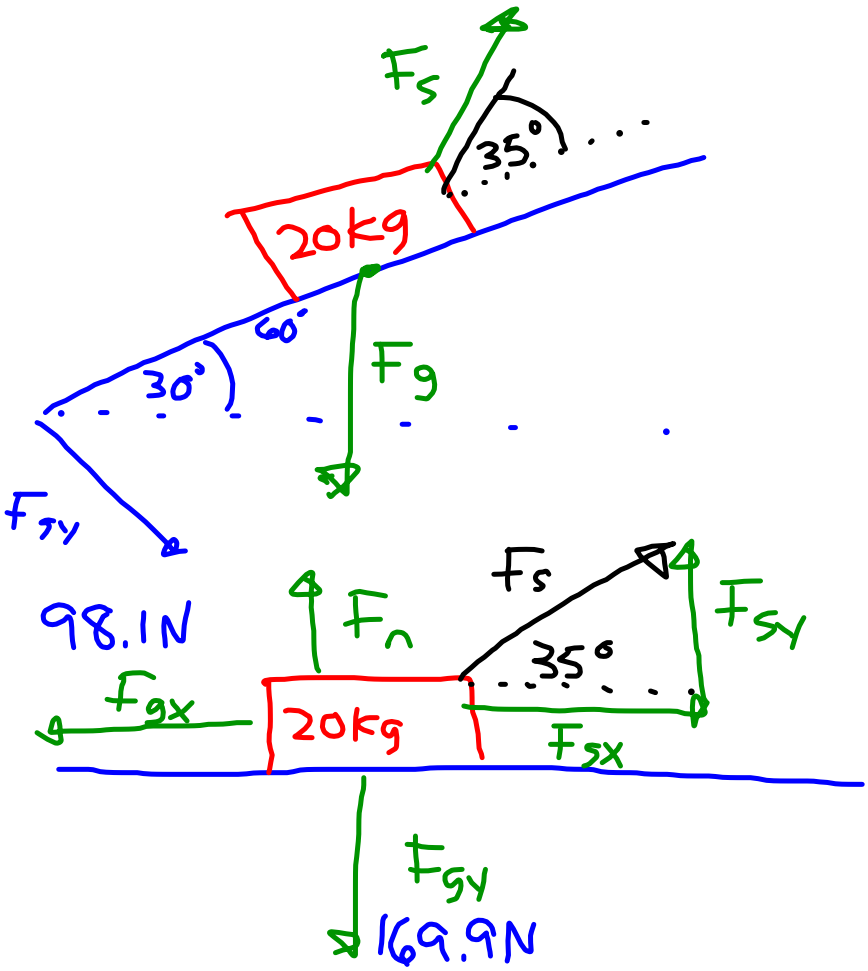
March 6, 2017

Ex. 1: Mr. Sadler pulls his 20kg daughter up a 30° snow hill. If the rope is inclined 35° to the sled, what force must Mr. S exert to keep in equilibrium?

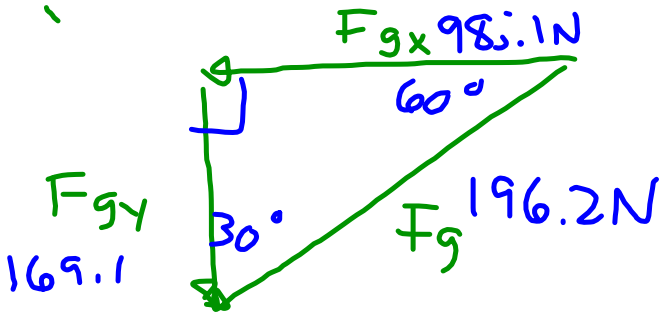
$F_{net} = 0$

(all forces add to 0)


F_s
35°
20kg
60°
30°
F_g
F_{gy}
98.1N
F_n
F_s
F_{sy}
35°
F_{gx}
20kg
F_{sx}
F_{gy}
169.9N

$$F_{gx} + F_{gy} = F_g$$
$$= mg$$
$$= (20kg)(9.81)$$

$$\boxed{F_{gx} + F_{gy} = 196.2}$$

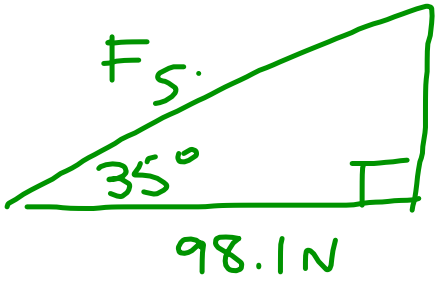


$$\sin 60 = \frac{F_{gy}}{196.2}$$

$$\boxed{F_{gy} = 169.9N}$$

$$F_{gx} = F_{sx} \quad \therefore F_{sx} = 98.1N,$$

$$F_{sy} + F_n = F_{gy}$$



$$\cos 35^\circ = \frac{98.1}{F_S}$$

$$F_S = \frac{98.1}{\cos 35^\circ}$$

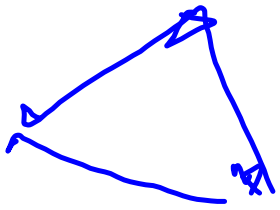
$$\boxed{F_S = 119.8\text{N}}$$

$\therefore$ Mr. S pulls at 119.8N.

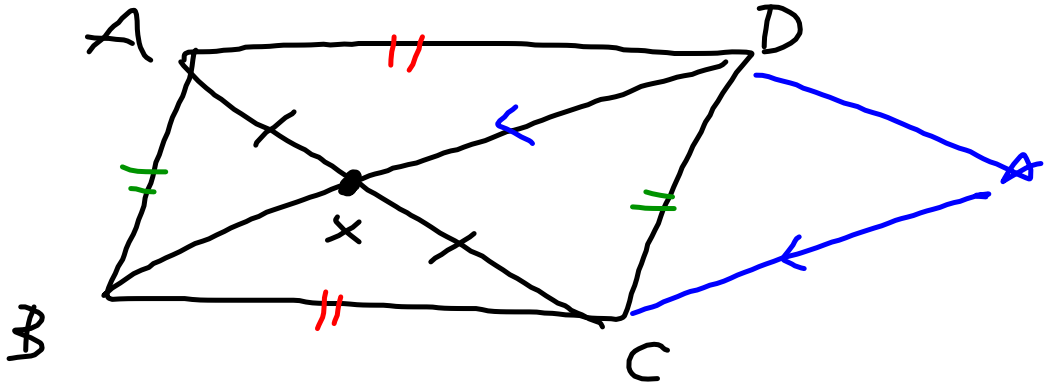
Test #2: Wed. March 8th

Contents

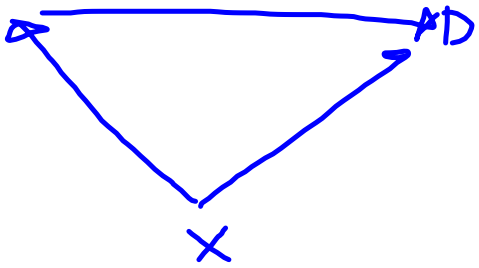
- Vector Addition and Subtraction
- Vector Proofs
- Components
- Speed / Tension Word Problems
- Inclined Plane



4) Vector Proof Sheet



show $\overline{BX} = \overline{XD}$



$\overline{BC} + \overline{CX} = \overline{XD}$

$\overline{AD} + \overline{XA}$

$\overline{XA} + \overline{AD}$

$\overline{XD} = \overline{XD}$ ∴ proven

$$\overline{BX} = \overline{X}\,\overline{D}$$

$$\overline{B}\,\overline{A} + \overline{A}\,\overline{X} = \overline{X}\,\overline{D}$$

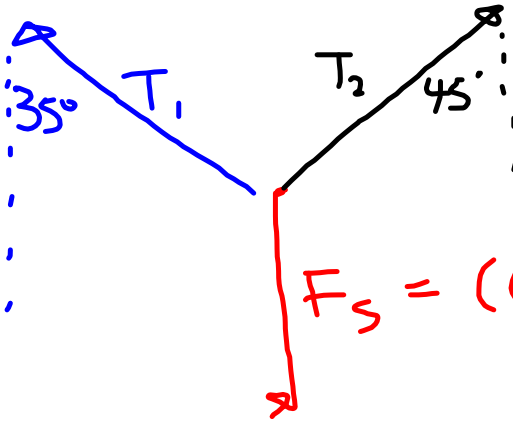
$$\overline{C}\,\overline{D} + \overline{X}\,\overline{C} = \overline{\overline{X}\,D}$$

$$\overline{X}\,\overline{C} + \overline{C}\,\overline{D} = \overline{X}\,\overline{D}$$

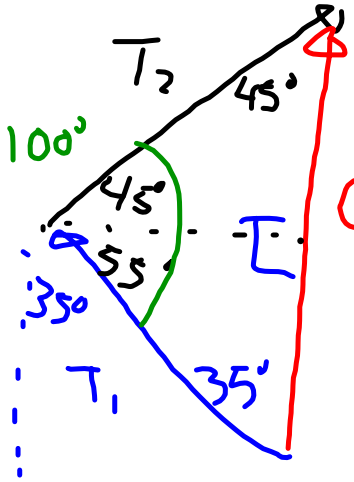
$$\overline{\overline{X}\,D} = \overline{X}\,\overline{D}$$

Tension

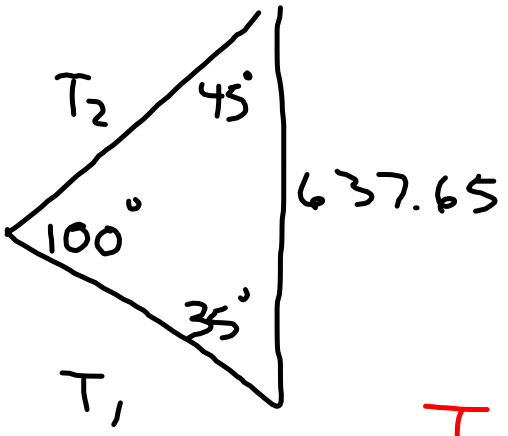
Spider-man weighs 65kg. If his left arms web is at 35° to the wall and his right web is 45° to the wall, how much tension in each web?



$F_s = (65)(9.81) = 637.65\ N$ [down]



637.65 N [up]



$$\frac{T_1}{\sin 45} = \frac{637.65}{\sin 100^\circ}$$

$$T_1 = \frac{637.65 \cdot \sin 45^\circ}{\sin 100^\circ}$$

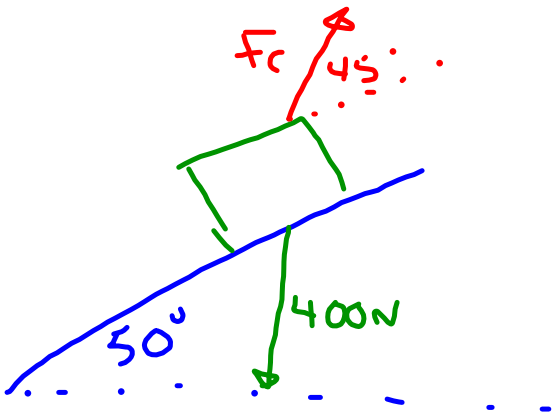
$$\boxed{T_1 = 457.84\,N}$$

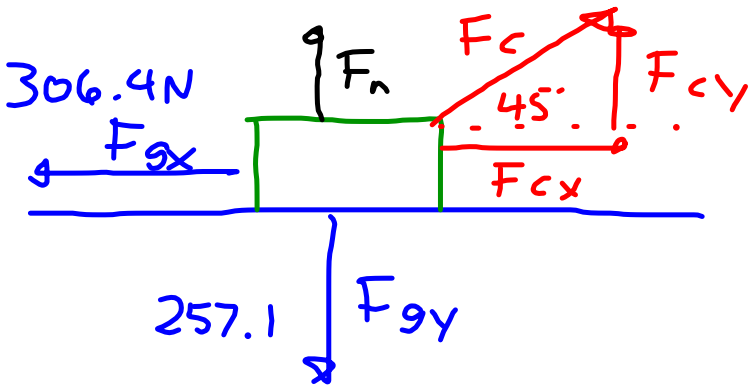
$$\frac{T_2}{\sin 35} = \frac{637.65}{\sin 100^\circ}$$

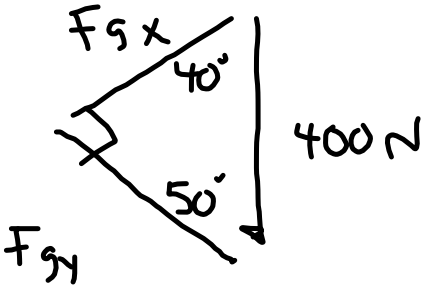
$$T_2 = \frac{637.65 \cdot \sin 35^\circ}{\sin 100}$$

$$\boxed{T_2 = 371.38\,N}$$

Ex. 4: Caleb carries his 400 N Calculus assignment up a 50° hill. If the angle between the rope and Caleb's arm is 45° what force must Caleb use?







$$\sin 50 = \frac{F_{gx}}{400}$$

$$F_{gx} = 400 \cdot \sin 50$$

$$\boxed{F_{gx} = 306.4\text{N}}$$

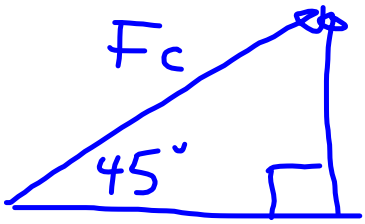
$$\cos 50 = \frac{F_{gy}}{400}$$

$$F_{gy} = 400 \cdot \cos 50$$

$$\boxed{F_{gy} = 257.1\text{N}}$$

$F_{gy} = F_n + F_{cy}$

$F_{gx} = F_{cx}$



$\cos 45 = \frac{306.4}{F_c}$

$F_c = \frac{306.4}{\cos 45}$

$\boxed{F_c = 433.3\text{N}}$

∴ Caleb pulls at 433.3N.