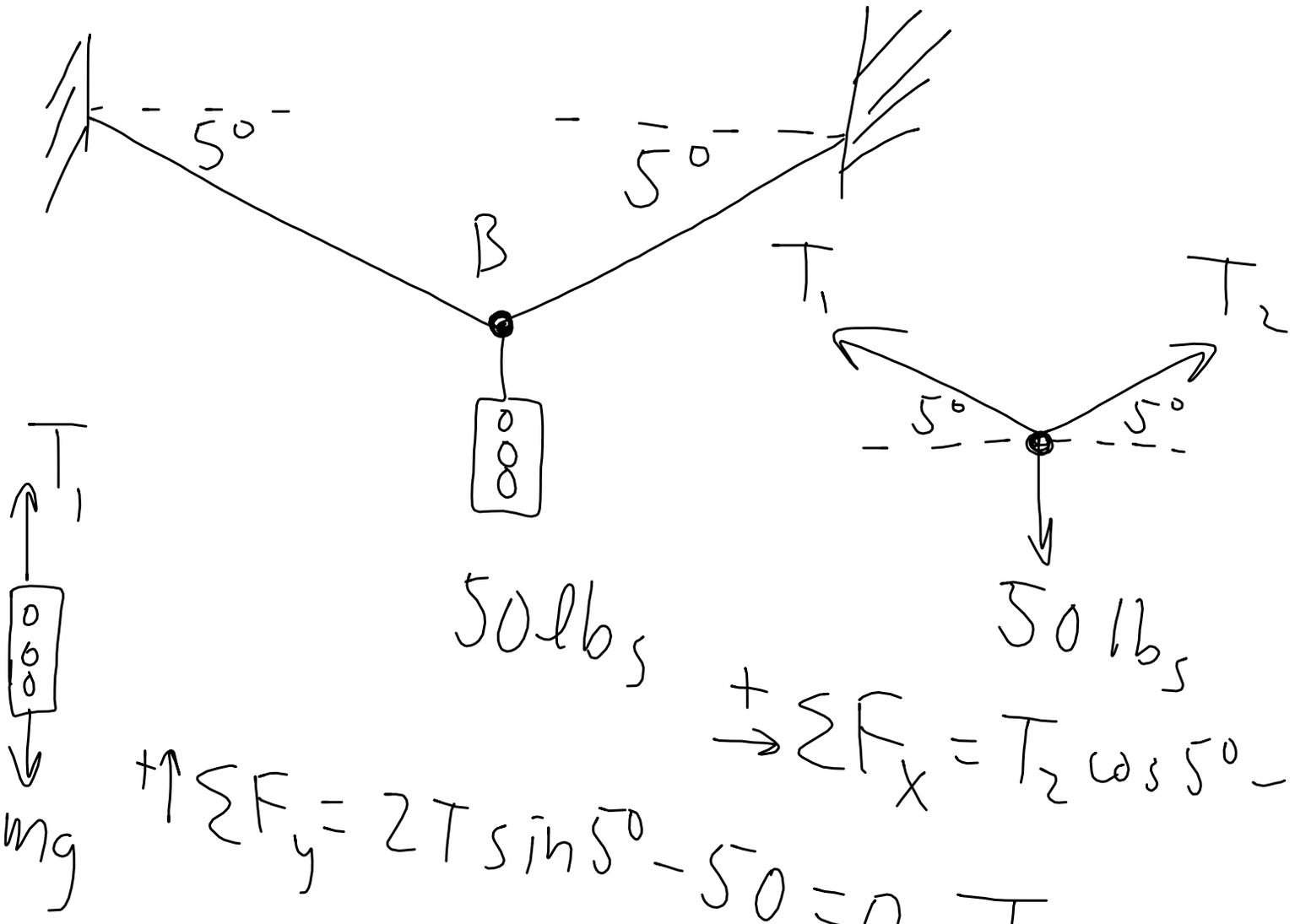
Ch 3 Equil. of a Particle



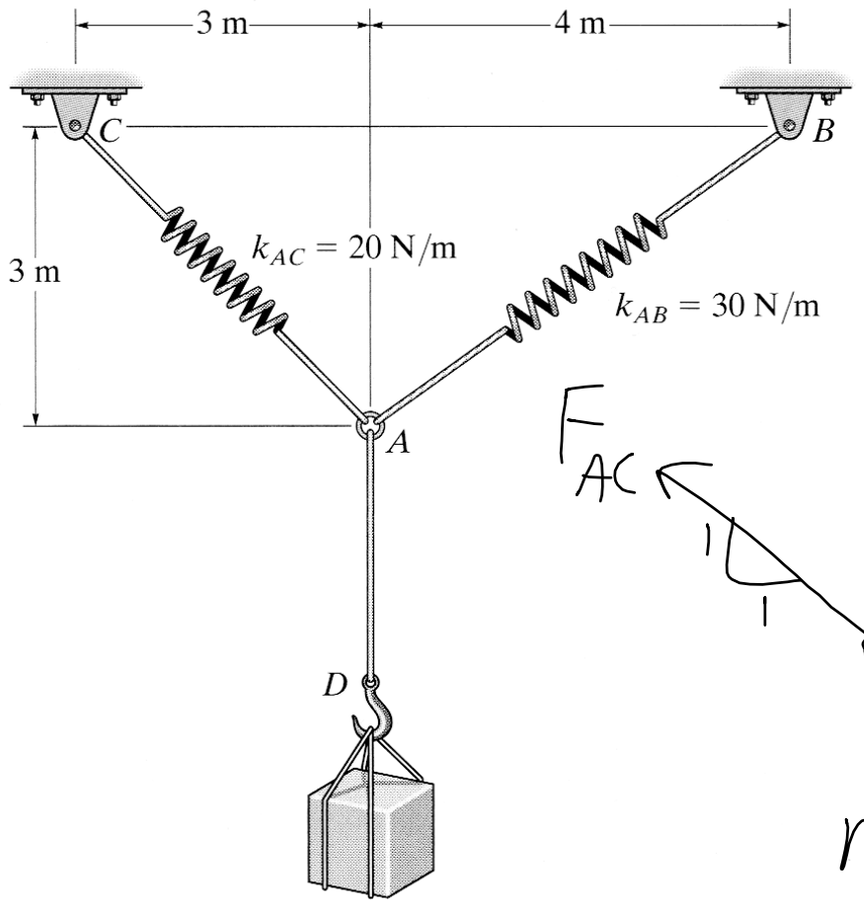
$$\pm \rightarrow \sum F_x = T_2 \cos 5^\circ - T_1 \cos 5^\circ = 0$$

$$+\uparrow \sum F_y = 2T \sin 5^\circ - 50 = 0$$

$$T_1 = T_2$$

$$T = 287 \text{ lbs}$$

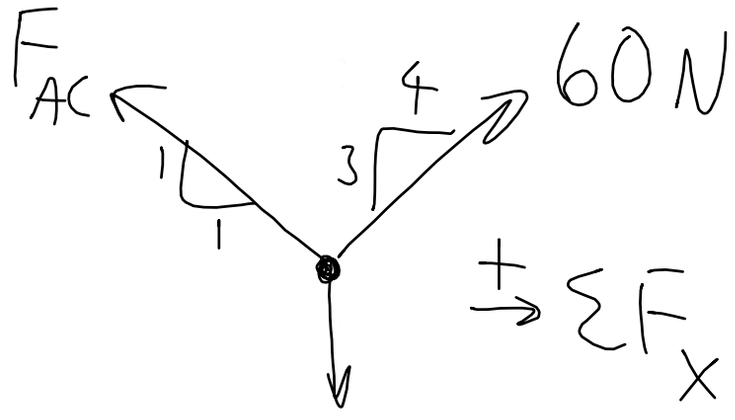
3–15. The unstretched length of spring AB is 3 m. If the block is held in the equilibrium position shown, determine the mass of the block at D.



Probs. 3–14/15

$$F_{AB} = k_{AB}\,\Delta s_{AB}$$

$$= (30)(2) = 60\text{N}$$



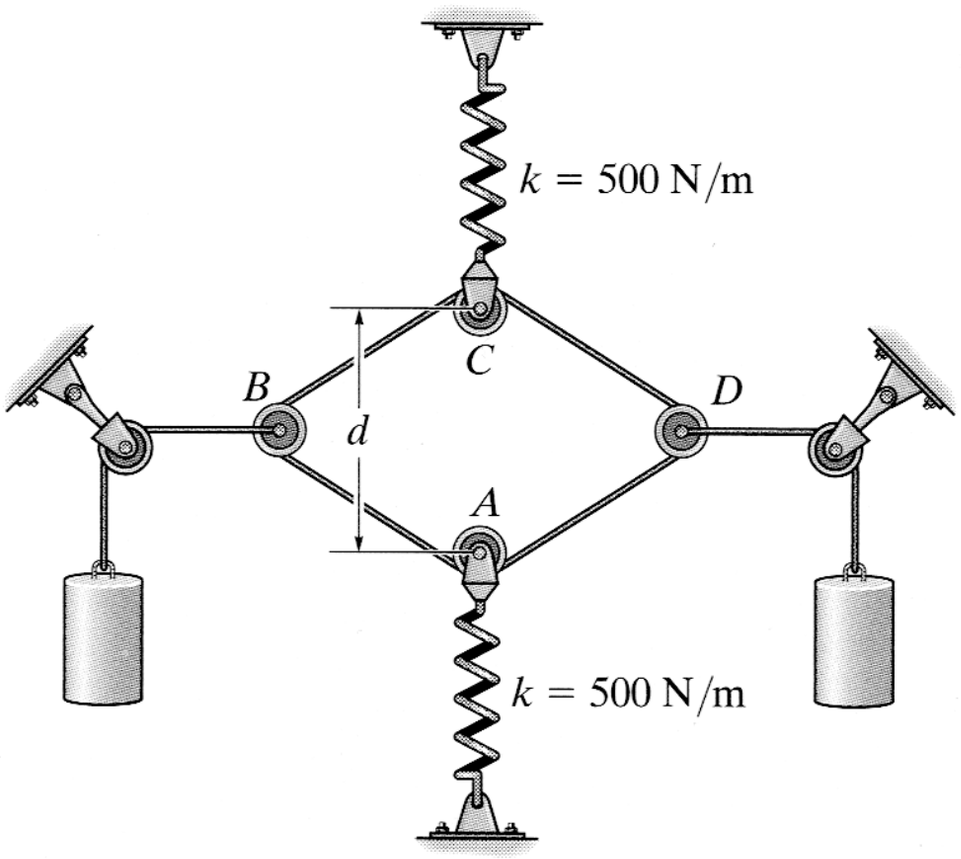
$$\pm\rightarrow \Sigma F_x = 60\left(\frac{4}{5}\right) - \frac{F_{AC}}{\sqrt{2}} = 0$$

$$F_{AC} = 48\sqrt{2}$$

$$+\uparrow \Sigma F_y = \frac{48\sqrt{2}}{\sqrt{2}} + 60\left(\frac{3}{5}\right) - m(9.81) = 0$$

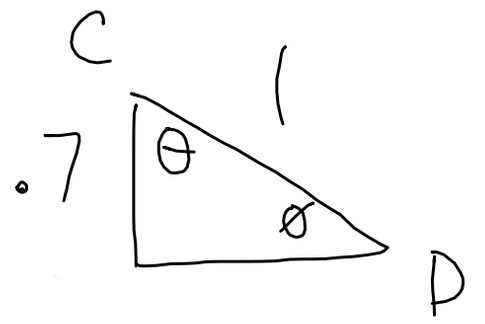
$$m = \frac{84}{9.81}$$

•3–41. A continuous cable of total length 4 m is wrapped around the *small* pulleys at *A*, *B*, *C*, and *D*. If each spring is stretched 300 mm, determine the mass *m* of each block. Neglect the weight of the pulleys and cords. The springs are unstretched when $d = 2$ m.



Prob. 3–41

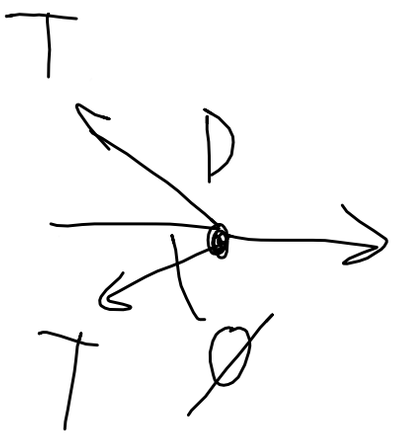
$d = ? = 2 - .3 - .3 = 1.4$ m



$\cos\theta = .7 = \sin\phi$

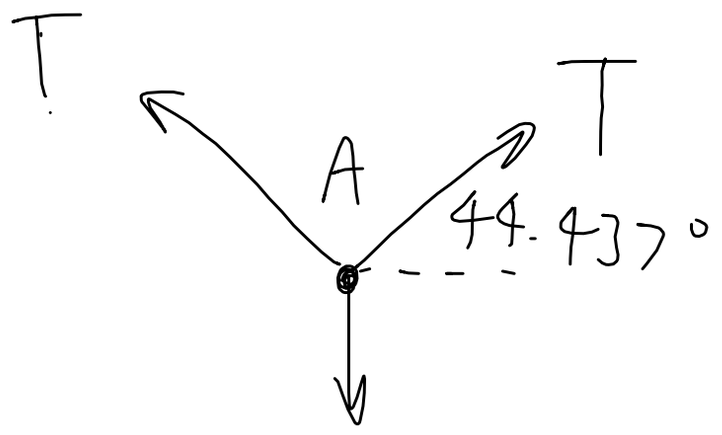
$\phi = \sin^{-1}(.7)$

$= 44.43^\circ$



$$\xrightarrow{+} \sum F_x = mg - 2T\cos\phi = 0$$

$\phi = 44.437°$



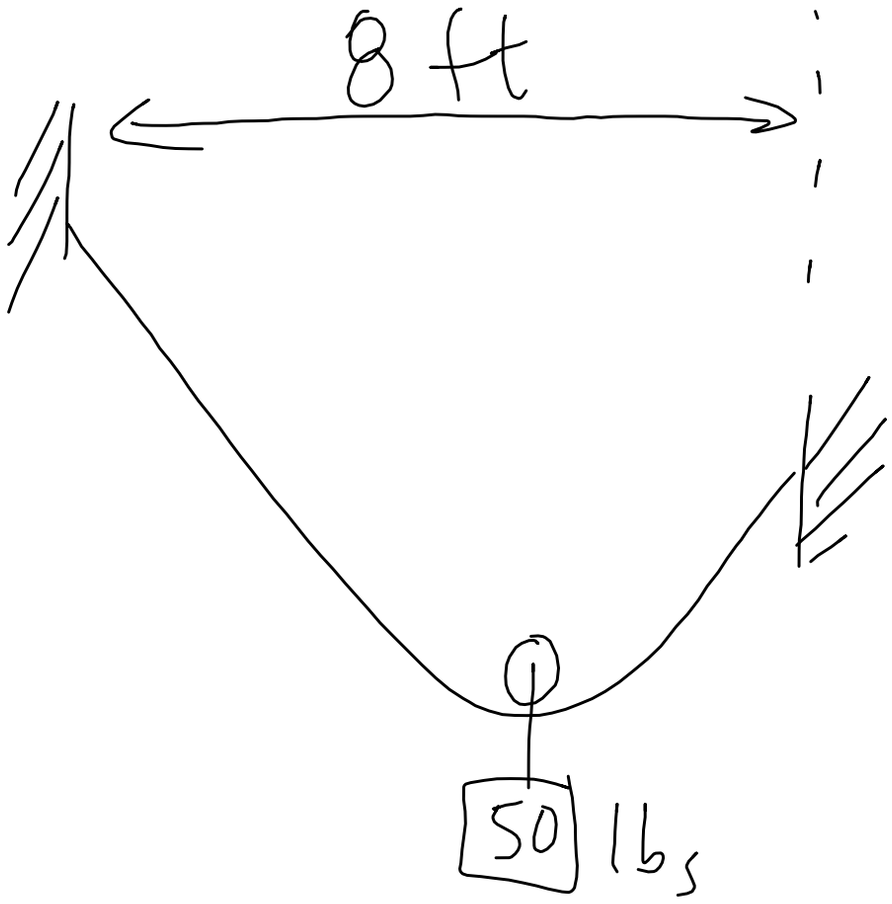
$$500(.3) = 150\,N$$

$$+\uparrow \sum F_y = 2T(\sin 44.437) - 150 = 0$$

$$T = 107.14\,N$$

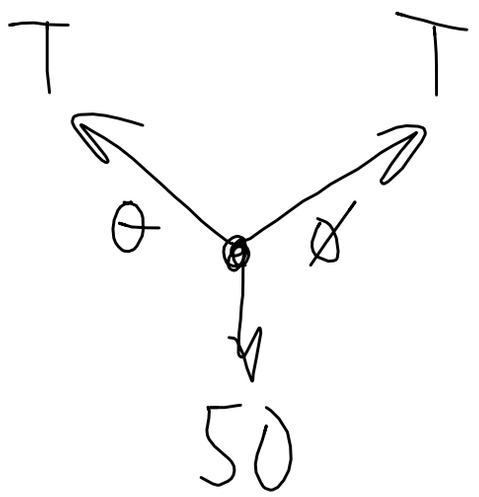
$$m = \frac{2(107.14)\cos(44.437)}{9.81}$$

$$= 15.6\,kg$$

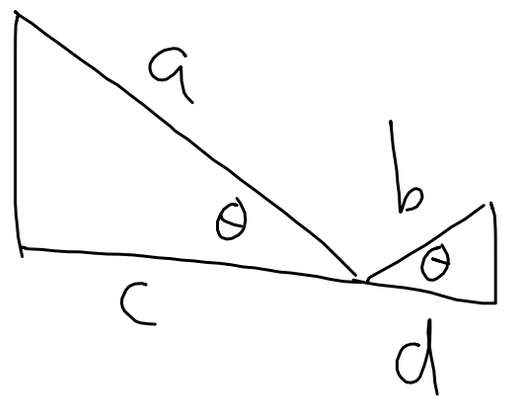


Cable is 10 ft long

T = ?



$\theta = \phi$



$a + b = 10$

$c + d = 8$

$\frac{a}{b} + 1 = \frac{10}{b}$

$\frac{c}{d} + 1 = \frac{8}{d}$

$\frac{a}{b} = \frac{c}{d}$ or $\frac{a}{c} = \frac{b}{d}$

So $\frac{10}{b} = \frac{8}{d}$ $\frac{d}{b} = \frac{8}{10}$

$= \cos\theta$

$$+\uparrow \sum F_y = 2T\sin\theta - 50 = 0$$

$$\theta = \cos^{-1}(.8) \Rightarrow \sin\theta = .6$$

$$T = \frac{50}{2(.6)} = 41.\overline{6} \text{ lbs}$$

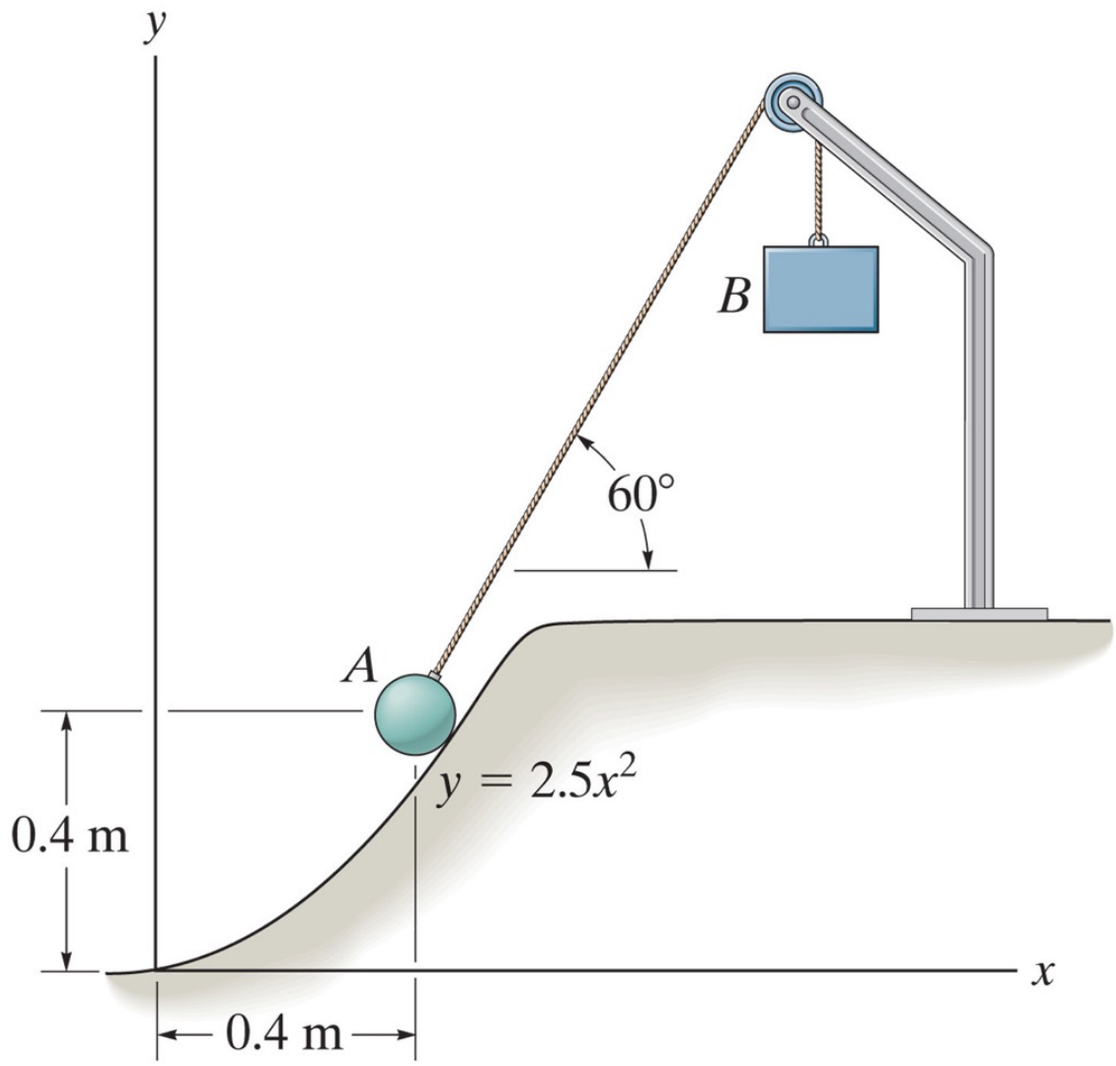


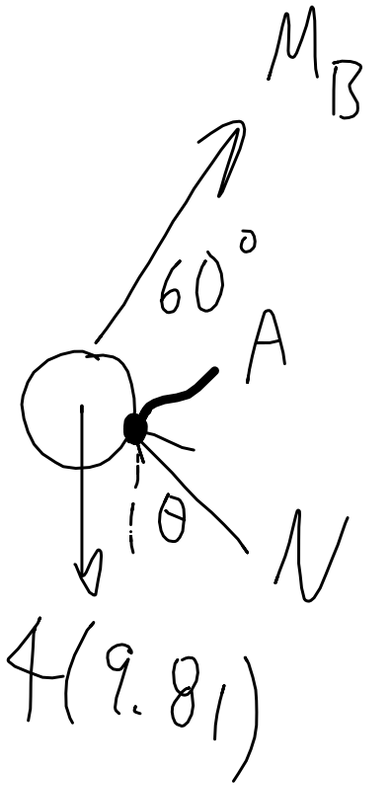
Figure: 03_P030

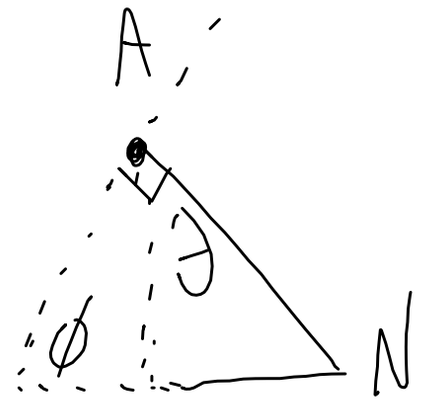
$M_A = 4\ kg$, no friction

Find M_B

$$\left.\frac{dy}{dx}(2.5x^2)\right|_{x=.4} = \tan\phi$$

$$9\tan\theta$$





$$\left.\frac{dy}{dx}\right|_{x=.4} = 2 = \tan\theta \qquad \theta = \tan^{-1} 2$$

$$= 63.43^\circ$$

$$\stackrel{+}{\rightarrow} \Sigma F_x = M_B g \cos 60 - N \sin 63.43 = 0$$

$$+\uparrow \Sigma F_y = M_B g \sin 60 + N \cos 63.43 - 4(9.81) = 0$$

$$M_B = 4.87 \text{ kg}$$