

Física A para Engenharia Ambiental - 2020

# Vídeo-aula 5 – Leis de Newton (2)

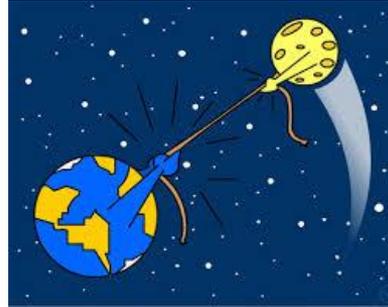
Prof. Dr. Marcos de Oliveira Junior



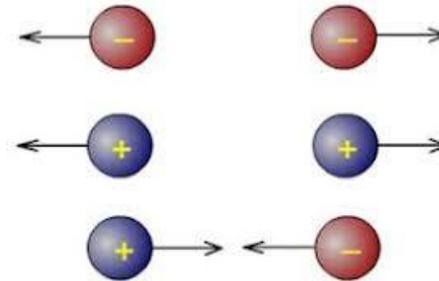
**IFSC** UNIVERSIDADE  
DE SÃO PAULO  
Instituto de Física de São Carlos

# Forças fundamentais

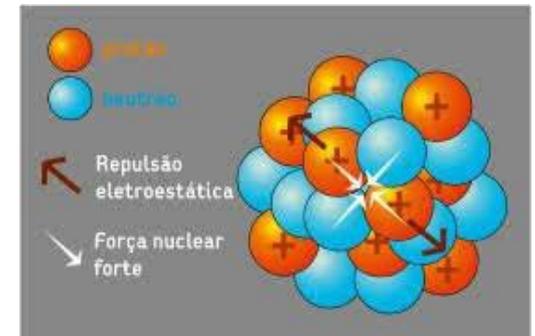
- Força gravitacional;



- Força eletromagnética;



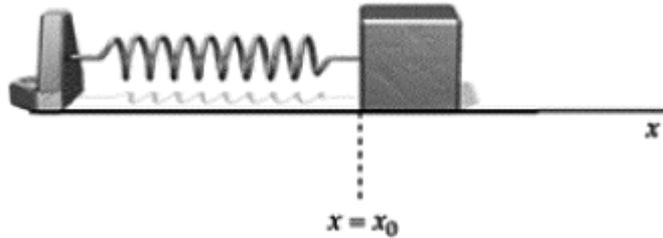
- Força nuclear forte (ou força harônica);



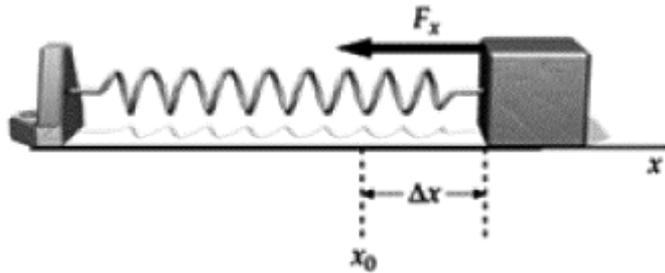
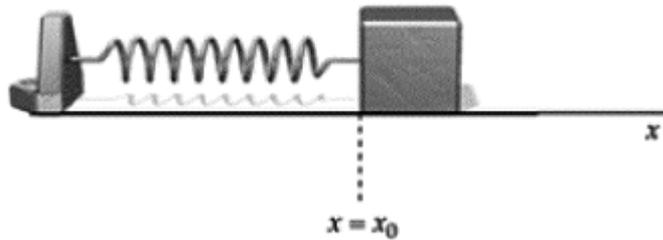
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# Sistema massa-mola (Força restauradora)

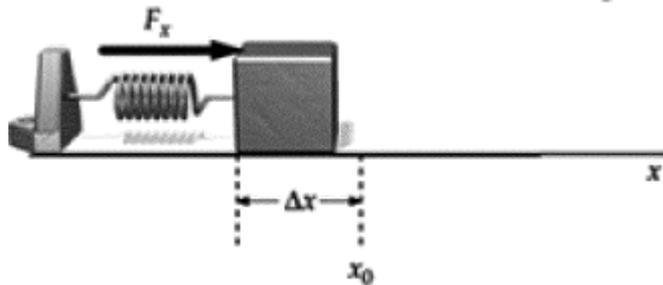
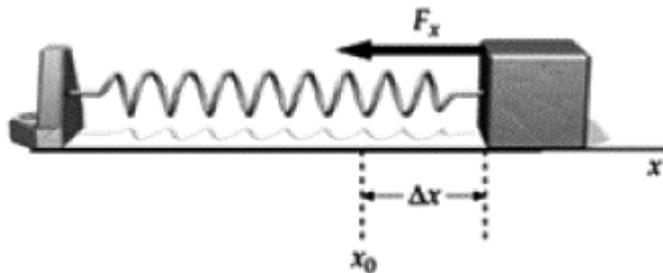
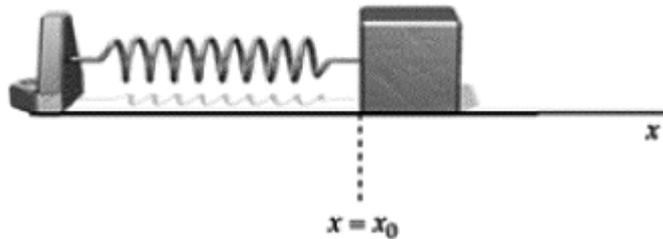


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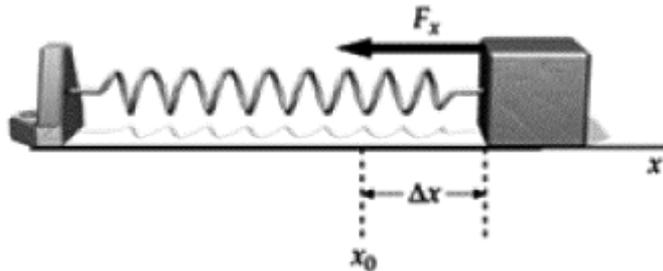
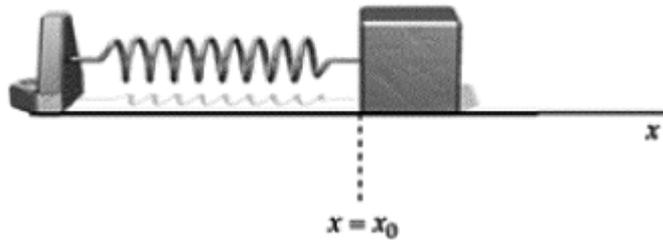
$$F_x = -k(x - x_0) = -k\Delta x$$

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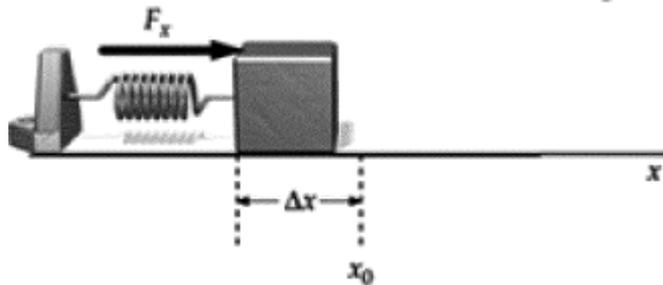


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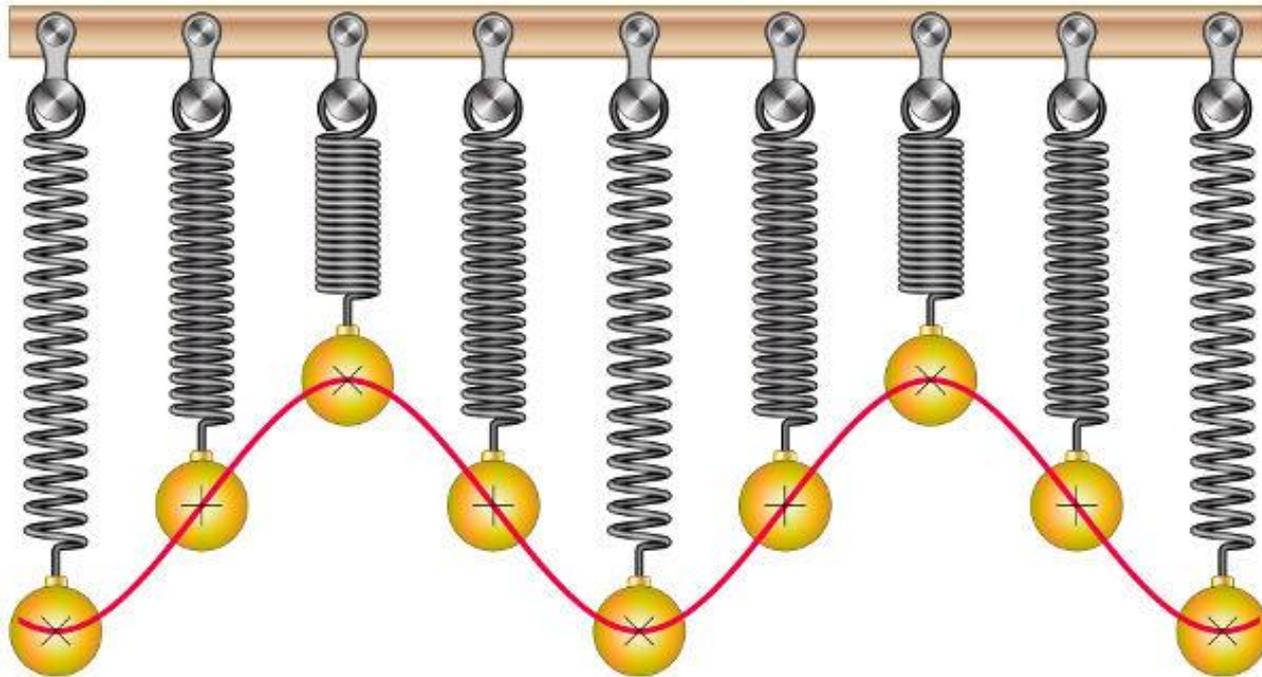
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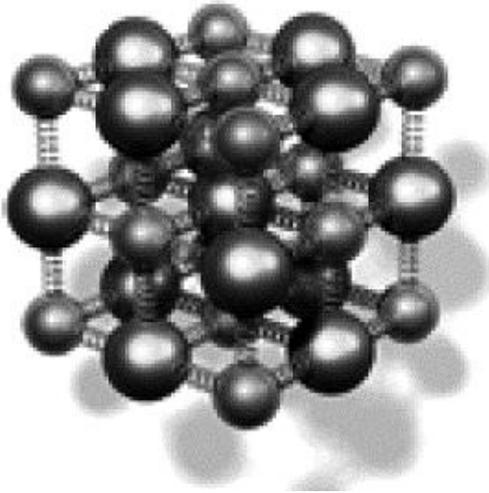
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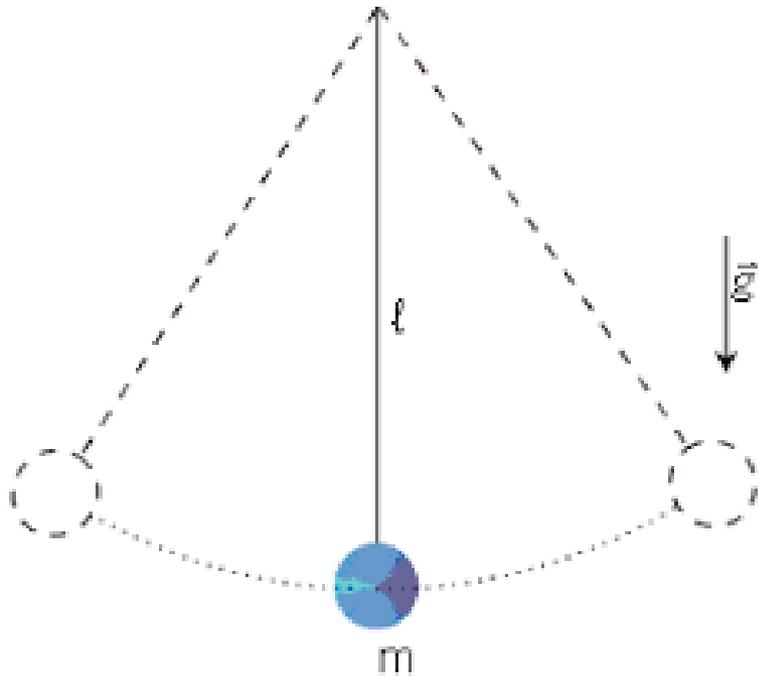
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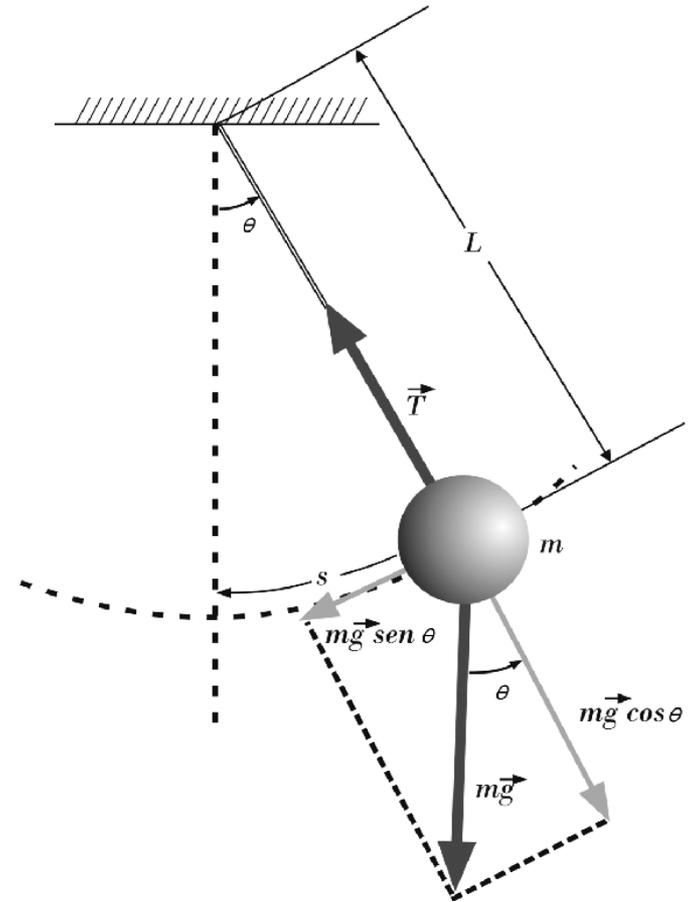
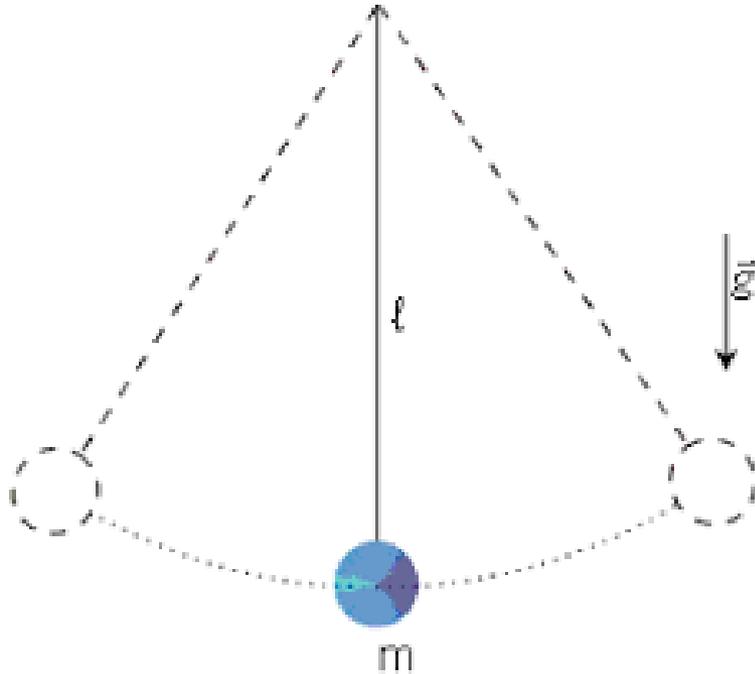
# Oscilador harmônico



# Pêndulo simples



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# Exemplo

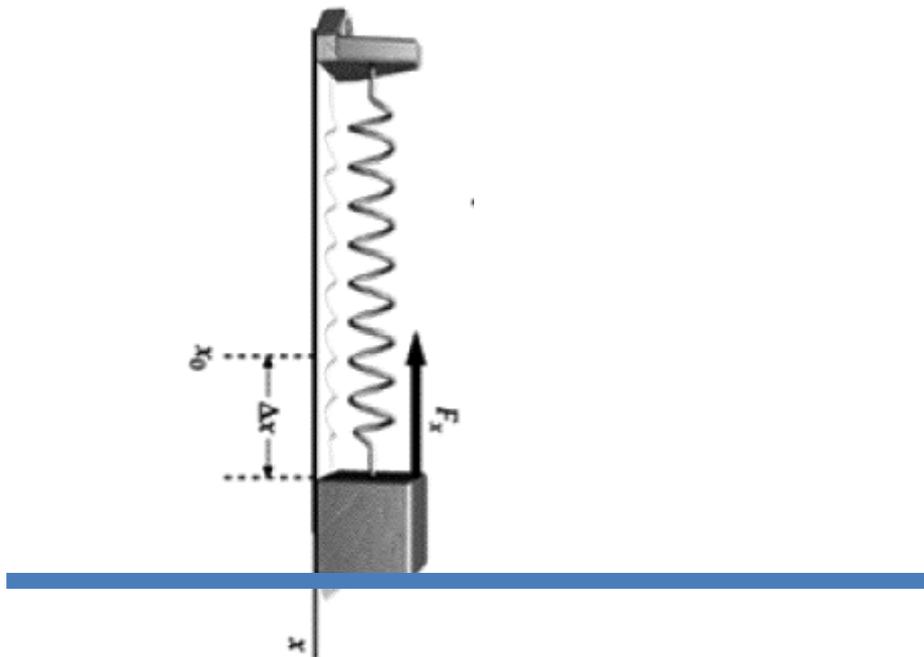
Uma mola vertical, com constante de mola de  $600 \text{ N/m}$ , está pendurada por uma ponta no teto de uma sala, e tem na outra ponta uma massa de  $12 \text{ kg}$  que repousa sobre uma mesa horizontal. A mola está esticada de  $10 \text{ cm}$ .

- a) Qual a força exercida pela massa sobre a mesa?
- b) Que força a superfície da mesa exerce sobre o corpo?

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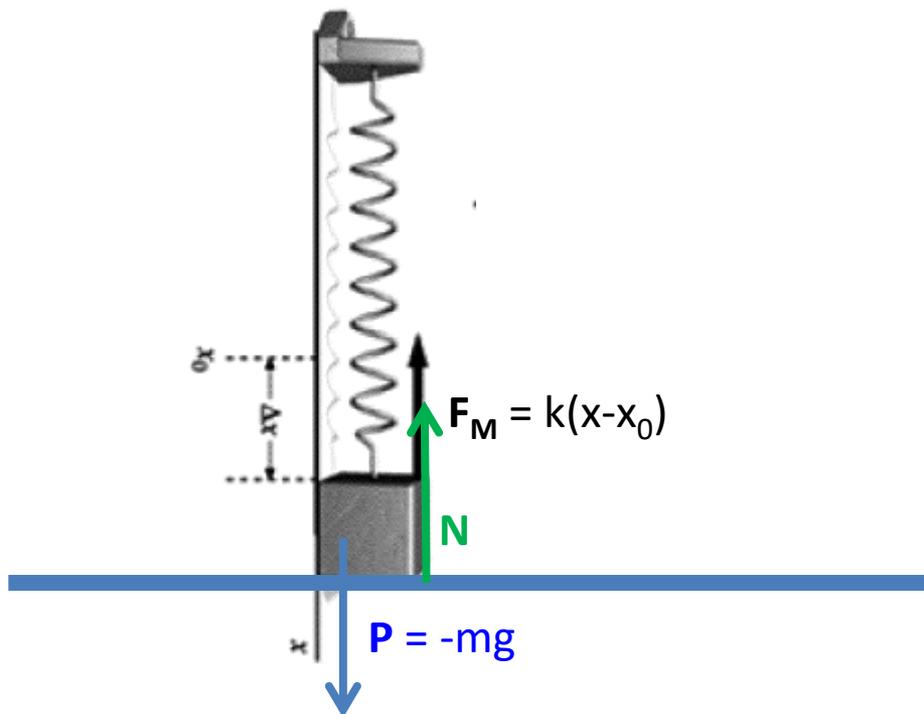
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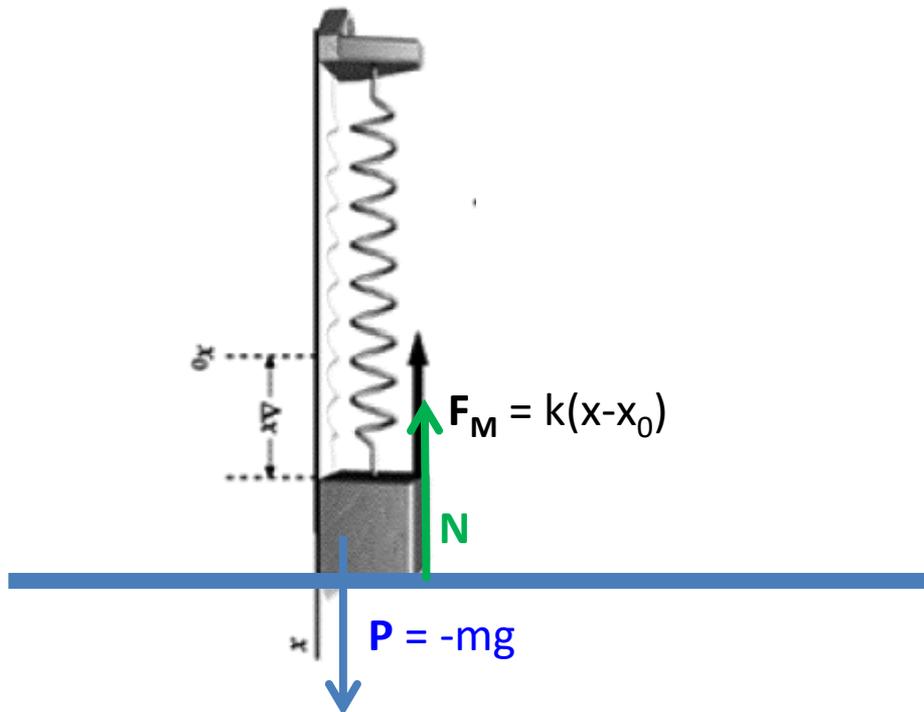
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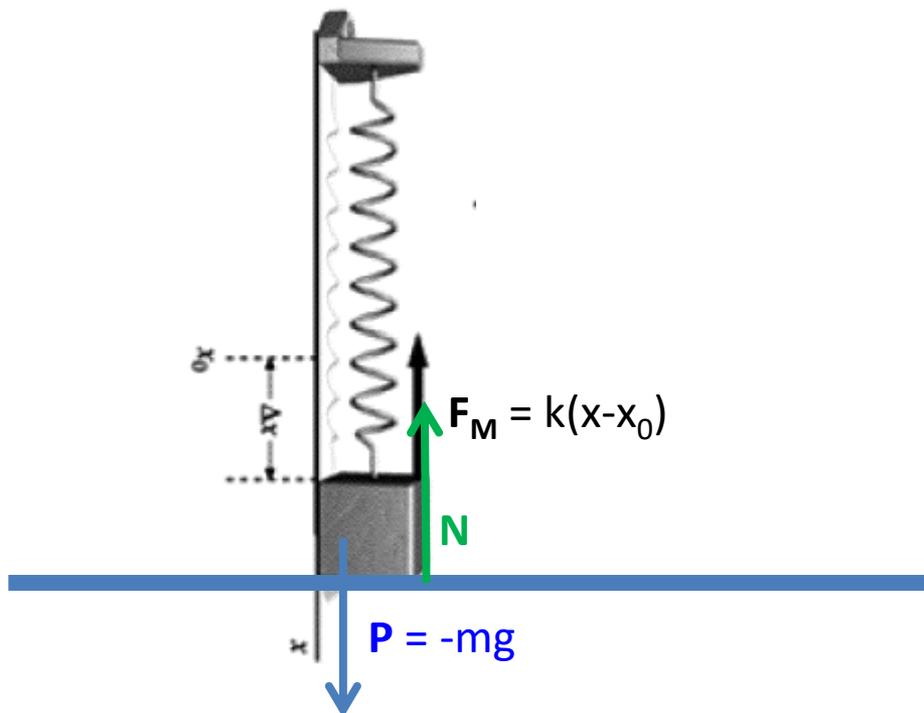
$$P = N + F_M$$

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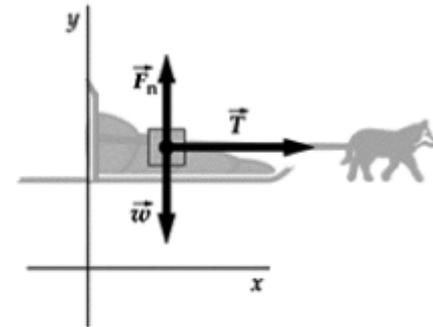
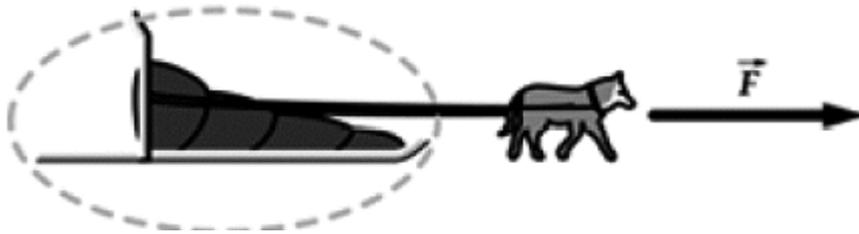
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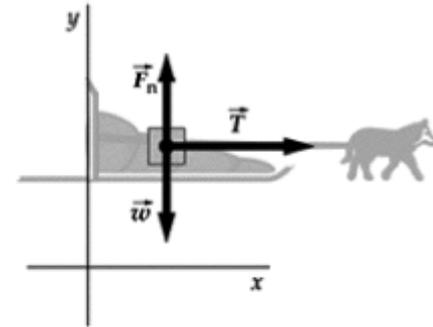
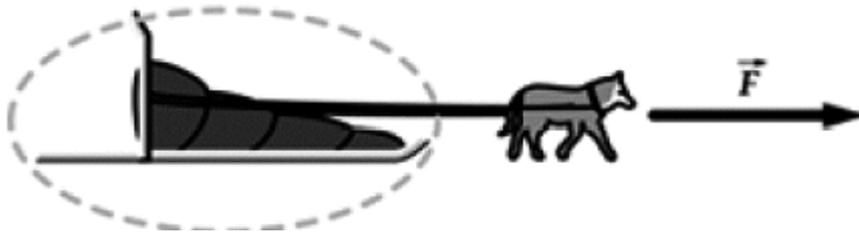
$$N = 12 \times 9,8 - 600 \times 0,10$$

$$N = 57,6 \text{ N}$$

# Dicas para resolução de problemas



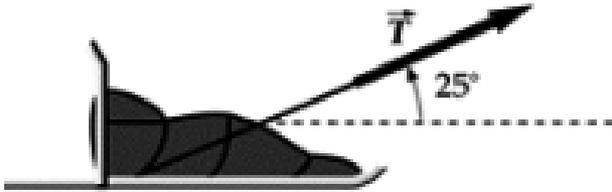
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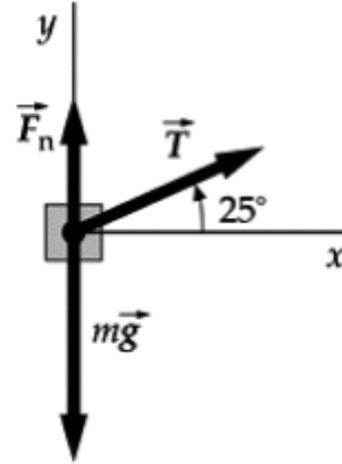
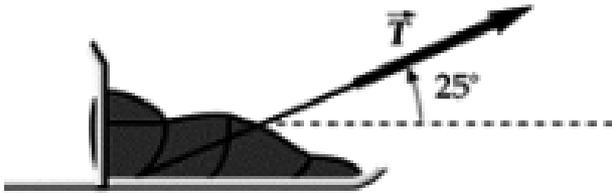
$$\sum F_y = 0 \quad \Rightarrow \quad F_n = w$$

$$\sum F_x = ma_x \quad \Rightarrow \quad a_x = \frac{T}{m}$$

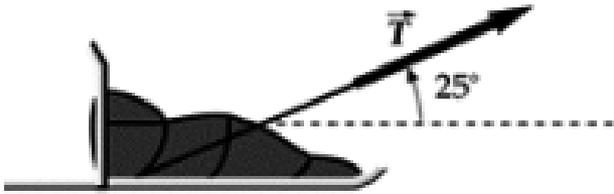
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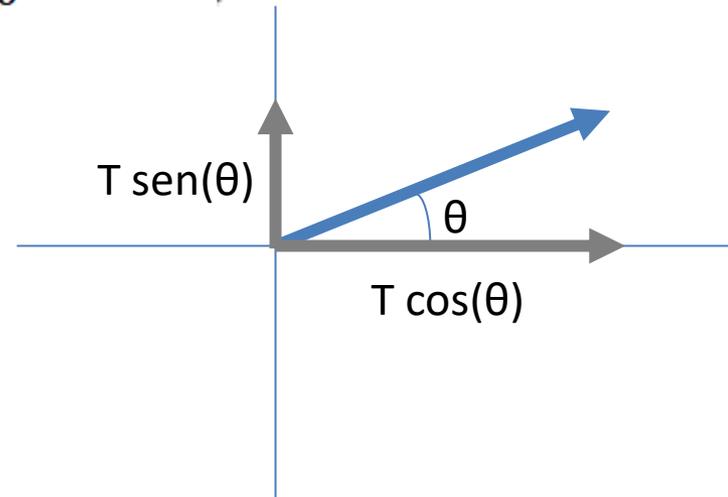
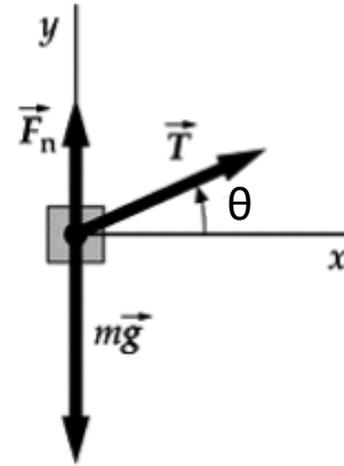
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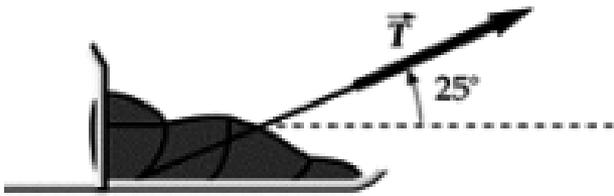
# Dicas para resolução de problemas



$$\sum F_y = 0 \quad \longrightarrow \quad F_n + T \text{sen}(\theta) - w = 0$$



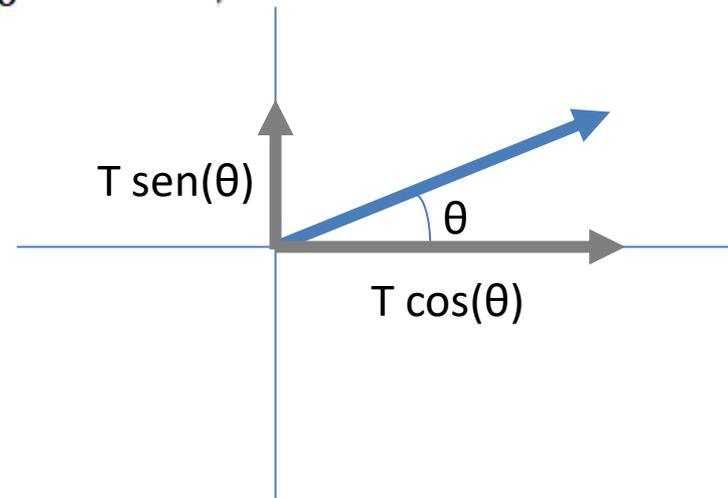
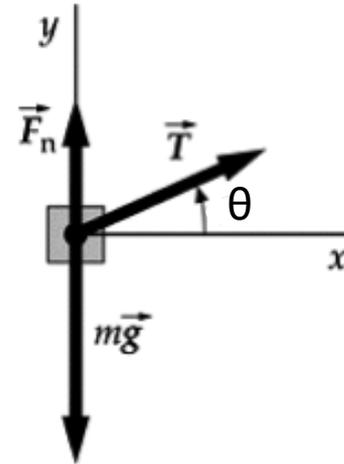
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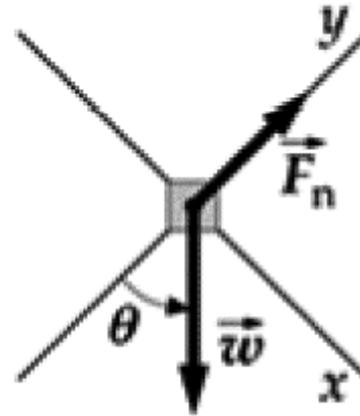
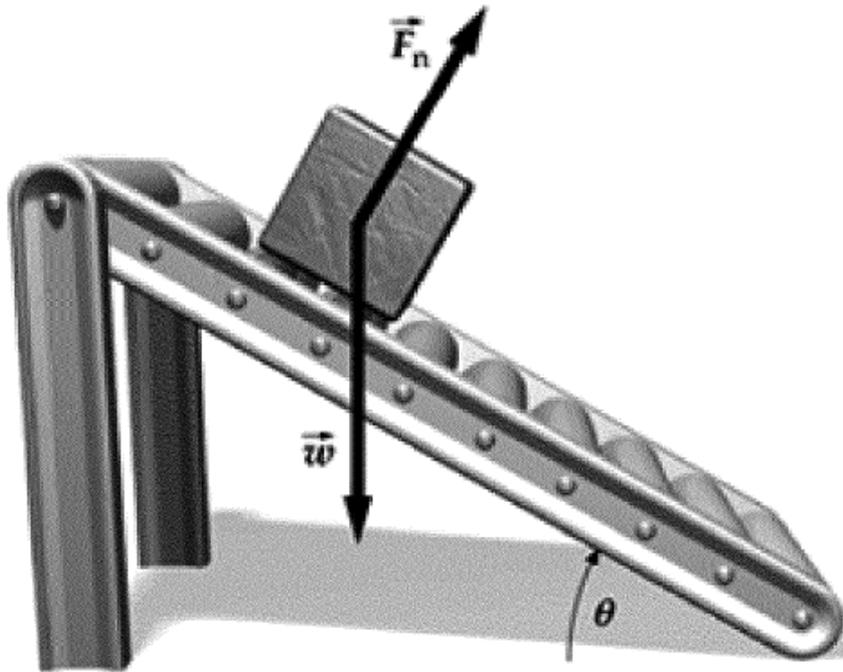
$$\sum F_y = 0 \quad \longrightarrow \quad F_n + T \sin(\theta) - w = 0$$

$$\sum F_x = ma_x \quad \longrightarrow \quad T \cos(\theta) = ma_x$$

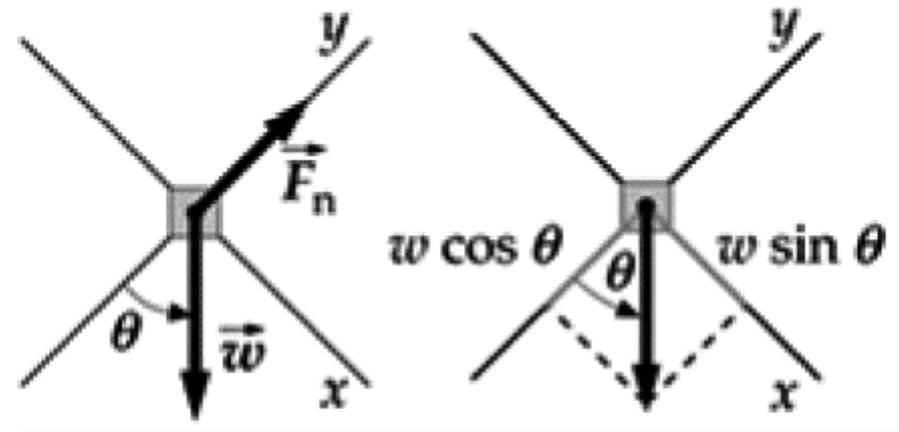
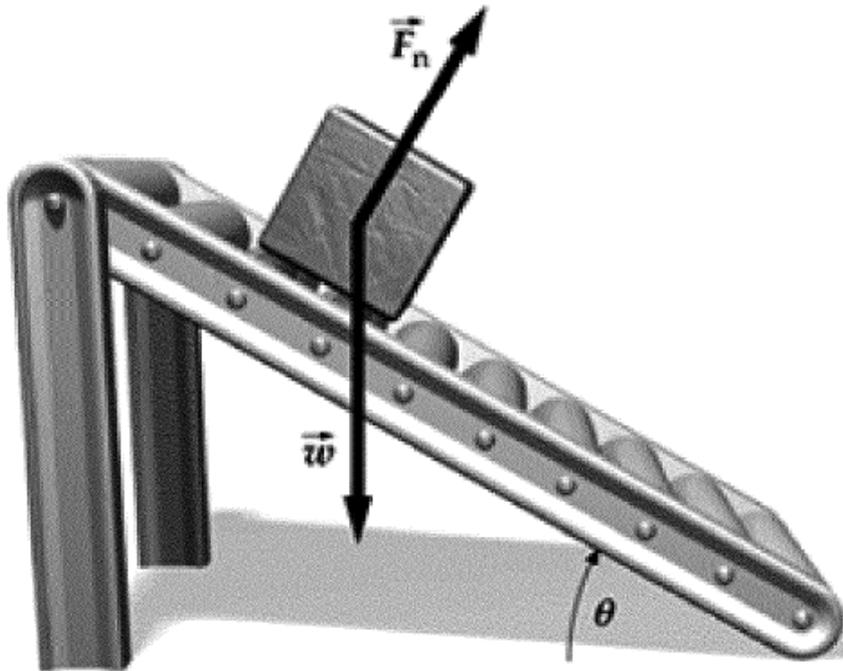
$$a_x = \frac{T \cos(\theta)}{m}$$



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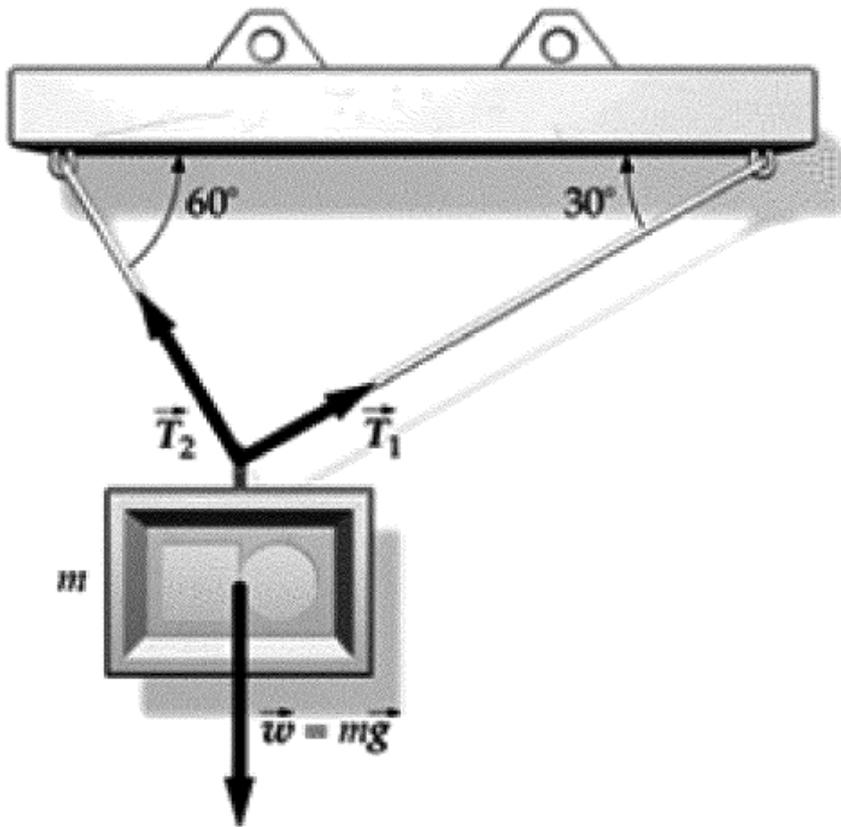


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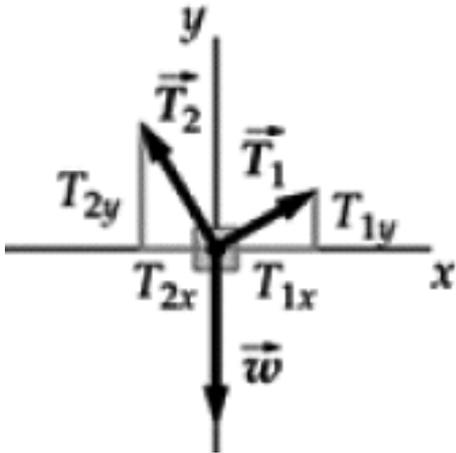
# Exemplo

Quadrado pesando 8 N. Calcular as tensões  $T_1$  e  $T_2$ .



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$$\sum \vec{F} = \vec{T}_1 + \vec{T}_2 + \vec{w} = m\vec{a} = 0$$

$$\sum F_x = T_1 \cos 30^\circ - T_2 \cos 60^\circ = 0$$

$$\sum F_y = T_1 \sin 30^\circ + T_2 \sin 60^\circ - mg$$

$$T_2 = T_1 \frac{\cos 30^\circ}{\cos 60^\circ} = T_1 \sqrt{3}$$

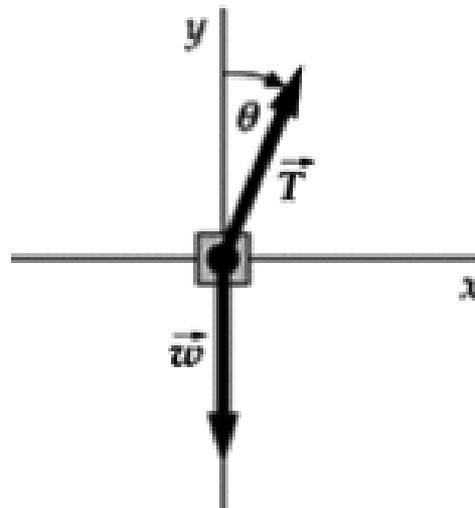
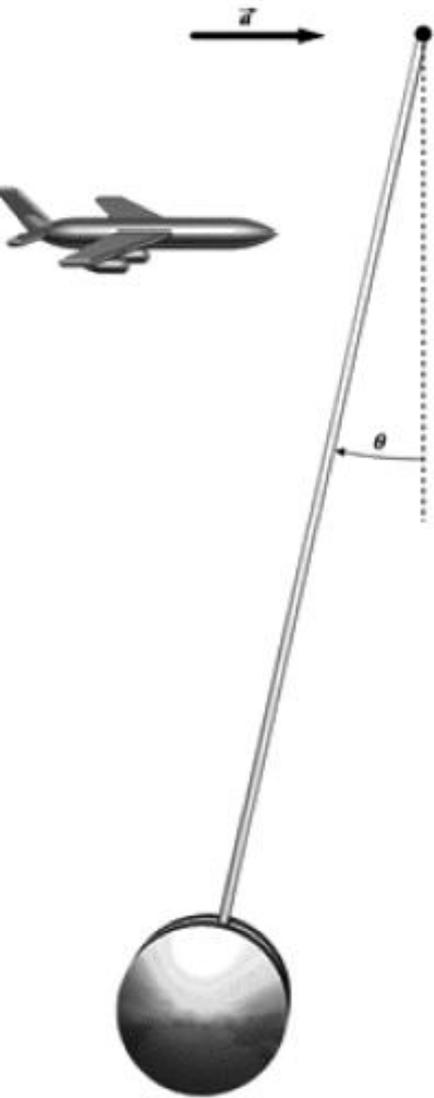
$$T_1 \sin 30^\circ + (T_1 \sqrt{3}) \sin 60^\circ - mg = 0$$

$$T_1 = \frac{1}{2} mg = 4 \text{ N}$$

$$T_2 = \sqrt{3} T_1 = \frac{\sqrt{3}}{2} mg = 6.93 \text{ N}$$

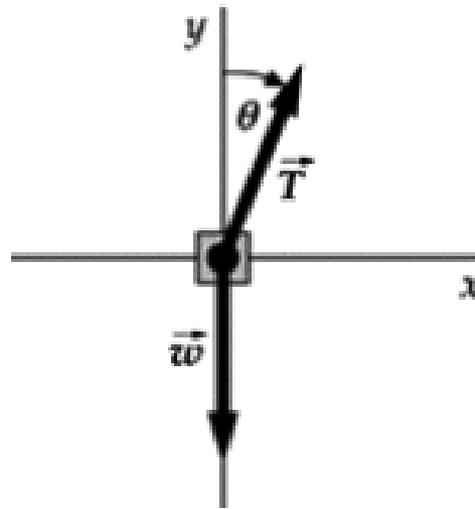
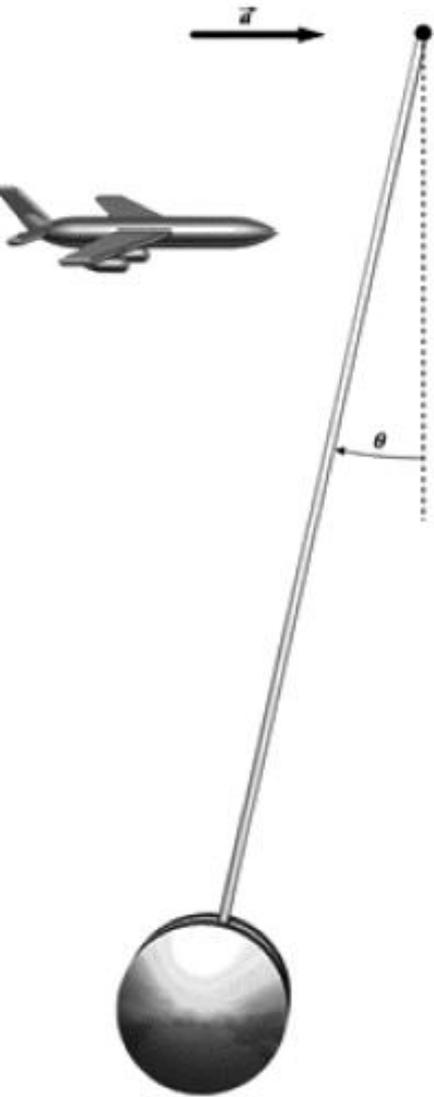
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Determinar aceleração de um avião usando um pêndulo.  
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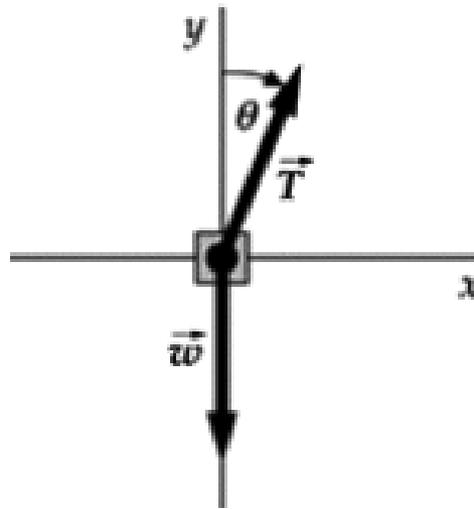
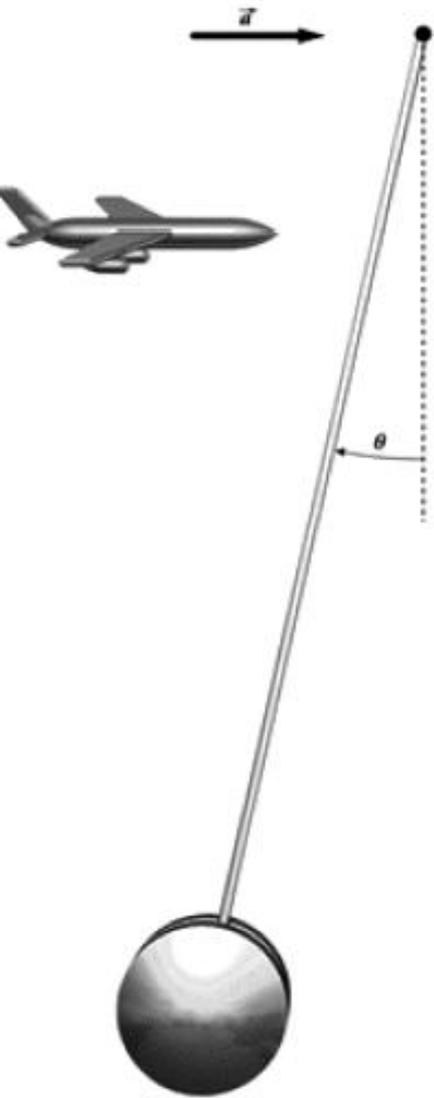


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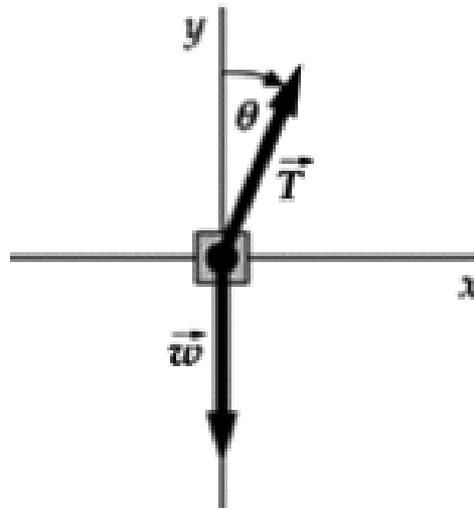
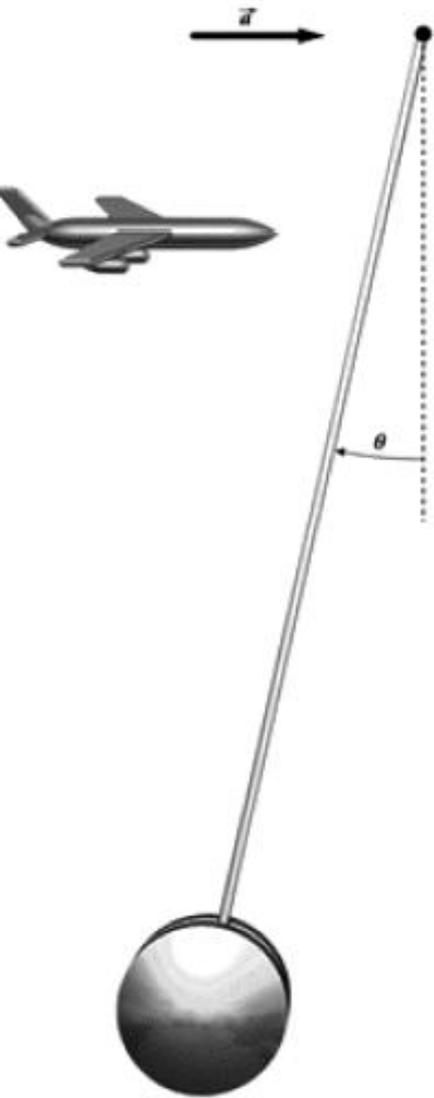
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$$\frac{T \sin(\theta)}{T \cos(\theta)} = \frac{ma_x}{mg}$$

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$$\frac{T \sin(\theta)}{T \cos(\theta)} = \frac{ma_x}{mg}$$

$$a_x = g \tan \theta = 3,96 \text{ m/s}^2$$

# Exemplo

**54 •** The system shown in Figure 4-33 is in equilibrium. It follows that the mass  $m$  is

- (a) 3.5 kg.
- (b)  $3.5 \sin 40^\circ$  kg.
- (c)  $3.5 \tan 40^\circ$  kg.
- (d) none of the above.

**Figure 4-33**  
Problem 54

