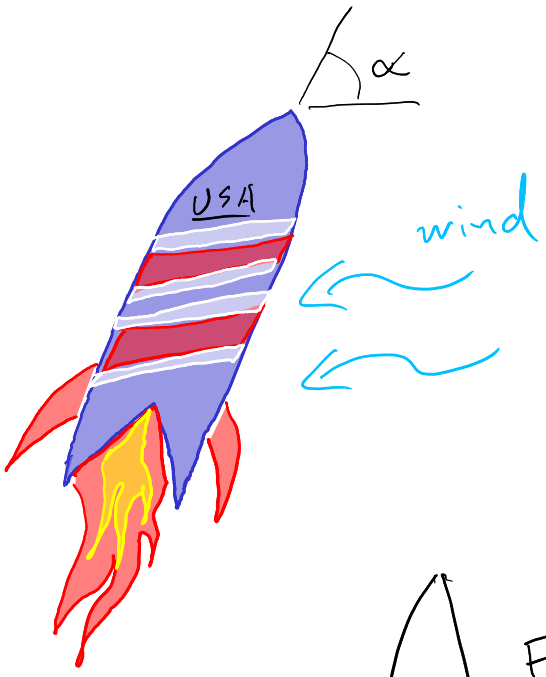
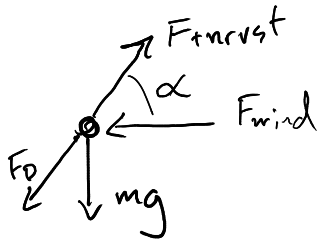
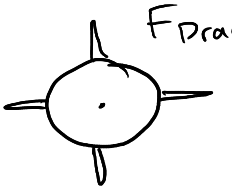


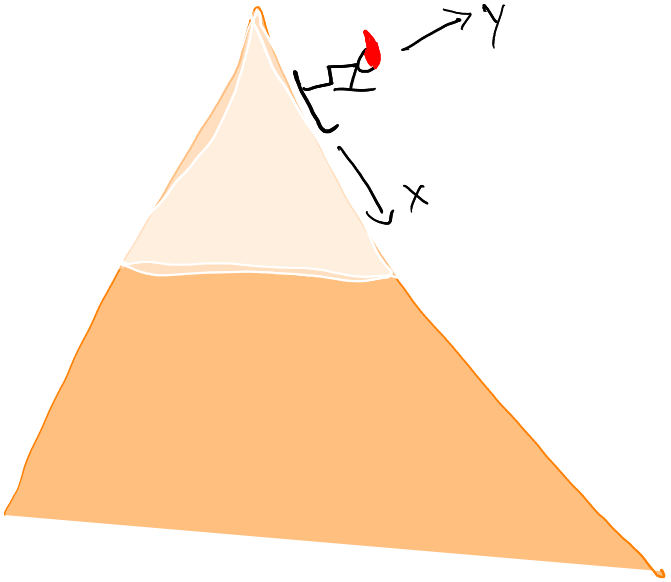

FBD

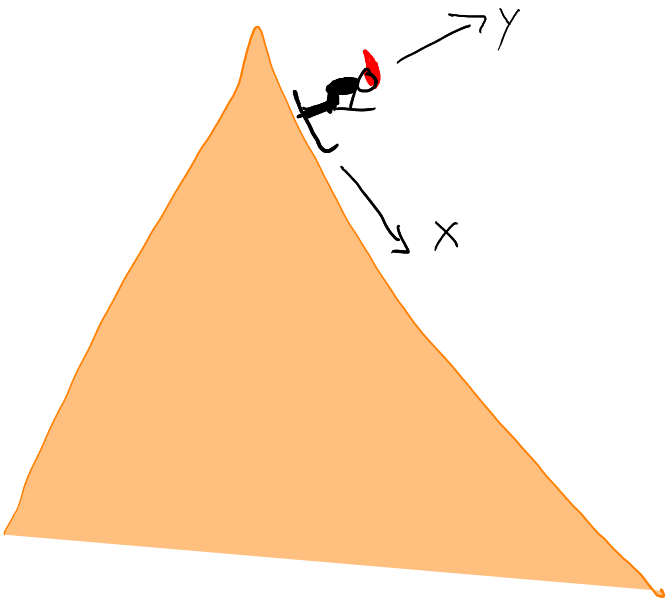



$F_{wind}$ x-section



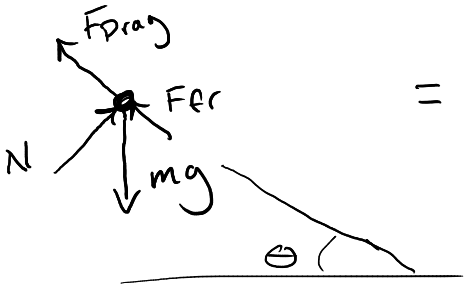

x-section




FBD

KD

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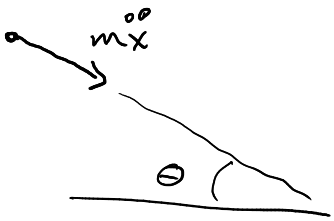
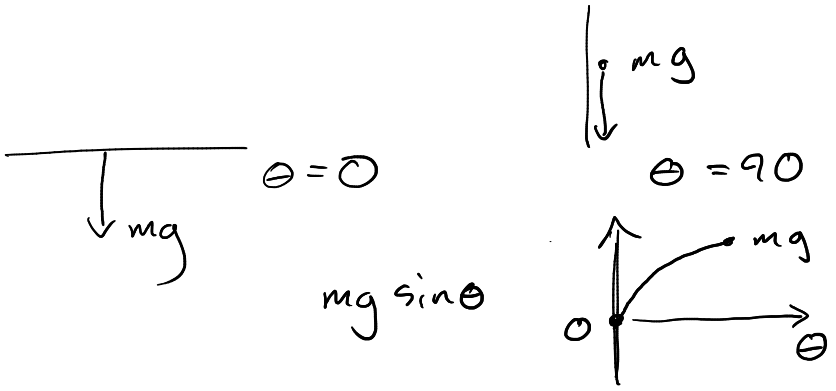


$$\text{Find } x\text{-axis forces} \begin{bmatrix} -F_{Drag} - F_{fr} \\ +mg\sin\theta \end{bmatrix} = m\frac{d^2x}{dt^2} = m\ddot{x}$$

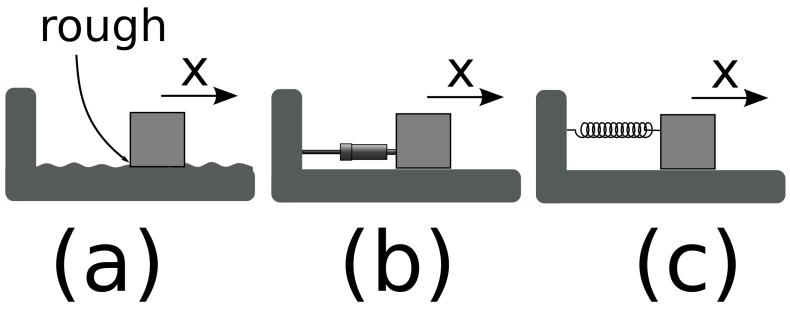



$$mg\sin\theta - \tfrac{1}{2}C_D A\rho\,\dot{x}^2 - \mu mg\cos\theta = m\ddot{x}$$

| case 1 | case 2 |
|---|---|
| $m = 50kg$ | $m = 100kg$ |

$$\ddot{x}_1 = \ddot{x}_2 \quad \text{if} \quad C_D = 0$$
$$\ddot{x}_1 = \ddot{x}_2 \quad \text{if} \quad v = 0$$
$$\ddot{x}_1 < \ddot{x}_2 \quad \text{if} \quad C_D > 0$$

$$g\sin\theta - \frac{\tfrac{1}{2}C_D\rho A\,\dot{x}^2}{m} - \mu g\cos\theta = \ddot{x}$$




(a)

FBD


KD


(b)

FBD

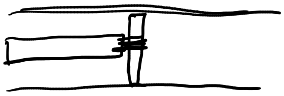

KD

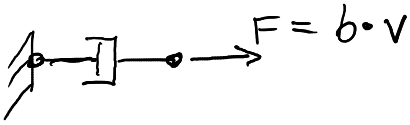

(c)

FBD


KD

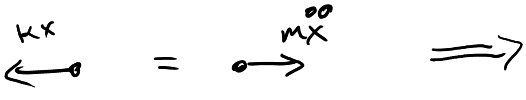

(b)






$$[N] = \left[\frac{kg\,m}{s^2}\right] = \left[\frac{kg}{s}\right]\left[\frac{m}{s}\right]$$

(c)




$$\Longrightarrow \quad -kx = m\ddot{x}$$

$$\ddot{x} = \frac{-k}{m}x$$

$a = -\frac{k}{m}x$ $\quad a \neq cst$

⊘

~~$x = x_0 + \dot{x}_0 t - \frac{k}{m}x\frac{t^2}{2}$~~

$\ddot{x} = -\frac{k}{m}x$

$x(t) = A\cos\omega t + B\sin\omega t$

$\ddot{x}(t) = -\omega^2(A\cos\omega t + B\sin\omega t)$

$-\omega^2(A\cos\omega t + B\sin\omega t) = -\frac{k}{m}(A\cos\omega t + B\sin\omega t)$

$\omega^2 = \frac{k}{m} \quad \omega = \sqrt{\frac{k}{m}}$ ≡ natural frequency

$x(0) = 0 = A$

$\dot{x}(0) = 10 = B\sqrt{\frac{k}{m}}$

$x(t) = \sqrt{\frac{m}{k}} \cdot 10 \sin\sqrt{\frac{k}{m}}t$