Force at Angle Example

- A person is pushing a 15 kg block across a floor with $\mu_k = 0.4$ at a constant speed. If she is pushing down at an angle of 25 degrees, what is the magnitude of her force on the block?

x- direction: $\Sigma F_x = ma_x$

$F_{push}\cos(\theta) - F_{friction} = 0$

$F_{push}\cos(\theta) - \mu F_{Normal} = 0$

$F_{Normal} = F_{push}\cos(\theta) / \mu$

y- direction: $\Sigma F_y = ma_y$

$F_{Normal} - F_{weight} - F_{Push}\sin(\theta) = 0$

$F_{Normal} - mg - F_{Push}\sin(\theta) = 0$

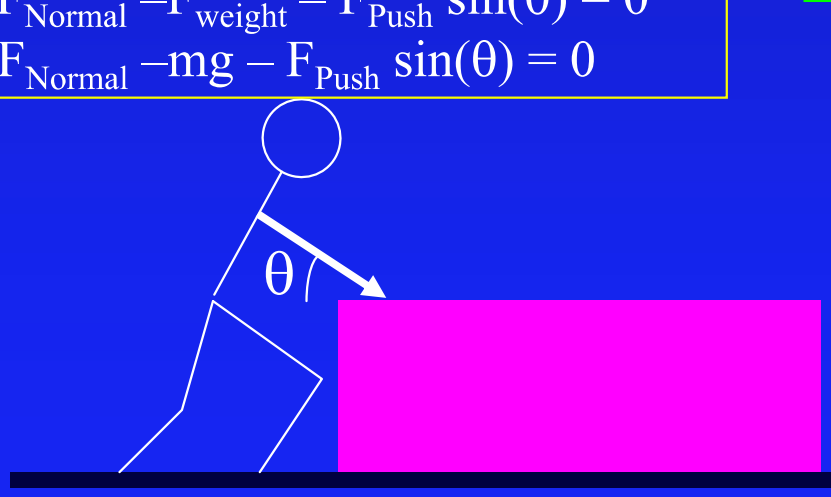
Combine:

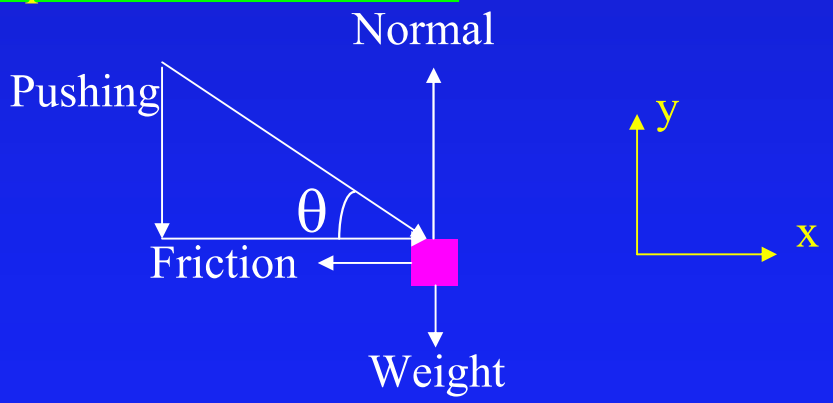
$F_{push}\cos(\theta) / \mu - mg - F_{Push}\sin(\theta) = 0$

$F_{push}(\cos(\theta) / \mu - \sin(\theta)) = mg$

$F_{push} = m\,g / (\cos(\theta)/\mu - \sin(\theta))$

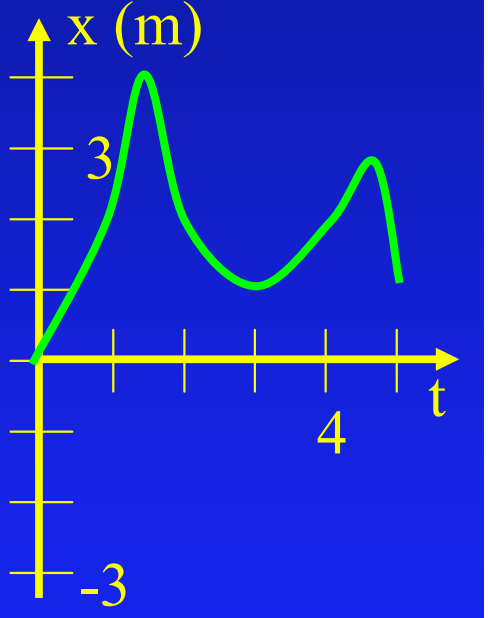
$F_{push} = 80$ N





Position vs Time Plots

- Gives location at any time.
- Displacement is change in position.
- Slope gives instantaneous velocity.



Position at t=3, x(3) = 1

Displacement between t=5 and t=1. Δx = -1.0 m

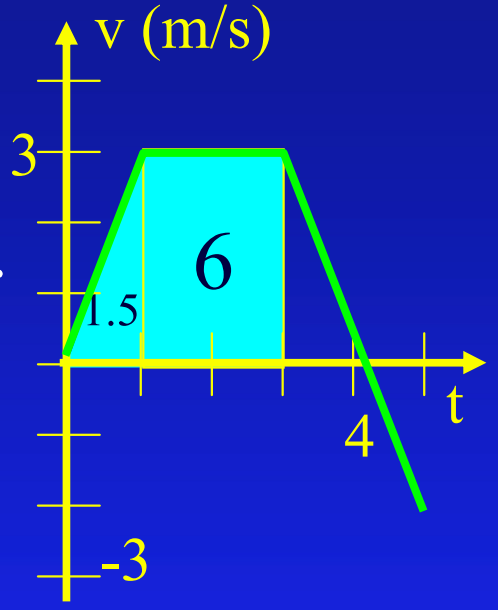
1.0 m - 2.0 m = -1.0 m

Average velocity between t=5 and t=1. v = -0.25 m/s

-1 m / 4 s = -0.25 m/s

Velocity vs Time Plots

- Gives velocity at any time.
- Area gives displacement
- Slope gives instantaneous acceleration.



velocity at t=2, v(2) = 3 m/s

Displacement between t=0 and t=3: Δx= 7.5 m

t=0 to t=1: ½ (3m/s) (1 s) = 1.5 m

t=1 to t=3: (3m/s) (2 s) = 6 m

Average velocity between t=0 and t=3? v= 7.5 m / 3s = 2.5 m/s

Change in v between t=5 and t=3. Δv = -2 m/s – 3 m/s = -5 m/s

Average acceleration between t=5 and t=3: a =-5 m/s / (2 s) = -2.5 m/s^2