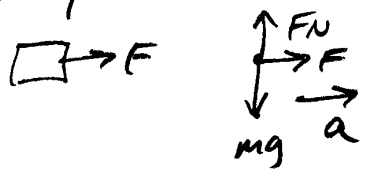
2nd Law problems

No friction

1) simple acceleration

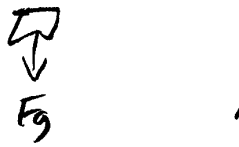


$\Sigma F = ma$

$a = \frac{\Sigma F}{m}$

$\boxed{a = \frac{F}{m}}$

2) Free fall



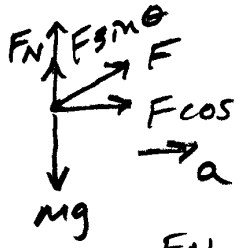
$\Sigma F = ma$

$mg = ma$

$\boxed{a = g}$

3)

Box pulled at angle



$\Sigma F_x = ma_x$

$F\cos\theta = ma_x$

$\boxed{a_x = \frac{F\cos\theta}{m}}$

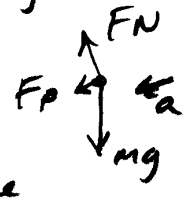
$\Sigma F_y = ma_y = 0$

$F_N + F\sin\theta - mg = 0$

$\boxed{F_N = mg - F\sin\theta}$

4)

inclined plane



$F_p = mg\sin\theta$

$\Sigma F = ma$

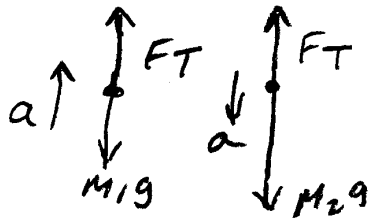
$F_p = ma$

$mg\sin\theta = ma$

$\boxed{a = g\sin\theta}$

5)

need 2 FBDs



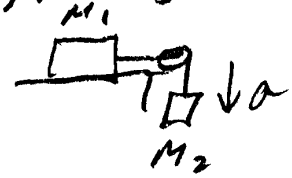
① $F_T - M_1 g = M_1 a$

② $-F_T + M_2 g = M_2 a$

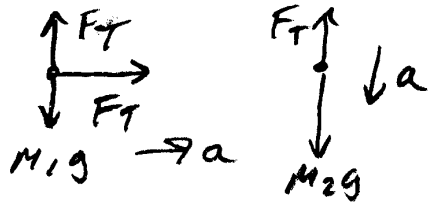
$(M_2 - M_1)g = (M_1 + M_2)a$

$\boxed{a = \frac{(M_2 - M_1)g}{M_1 + M_2}}$

6) pulling object with mass hanging



need 2 FBDs



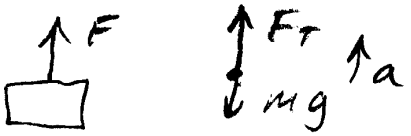
① $F_T = M_1 a$

$-F_T + M_2 g = M_2 a$

$M_2 g = (M_1 + M_2)a$

$\boxed{a = \frac{M_2 g}{M_1 + M_2}}$

7) Elevator problem - Going up!



$\Sigma F = ma$

$F_T - Mg = Ma$

$\boxed{a = \frac{F_T - Mg}{M}}$ OR $F_T = Mg + Ma$

$F_T = M(g + a)$