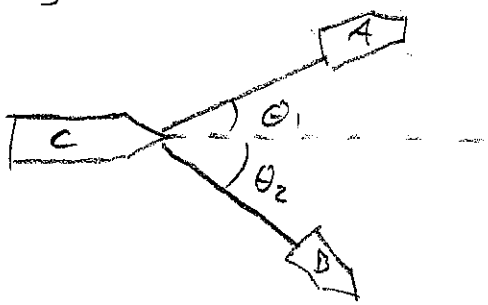
Example

Tug Boats



$\theta_1 = 30°$

$\theta_2 = 45°$

$F_{AC} = 800\,N$

$F_{BC} = 1200\,N$

$m_c = 1000\,kg$

$v_0 = 0$

a) Find a_c

B) After 1 min, find Position

---

a) Newton's 2nd

$$a_c = \frac{F_c}{m_c}$$

Net Force

$$\vec{F}_c = \vec{F}_{AC} + \vec{F}_{BC}$$

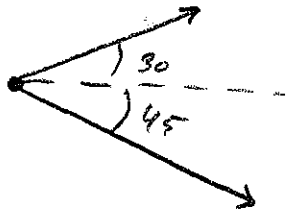
$$F_{cx} = F_{ACx} + F_{BCx}$$

$$= |F_{AC}| \cos\theta_1 + |F_{BC}| \cos(-\theta_2)$$

$$= 800\,N \cos(30) + 1200\,N \cos(-45)$$

$$= 693 + 849 = 1542$$

Free Body



$$F_{cy} = F_{ACy} + F_{BCy}$$

$$= F_{AC}\sin\theta_1 + F_{BC}\sin(-\theta_2)$$

$$= 800\,N \sin(30) + F_{BC}\sin(-45)$$

$$= 400 + (-848) = -449$$

$$|F_c| = \sqrt{F_{cx}^2 + F_{cy}^2} = 1606\,N$$

$$\theta_c = \tan^{-1}\left(\frac{F_{cy}}{F_{cx}}\right) = -16°$$

$$|a_c| = \frac{|F_c|}{m_c} = 1.61\ m/s^2$$

b) $x(t) = \cancel{x_0}^{\,0} + \cancel{v_0 t}^{\,0} + \frac{1}{2}a_c t^2$

$$= \frac{1}{2} a_c t^2$$

$$= \frac{1}{2}(1.6)(60s)^2$$

$$= 2,880\ m$$