Dynamics Notes

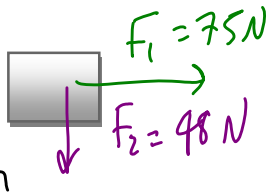
2 – Forces in 2-D

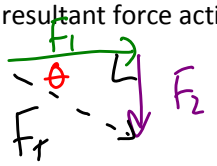
As with any vectors, forces must be resolved with consideration to both their magnitude and direction.

Ex

Two students push a crate across a frictionless surface. Student A pushes with 75 N East and Student B pushes with 48 N South.

What is the resultant force acting on the box?





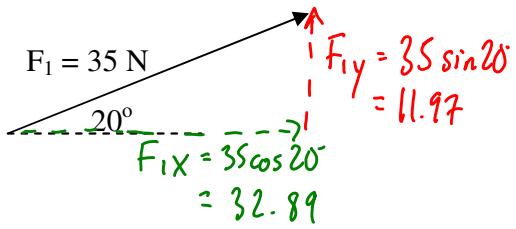
$$F_T = \sqrt{F_1^2 + F_2^2} = 89\ N$$

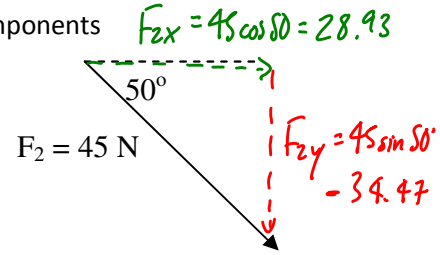
$$\theta = \tan^{-1}\left(\frac{48}{75}\right) = 33^\circ\ (S.of\ E)$$

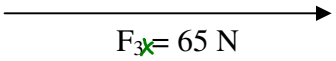
If there are more than two forces then it is best to solve for the resultant using the... component method

Ex

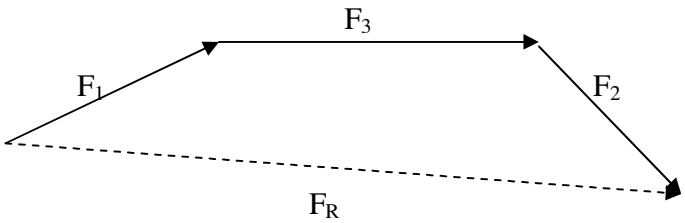
Resolve these force vectors into their x and y components







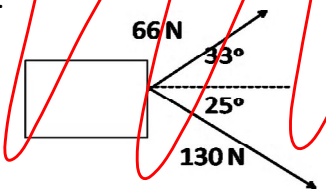
Ex 2 - Determine the resultant force if all three forces in the last example are applied to a single body.

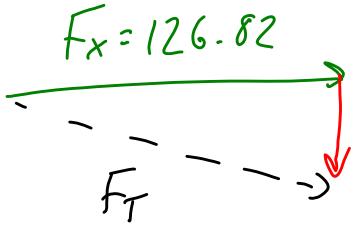


$$\sum F_x = F_{1x} + F_{2x} + F_{3x} = 32.89 + 28.93 + 65 = 126.82\ N$$

$$\sum F_y = F_{1y} + F_{2y} = 11.97 + (34.47) = -22.5\ N$$

Ex 3: Two children pull a third child on a toboggan (shown from the top, assume up is north). Assuming that they pull on ropes that are parallel to the ground determine the magnitude of the force exerted on the toboggan.





$$F_T = \sqrt{F_x^2 + F_y^2} = 129\ N$$

$$\theta = \tan^{-1}\left(\frac{22.5}{126.82}\right) = 10^\circ\ (S\ of\ E)$$