So, last year...

- vectors
- bearings and directions
- vector addition

Vector Components

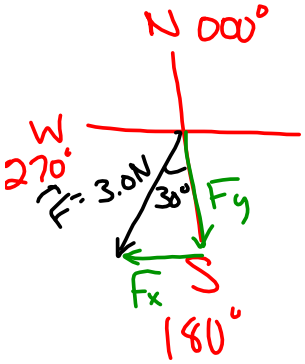
What are the components of the following vector?

$\vec{F} = 3.0\ \text{N}\ 210^\circ$

bearing

principal = main
orthoganal = perpendicular
(≤ 3 Dimensions)

N-S, E-W



$F_y = F\cos\theta$
$= 3.0\text{N}\cos 30^\circ$
$= 2.6\text{N}$

$F_x = F\sin\theta$
$= 3.0\text{N}\sin 30^\circ$
$= 1.5\text{N}$

$\vec{F}$ = vector

$F = |\vec{F}|$ = size of $\vec{F}$

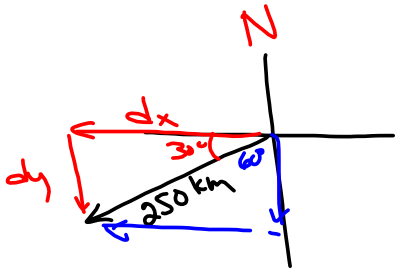
$\vec{F_x} = 1.5\text{N}$ W

$\vec{F_y} = 2.6\text{N}$ S

Example 1:

What are the components in the principal directions of the vector

$$\vec{d} = 250 \text{ km } 240^\circ$$



$d_x = d \cos 30^\circ$

$= 250 \text{ km} \cos 30^\circ = 217 \text{ km}$

$d_y = d \sin 30^\circ$

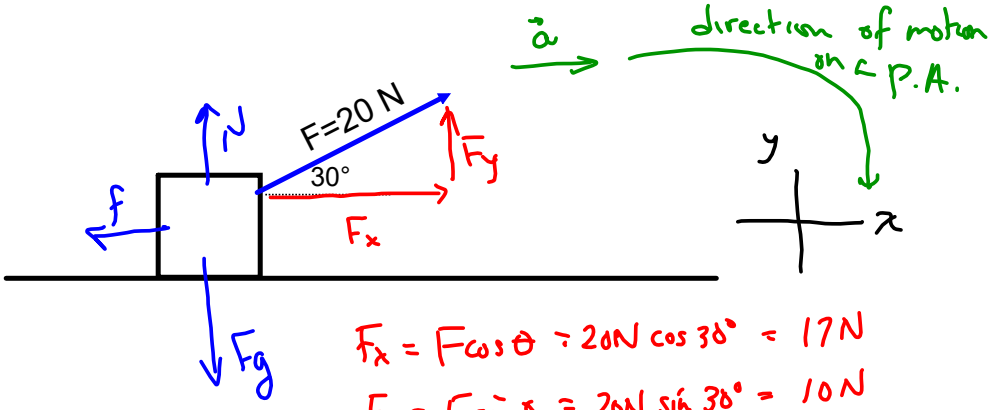
$= 250 \text{ km} \sin 30^\circ = 125 \text{ km}$

$\vec{d}_x = 217 \text{ km W}$

$\vec{d}_y = 125 \text{ km S}$

Example 2:

What are the principal components of the force vector in the following situation? How can we describe them?



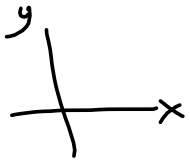
$F_x = F\cos\theta = 20N \cos 30° = 17N$

$F_y = F\sin\theta = 20N \sin 30° = 10N$

$\vec{F}_x = 17N$ right

$\vec{F}_y = 10N$ up

Unit Vectors

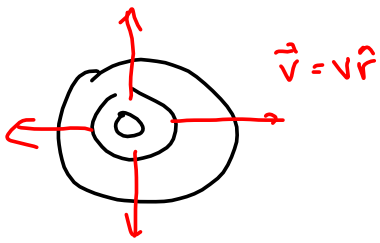


A unit vector is a vector of length 1 in some direction

$\hat{n}$ (n-hat) is a vector of length 1 in the increasing n direction

$\hat{x}$ = " " " " " " " " +x direction

$\hat{y}$ = " " " " " " " " +y direction



Last question

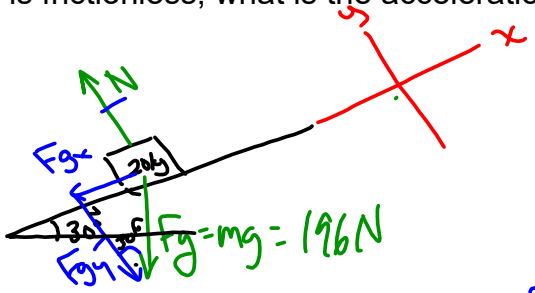
$\vec{F}_x = 17N\hat{x}$

$\vec{F}_y = 10N\hat{y}$

$\vec{F} = 17N\hat{x} + 10N\hat{y}$

Example 3:

A mass of 20 kg sits on a plane that is inclined at an angle of 30˚.
a) What are the components of the weight vector parallel and perpendicular to the plane?
b) If the incline is frictionless, what is the acceleration of the mass?



$F_{gx} = F_g \sin\theta$
$= 196N \sin 30°$
$= 98N$

$F_{gy} = F_g \cos\theta$
$= 196N \cos 30°$
$= 170N$

b) $\Sigma F = F_{gx} = ma$
$98N = 20kg\ a$
$a = 4.9\ m/s^2$

$\vec{a} = -4.9\ m/s^2\ \hat{x}$
$-x$ direction

Homework: Read pp 459-463
p.459 Problems 1-3