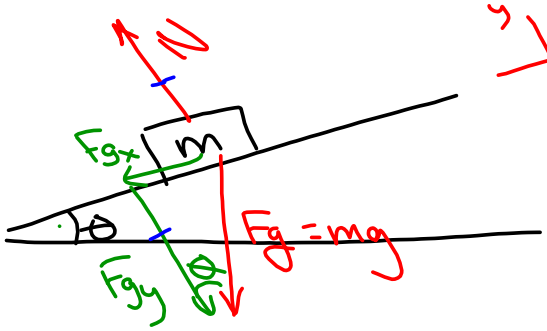
Homework: Questions?

Example 3b:

A mass, m, sits on a plane that is inclined at an angle of θ.
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?



$N = F_{gy}$
(Newton's 1st Law
$a_y = 0$)

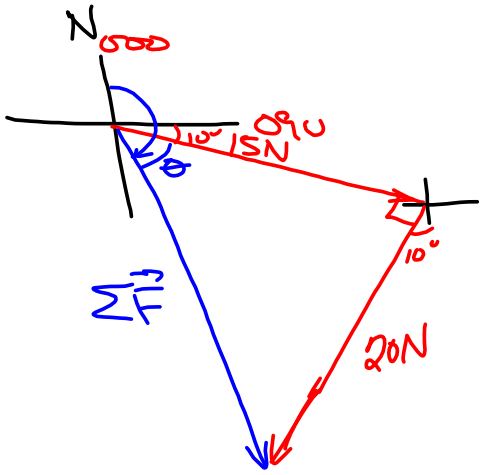
a) $F_{gx} = F_g \sin\theta = mg\sin\theta$
$F_{gy} = F_g \cos\theta = mg\cos\theta$

b) $\Sigma F = F_{gx} = ma$
$mg\sin\theta = ma$
$a = g\sin\theta$

Adding Vectors at Right Angles and Non-Right Angles

Recall in physics 112 you added vectors at right angles. Consider the following example.

Example 1: Add the vectors 15 N 100° and 20 N 190°



$c^2 = a^2 + b^2$
$= 15^2 + 20^2$
$= 625$
$c = 25N$

$\tan\theta = \frac{20N}{15N}$

$\theta = 53°$

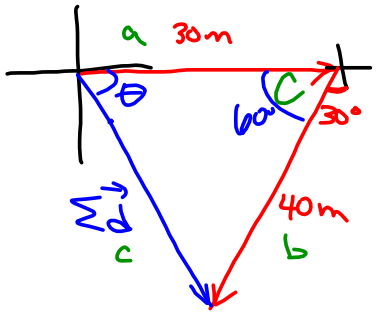
$\Sigma F = 25N$
(3-4-5 Δ)
$\theta = 53°$

$\Sigma\vec{F} = 25N\ 153°$
E63°S
S27°E

But what happens if the vectors *aren't* perpendicular to each other?

Example 2: Find the sum of the vectors 30 m 090° and 40 m 210°.

Method 1: (But can be risky if you're not paying attention!)



Cosine Law

$c^2 = a^2 + b^2 - 2ab\cos C$

$(\Sigma d)^2 = 30^2 + 40^2 - 2(30)(40)\cos 60°$

$= 900 + 1600 - 1200$

$= 1300$

$\Sigma d = 36.1$ m

$\vec{\Sigma d} = 36.1$m E74°S

164°

S16°E

Sine law

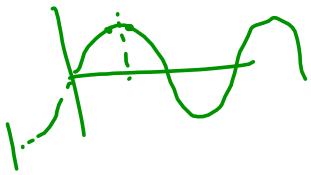
$\frac{\sin B}{b} = \frac{\sin C}{c}$

$\frac{\sin\theta}{40m} = \frac{\sin 60°}{36.1}$

$\sin\theta = \frac{40}{36.1}\sin 60°$

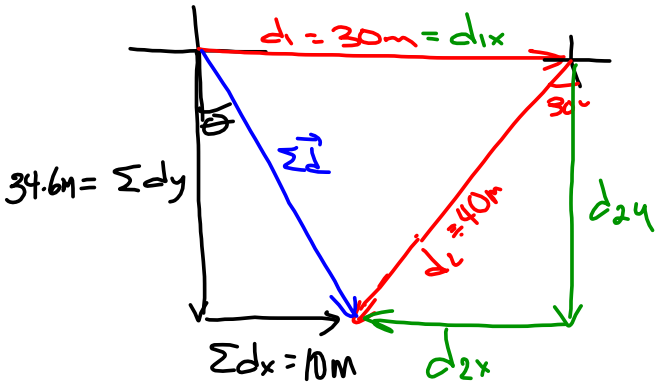
$\theta = 74°$

Risky when θ is close to 90° (and you're not SURE if it's > or < 90°



Method 2: Components

Break vectors down into principal components



$$\Sigma d_y = d_{2y} = d_2 \cos 30^\circ$$
$$= 40m \cos 30^\circ = 34.6m$$

$$\Sigma d_x = d_{1x} - d_{2x}$$
$$= 30m - 40m \sin 30^\circ$$
$$= 10m$$

$$\tan\theta = \frac{10m}{34.6m}$$
$$\theta = 16^\circ$$

$$c^2 = a^2 + b^2$$
$$(\Sigma d)^2 = (34.6)^2 + (10)^2$$
$$= 1200 + 100$$
$$= 1300$$
$$\Sigma d = 36.1m$$

$\Sigma\vec{d} = 36.1\,m$
$S16^\circ E$

Homework (for Tuesday):

Read pp. 463 - 471 (ignore 468-469)
Problems p. 463 #4, 5, 6
Read Error Propagation (and print, or have digitally at school).