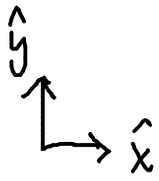
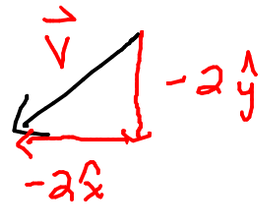




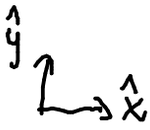
$\vec{v} = -2\hat{x} - 2\hat{y}$

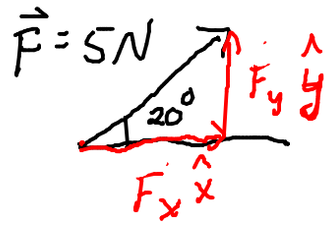
$v_x = -2$

$v_y = -2$

$|\vec{v}| = \sqrt{v_x^2 + v_y^2}$

$= \sqrt{(-2)^2 + (-2)^2} = \sqrt{8} = 2\sqrt{2}$





$\vec{F} = F_x \hat{x} + F_y \hat{y}$

$\sin 20^\circ = \frac{opp}{hyp} = \frac{F_y}{5N} \rightarrow F_y = 5\sin 20^\circ N$

$\cos 20^\circ = \frac{adj}{hyp} = \frac{F_x}{5N} \rightarrow F_x = 5\cos 20^\circ N$

In general, F_x & $F_y = \pm |\vec{F}| \begin{Bmatrix} \sin\theta \\ \cos\theta \end{Bmatrix}$

if θ measured from x-axis,

F_x gets cosine

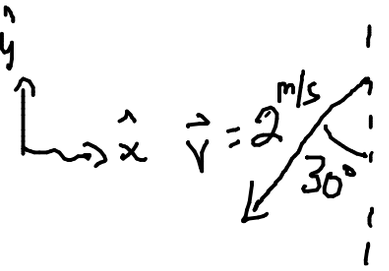
F_y gets sine

" " " "

y-axis

F_y : cosine

F_x : sine



$V_x =$

A) $2\cos 30^\circ$

B) $2\sin 30^\circ$

C) $-2\cos 30^\circ$

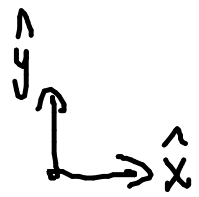
D) $-2\sin 30^\circ$

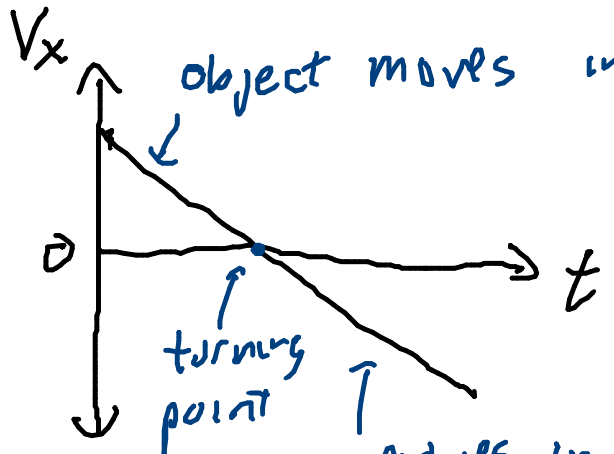
E) $2\tan 30^\circ$

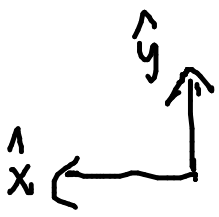
F) $-2\tan 30^\circ$

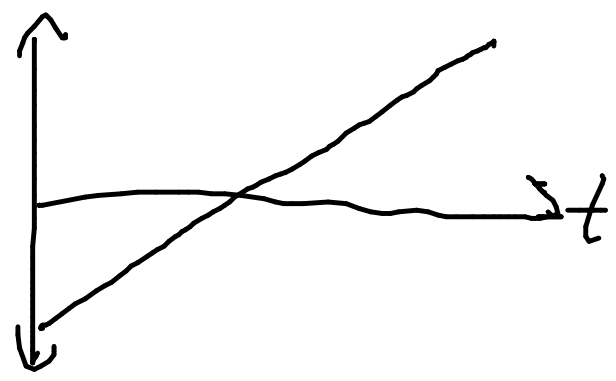
$V_y = -2\cos 30^\circ$

$\vec{V} = -2\sin 30^\circ \hat{x} - 2\cos 30^\circ \hat{y}$ m/s

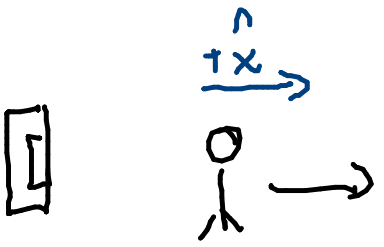






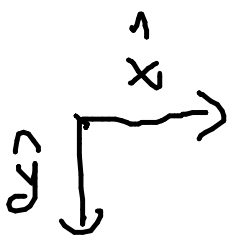


Same motion, different basis



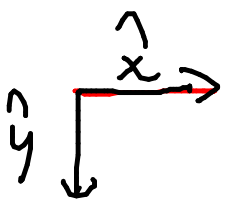
sign of component = direction of vector

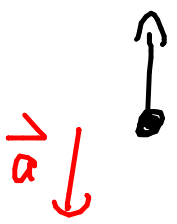
e.g.



v_y is **A) +** B) −

a_y is **C) +** D) −





$v_y < 0$

a_y is **C) +** D) −

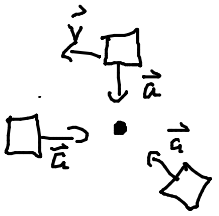
even though it's slowing down!

When v & a have same sign, speed up

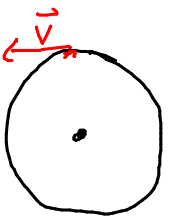
v & a have opposite sign, slow down

Special Types of Acceleration

1) Centripetal acceleration
center seeking



→ circular motion
- velocity is tangential to circle
- acceleration is towards center
- if speed is constant $|\vec{v}|$ then $\vec{a}$ is perpendicular to $\vec{v}$



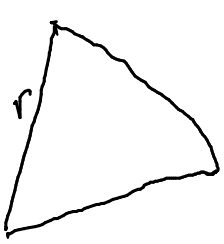
Our bodies detect acceleration by feeling a "force" in opposite direction.

e.g. stop a car, pushed forward

in circular motion.

$\vec{a}$ is towards center,
you feel a "force" away from center,
centrifugal "force"

gentle curve big radius



tight curve

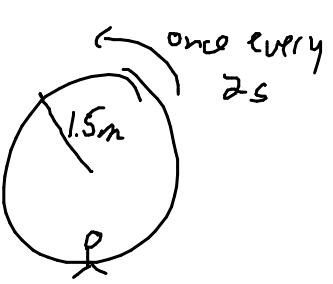
small radius
more centrifugal force —
more acceleration

$$a \propto \frac{1}{r}$$

$$a \propto v^2$$ faster → more acceleration

centripetal acceleration: $\boxed{a_c = \frac{v^2}{r}}$

e.g. merry-go-round



$$v = \frac{\text{circumference}}{2s} = \frac{2\pi(1.5m)}{2} = 4.7\ m/s$$

$$a = \frac{v^2}{r} = \frac{(4.7)^2}{1.5} = 14.8\ m/s^2 > 9.8\ m/s^2$$

$\approx 1.5g$