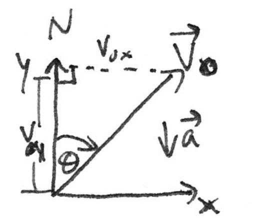
1. You're sailboarding NE (i.e. 45 degrees east of north) at 6.5 m/s when a wind gust hits, lasting 6.6 s, accelerating your board at 0.53 m/s² due south. What is your velocity when the gust stops?

Strategy: (1) Resolve $\vec{V}_0$ into x & y components
(2) Analyze x & y motions separately using Ch. 2 equations for constant acceleration
(3) Combine to get final $\vec{v}$ vector

---

(1)



$\theta = 45°$

$V_0 = 6.5\,m/s$

Given my diagram, $\sin\theta = \frac{V_{ox}}{V_0}$ and $\cos\theta = \frac{V_{oy}}{V_0}$

So $V_{ox} = V_0 \sin\theta$ $\quad$ $V_{oy} = V_0\cos\theta$

$= (6.5\frac{m}{s})(\sin 45°)$ $\quad$ $= (6.5\frac{m}{s})(\cos 45°)$

$V_{ox} = 4.60\,m/s$ $\quad$ $V_{oy} = 4.60\,m/s$

(2) x motion: Since $\vec{a}$ is in the $-y$ direction, $a_x = 0$

Therefore $V_x = V_{ox} + a_x t$ with $a_x = 0 \rightarrow V_x = V_{ox} = 4.60\,m/s$

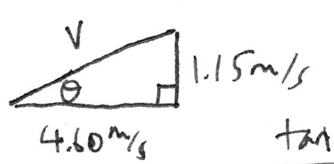
y motion: $V_y = V_{oy} + a_y t$ with $a_y = -0.53\,m/s^2$ (since +y is north, this is negative)

$= 4.60\,m/s + (-0.53\frac{m}{s^2})(6.6s)$

$V_y = 1.15\,m/s$

So $\boxed{V = 4.60\frac{m}{s}\,\hat{\imath} + 1.15\,m/s\,\hat{\jmath}}$ In terms of magnitude & direction,

we get the following triangle to analyze:



$V = \sqrt{(4.60\,m/s)^2 + (1.15\,m/s)^2} = 4.74\frac{m}{s}$

$\tan\theta = \frac{1.15\,m/s}{4.60\,m/s}$ so $\theta = \tan^{-1}\frac{1.15}{4.60} = 14°$

So $\boxed{\vec{V} = 4.74\,m/s\ 14° \text{ N of E}}$

2. A merry-go-round turns at 7.0 revolutions per minute. There are children at different distances from the center of the merry-go-round.
   a. Find a ***formula*** for the speed of the child's motion as a function of r, the distance from the center.
   b. If a child is 2.5 meters from the center of the merry-go-round, what is the child's acceleration? Use your result from part a to find this.

a) In 1 revolution, the distance traveled $s = 2\pi r$

The speed is the distance s divided by the time to travel that distance.

You can either consider the time for 7 revolutions (and corresponding distance) or find T = time for 1 revolution. Either way gives the same V.

7 revs: $V = \frac{7 \cdot (2\pi r)}{60\,s} = \frac{s}{t}$; $V = 0.733 \cdot r \; (s^{-1})$

1 rev: $T = \frac{60\,s}{7\,rev} = 8.57 \frac{sec}{rev}$; $V = \frac{s}{T} = \frac{2\pi r}{8.57\,s/rev} = \boxed{(0.733\,s^{-1})\,r}$

b) Using $a = \frac{v^2}{r}$ & the above result,

$$a = \frac{\left(\frac{2\pi r}{T}\right)^2}{r} = \left(\frac{2\pi}{T}\right)^2 r = \left(\frac{2\pi}{8.57\,s}\right)^2 (2.5\,m) = \boxed{1.34 \frac{m}{s^2}}$$