Review: Angelica rides her magical bike at a rate of 120 miles per hour. The angular speed of each wheel is 528 revoluons per minute. What is the radius of a wheel, in inches?

$V = 120$ mi/h ; $\omega = 528$ rev/min ; $r = ?$ in

$\frac{V}{\omega} = \frac{r\cancel{\omega}}{\cancel{\omega}}$ $\quad r = V \cdot \frac{1}{\omega}$

$r = \frac{\overset{2}{\cancel{120}}\,\cancel{mi}}{\cancel{h}} \cdot \frac{1\ \cancel{min}}{\cancel{528}\ \cancel{rev}} \cdot \frac{\overset{10}{\cancel{5280}}\,\cancel{ft}}{1\ \cancel{mi}} \cdot \frac{12\,in}{1\,\cancel{ft}} \cdot \frac{1\,\cancel{h}}{\cancel{60}\,\cancel{min}} \cdot \frac{1\,\cancel{rev}}{\cancel{2}\pi}$

$= \boxed{\frac{120}{\pi}\text{ in}}$

Homework questions?

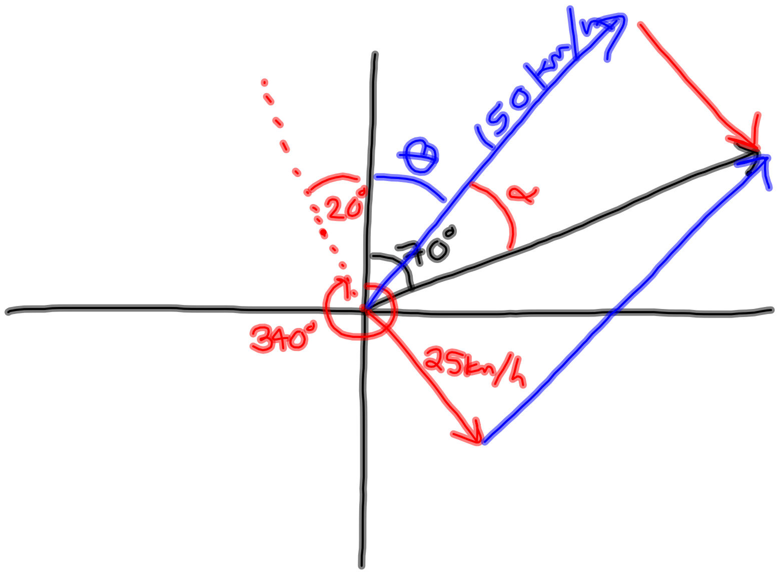
$\tan\frac{\pi}{12}$

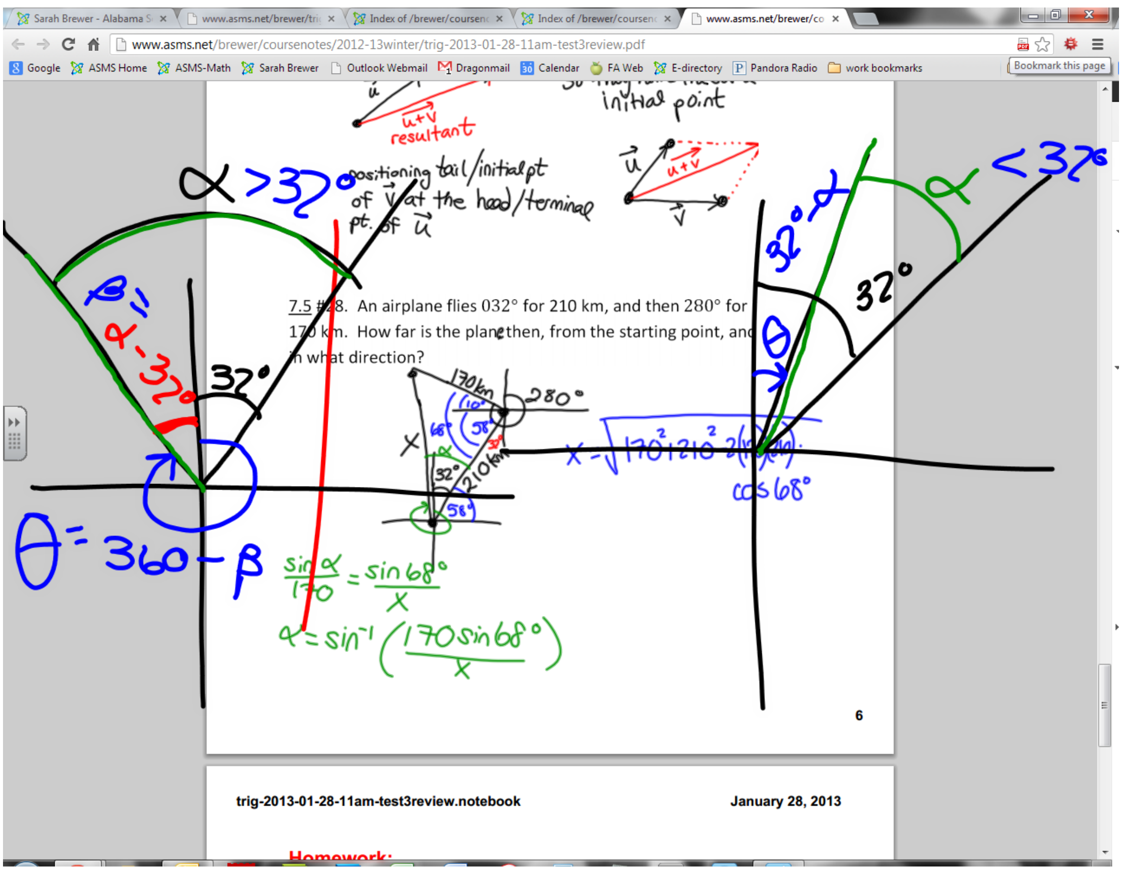
$\frac{\pi}{6} \pm \frac{\pi}{2}$

$\frac{\pi}{3} - \frac{\pi}{4}$

$\frac{4\pi}{12} - \frac{3\pi}{12}$

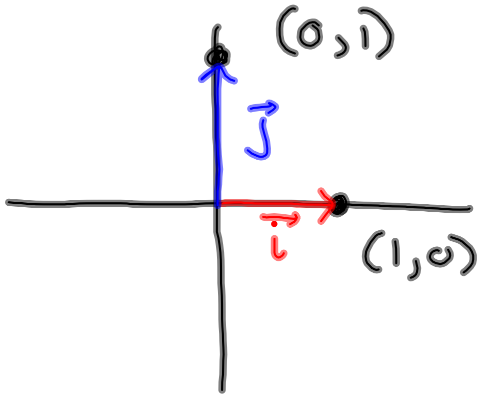
7.5 #29


150 km/h
θ
α
20°
70°
340°
25km/h


www.asms.net/brewer/coursenotes/2012-13winter/trig-2013-01-28-11am-test3review.pdf
initial point
u+v resultant
positioning tail/initial pt of v at the head/terminal pt. of u
α > 32°
β = α - 32°
32°
θ = 360 - β
7.5 #28. An airplane flies 032° for 210 km, and then 280° for 170 km. How far is the plane then, from the starting point, and in what direction?
170km
280°
210km
68°
58°
32°
sin α / 170 = sin 68° / x
α = sin⁻¹(170 sin 68° / x)
x = √(170² + 210² - 2(170)(210) cos 68°)
α < 32°
32°
θ
6
trig-2013-01-28-11am-test3review.notebook
January 28, 2013
Homework:

7.6, cont. - Unit Vectors

A **unit vector** is a vector whose magnitude is 1.



Special Unit Vectors:

$\vec{\boldsymbol{\imath}} =< 1,0 >$ & $\vec{\boldsymbol{\jmath}} =< 0,1 >$

In 3 dimensions we would have

$\vec{\boldsymbol{\imath}} =< 1,0,0 >$, $\vec{\boldsymbol{\jmath}} =< 0,1,0 >$ & $\vec{\boldsymbol{k}} =< 0,0,1 >$

Any vector given in component form can also be written in terms of $\vec{\imath}$ and $\vec{\jmath}$.

$\vec{V} = \langle a, b \rangle$

$= \langle a, 0 \rangle + \langle 0, b \rangle$

$= a\langle 1, 0 \rangle + b\langle 0, 1 \rangle$

$\vec{V} = a\vec{i} + b\vec{j}$

Vector operations for vectors given in terms of $\vec{\imath}$ and $\vec{\jmath}$ are in some ways simpler than for vectors given in component form, as $\vec{\imath}$ and $\vec{\jmath}$ can be treated like variables.

7.6 #46 & 48. $\vec{u} = 2\vec{\imath} + \vec{\jmath}$; $\vec{v} = -3\vec{\imath} - 10\vec{\jmath}$; $\vec{w} = \vec{\imath} - 5\vec{\jmath}$

46. $\vec{v} + 3\vec{w} = -3\vec{\imath} - 10\vec{\jmath} + 3(\vec{\imath} - 5\vec{\jmath})$
$= -3\vec{\imath} - 10\vec{\jmath} + 3\vec{\imath} - 15\vec{\jmath}$
$= \boxed{-25\vec{\jmath}} = \langle 0, -25 \rangle$

48. $(\vec{u} - \vec{v}) + \vec{w} = 2\vec{\imath} + \vec{\jmath} - (-3\vec{\imath} - 10\vec{\jmath}) + \vec{\imath} - 5\vec{\jmath}$
$= 2\vec{\imath} + \vec{\jmath} + 3\vec{\imath} + 10\vec{\jmath} + \vec{\imath} - 5\vec{\jmath}$
$= \boxed{6\vec{\imath} + 6\vec{\jmath}} = \langle 6, 6 \rangle$

Note that the magnitude of a vector given in the form $\vec{v} = a\vec{\imath} + b\vec{\jmath}$ is still found by the formula $|\vec{v}| = \sqrt{a^2 + b^2}$

$a = 3,\ b = -2$

$\vec{v} = 3\vec{\imath} - 2\vec{\jmath}$

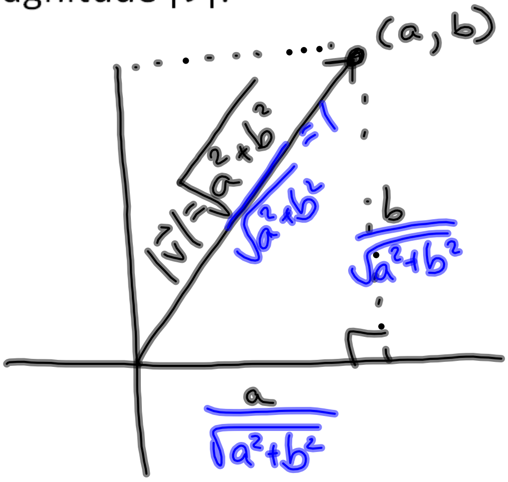
$|\vec{v}| = \sqrt{3^2 + (-2)^2} = \sqrt{9+4} = \boxed{\sqrt{13}}$

$\cancel{\neq \sqrt{(3i)^2 + (-2j)^2}}$

$\cancel{\neq \sqrt{-1}}$

a & b are coefficients!

Given a vector $\vec{v} = < a, b >$, we can find a **unit vector $\vec{u}$ in the direction of $\vec{v}$** by dividing each component (a & b) by the magnitude $|\vec{v}|$.



$$\vec{u} = \frac{\vec{v}}{|\vec{v}|}$$

$$= \left\langle \frac{a}{\sqrt{a^2+b^2}}, \frac{b}{\sqrt{a^2+b^2}} \right\rangle$$

Given $\vec{v} = < -3,4 >$, find a unit vector $\vec{u}$ in the direction of $\vec{v}$.

$$|\vec{v}| = \sqrt{(-3)^2 + 4^2} = 5$$

$$\vec{u} = \frac{\vec{v}}{|\vec{v}|} = \boxed{\left\langle \frac{-3}{5}, \frac{4}{5} \right\rangle}$$

$$|\vec{u}| = \sqrt{\left(\frac{-3}{5}\right)^2 + \left(\frac{4}{5}\right)^2} = \sqrt{\frac{9}{25} + \frac{16}{25}} = \sqrt{\frac{25}{25}} = \sqrt{1} = 1$$

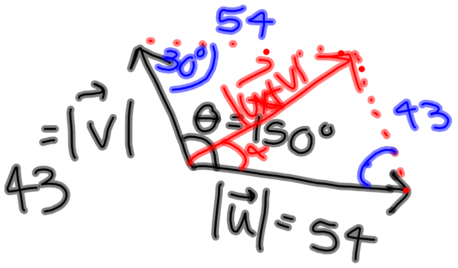
✓

Applications from section 7.5

18. Find $|\vec{u}+\vec{v}|$ and the angle that $\vec{u}+\vec{v}$ makes with $\vec{u}$, given $|\vec{u}|=54$, $|\vec{v}|=43$, & the angle θ between $\vec{u}$ & $\vec{v}$ is $150°$.

$$|\vec{u}+\vec{v}|=\sqrt{43^2+54^2-2(43)(54)\cos 30°}$$

$$=\boxed{27.3}$$

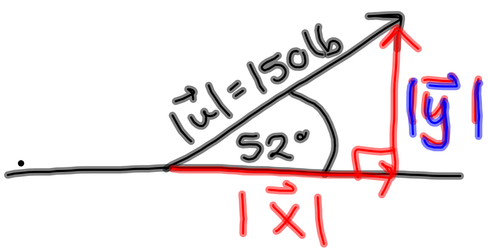


$$\frac{\sin\alpha}{43}=\frac{\sin 30°}{27.3}$$

$$\alpha=\sin^{-1}\left(\frac{43\sin 30°}{27}\right)=\boxed{52.8°}$$

Resolving a vector into horizontal and vertical components

32. $|\vec{u}|=150$ lb, inclined upward to the right at $52°$ from the horizontal. Resolve $\vec{u}$ into horizontal and vertical components.



vertical component

$$\sin 52°=\frac{|y|}{150}$$

$$|\vec{y}|=150\sin 52°=$$

$$=\boxed{118.2\text{ lb}}$$

horizontal component

$$\cos 52°=\frac{|x|}{150}$$

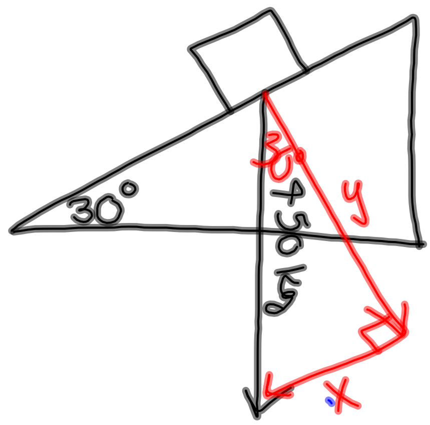
$$|\vec{x}|=150\cos 52°=\boxed{92.3\text{ lb}}$$

The object on a ramp problem

40. If a 450kg object is at rest on a ramp with a $30°$ incline, find the components of the force of the object's weight parallel and perpendicular to the ramp.

y "Normal force"

* weight always points straight down



parallel force:

$\sin 30° = \frac{|\vec{x}|}{450}$

$|\vec{x}| = 450 \sin 30° = \boxed{225\text{ kg}}$

perpendicular:

$\cos 30° = \frac{|\vec{y}|}{450}$ $\quad |\vec{y}| = 450 \cos 30° = 389.7$ k

Homework:

Already assigned: 7.5 #27,29; 7.6 #9-26 all

7.5# 19,21,33,39

7.6# 33-41odd, 45, 47, 57, 61

Due Friday