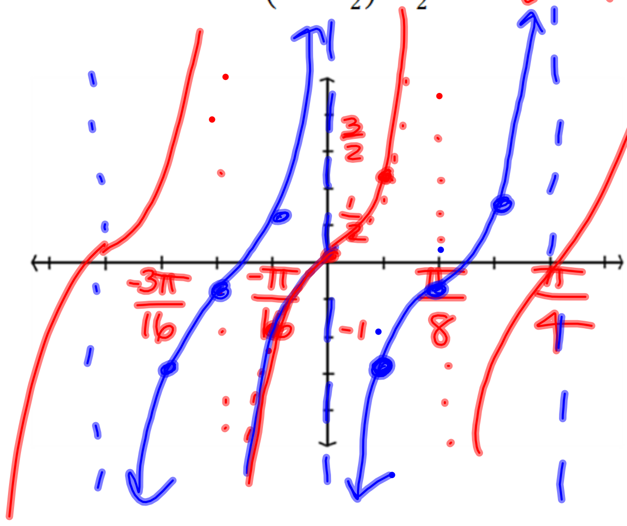
Graph: $y = \tan\left(4x - \frac{\pi}{2}\right) - \frac{1}{2}$ $= \tan 4\left(x - \frac{\pi}{8}\right) - \frac{1}{2}$



period: $\frac{\pi}{4}$

"amp": 1

right $\pi/8$

down $1/2$

7.6 $\quad \vec{v} = \langle -4, 7 \rangle \; ; \; \vec{w} = \langle -1, -3 \rangle$

11. $\left|3\vec{w} - \vec{v}\right| = \left|3\langle -1, -3\rangle - \langle -4, 7\rangle\right|$

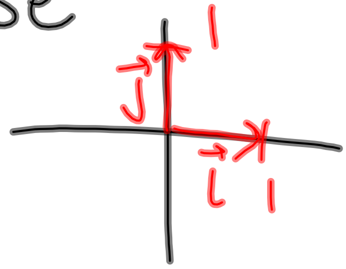
$= \left|\langle -3, -9\rangle - \langle -4, 7\rangle\right|$

$= \left|\langle 1, -16\rangle\right| = \sqrt{1^2 + (-16)^2} = \sqrt{1 + 256}$

$= \boxed{\sqrt{257}}$

7.6 Unit Vectors

A <u>unit vector</u> is a vector whose magnitude is 1.



special unit vectors:

$\vec{i} = \langle 1, 0 \rangle$ & $\vec{j} = \langle 0, 1 \rangle$

If 3 dimensions...

$\vec{i} = \langle 1, 0, 0 \rangle$; $\vec{j} = \langle 0, 1, 0 \rangle$; $\vec{k} = \langle 0, 0, 1 \rangle$

$\vec{v} = \langle a, b \rangle$ "component form"

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

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

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

$\vec{u} = 2\vec{i} + \vec{j}$; $\vec{v} = -3\vec{i} - 10\vec{j}$; $\vec{w} = \vec{i} - 5\vec{j}$

46. $\vec{v} + 3\vec{w} = -3\vec{i} - 10\vec{j} + 3(\vec{i} - 5\vec{j})$

$$= -3\vec{i} - 10\vec{j} + 3\vec{i} - 15\vec{j}$$

$$= \boxed{-25\vec{j}} = \langle 0, -25 \rangle$$

48. $(\vec{u} - \vec{v}) + \vec{w}$

$$= 2\vec{i} + \vec{j} - (-3\vec{i} - 10\vec{j}) + \vec{i} - 5\vec{j}$$

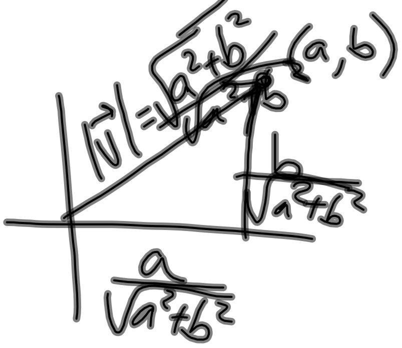
$$= \boxed{6\vec{i} + 6\vec{j}}$$

$$\vec{v} = 3\vec{i} - 2\vec{j}$$

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

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

Given a vector $\vec{v} = \langle a, b \rangle$ we can find a unit vector $\vec{u}$ in the direction of $\vec{v}$ by dividing each component by $|\vec{v}|$.



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

$$\vec{v} = \langle -3, 4 \rangle$$

Find a unit vector $\vec{u}$ in the direction of $\vec{v}$.

$$|\vec{v}| = \sqrt{(-3)^2 + 4^2} = \sqrt{25} = 5$$

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

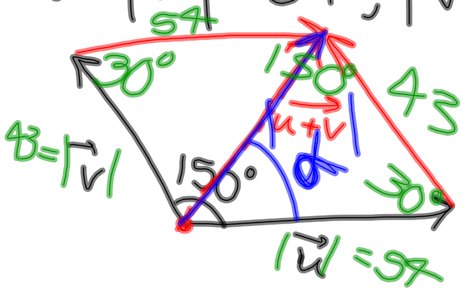
$$|\vec{u}| = \sqrt{\left(\frac{-3}{5}\right)^2 + \left(\frac{4}{5}\right)^2} = \sqrt{\frac{9}{25} + \frac{16}{25}} = \sqrt{\frac{25}{25}} = 1$$

7.5

Find $|\vec{u}+\vec{v}|$ & the angle that $\vec{u}+\vec{v}$ makes w/ $\vec{u}$.

18. $|\vec{u}| = 54$; $|\vec{v}| = 43$; $\theta = 150°$

∠ between $\vec{u}$ & $\vec{v}$



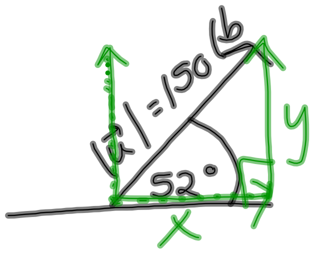
$$|\vec{u}+\vec{v}| = \sqrt{43^2+54^2-2(43)(54)\cos 30°} \approx \boxed{27.3}$$

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

$$\alpha = \sin^{-1}\left(\frac{43\sin 30°}{27.3}\right) \approx \boxed{52°}$$

Resolving a vector into horizontal & vertical components

32. $|\vec{u}| = 150$ lb inclined upward to the right @ 52° from the horizontal.



x = horizontal component

y = vertical component

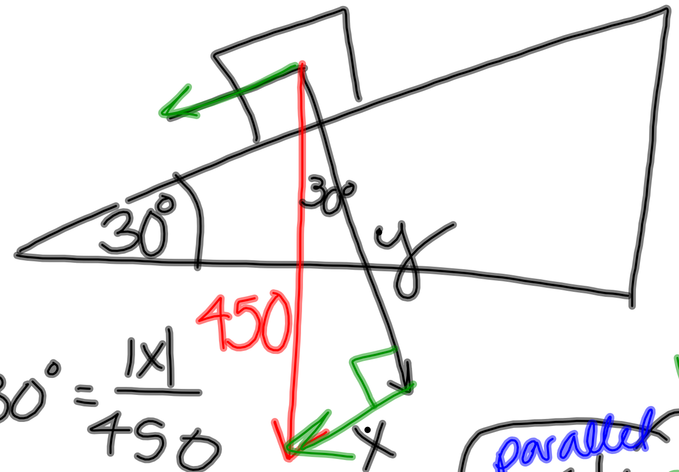
$\cos 52° = \frac{x}{150}$ $\sin 52° = \frac{y}{150}$

$|x| = 150\cos 52° \approx 92$ lb

$|y| = 150\sin 52° \approx 118$ lb

40.

weight: 450 kg (straight down)



$\sin 30^\circ = \frac{|x|}{450}$

$|x| = 450 \sin 30^\circ \approx \boxed{225 \text{ kg}}$ parallel

$\cos 30^\circ = \frac{|y|}{450}$

$|y| = 450 \cos 30^\circ \approx \boxed{389.7 \text{ kg}}$ perpendicular

Parallel (tangent) & perpendicular (normal) vectors are perpendicular to each other

7.5 # 19, 21, 33, 39

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