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?

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

$\frac{V}{\omega} = \frac{r\omega}{\omega}$

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

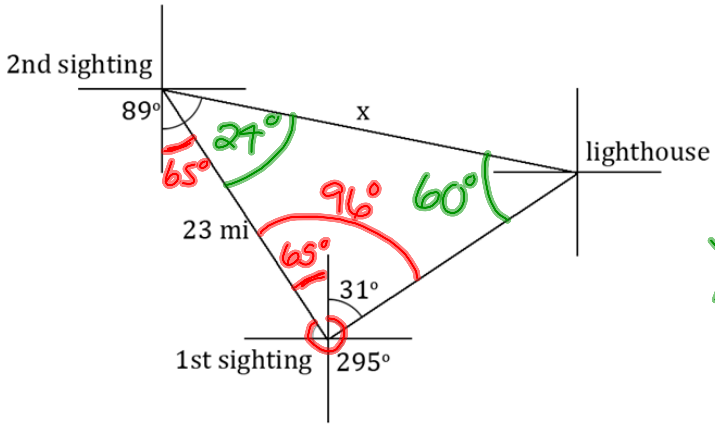
$= \frac{\cancelto{2}{120}\ \cancel{mi}}{\cancel{h}} \cdot \frac{1\ \cancel{min}}{\cancel{528}\ \cancel{rev}} \cdot \frac{1\ \cancel{h}}{\cancel{60}\ \cancel{min}} \cdot \frac{\cancelto{10}{5280}\ \cancel{ft}}{1\ \cancel{mi}} \cdot \frac{12\ in}{1\ \cancel{ft}} \cdot \frac{1\ \cancel{rev}}{\cancel{2}\pi}$

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

2. ASA
   $B = 69°$
   $a = 2.4$
   $c = 10.6$
3. SSA
   no $\triangle$ exists
4. SSS
   $B = 79.2°$
5. SSA
   $A = 18.7°$

6. SAS
   $c = 43.2$
7. AAS
   $c = 10.8$
8. $188.9\ cm^2$

9. A navigator on a ship sights a lighthouse at a bearing of $N31°E$. After traveling 23 miles at a heading of $295°$, the ship sights the lighthouse at a bearing of $S89°E$. How far is the ship from the lighthouse at the second sighting?

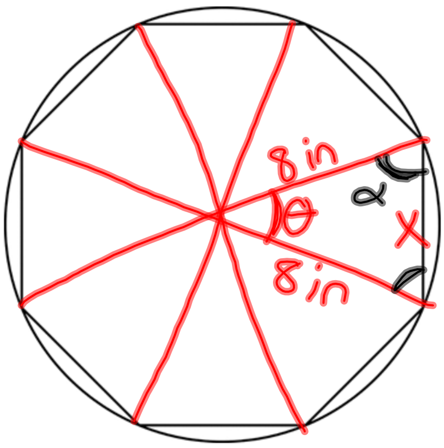


$$\frac{x}{\sin 96°} = \frac{23}{\sin 60°}$$

$$x = \frac{23 \sin 96°}{\sin 60°}$$

$$\approx \boxed{26.4 \text{ mi}}$$

10. A regular octagon is inscribed in a circle with a radius of 8 inches. Find the perimeter of the octagon.



$$8x = ?$$

$$\theta = \frac{360°}{8} = 45°$$

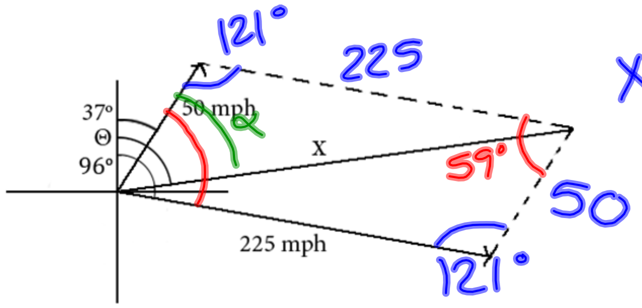
$$x = \sqrt{8^2 + 8^2 - 2(8)(8)\cos 45°}$$

$$\approx 6.1$$

$$8x \approx \boxed{49 \text{ in}}$$

$$\frac{360° - 45°}{2} = \alpha$$

Bonus: A pilot is flying at a heading of 96° at 225 miles per hour. A 50 mile per hour wind is blowing at a heading at 37°. Find the ground speed and course of the plane.



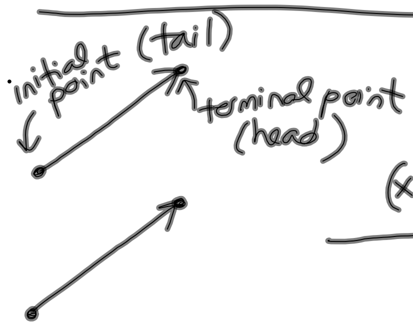
$$x=\sqrt{50^2+225^2-2(50)(225)\cos 121^\circ}$$
$$\approx \boxed{254.4 \text{ mph}}$$

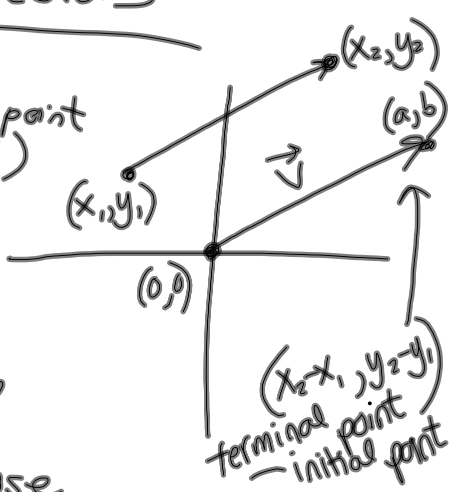
$$96^\circ-37^\circ=59^\circ$$
$$180^\circ-59^\circ=121^\circ$$

$$\frac{\sin\alpha}{225}=\frac{\sin 121^\circ}{254.4}$$
$$\alpha=\sin^{-1}\left(\frac{225\sin 121^\circ}{254.4}\right)$$
$$\approx 49.3^\circ$$

$$\theta=37^\circ+49.3^\circ$$
$$=\boxed{86.3^\circ}$$

7.5, 7.6 - Vectors





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

= vector whose initial point is (0,0) & terminal point is (a,b)

a & b are the components of the vector

the length or magnitude of vector $\vec{v}$ is $|\vec{v}|=\sqrt{a^2+b^2}$

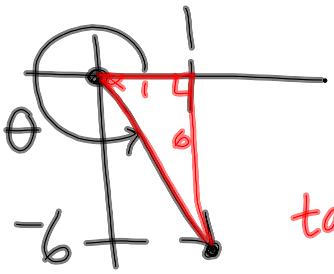
Given the vector $\overrightarrow{CD}$ whose tail is at the point $C(2,5)$ (initial) & head is at point $D(3,-1)$ (terminal). Determine a vector $\vec{w}$ that is equivalent to $\overrightarrow{CD}$ and has initial point at the origin.

$\vec{w} = \langle 3-2, -1-5 \rangle = \boxed{\langle 1, -6 \rangle}$

magnitude of $\vec{v} = \langle a, b \rangle$

$|\vec{v}| = \sqrt{a^2+b^2}$

direction $\angle\theta$ is measured counter-clockwise from $0°$.



$\vec{w} = \langle 1, -6 \rangle$

$|\vec{w}| = \sqrt{1^2+(-6)^2} = \sqrt{37}$

$\tan\alpha = \frac{6}{1}$ $\alpha = \tan^{-1}(6) \approx 81°$

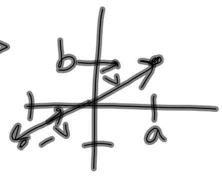
$\Rightarrow \theta = 360° - 81° = \boxed{279°}$

★ ref $\angle$ is always $\left|\tan^{-1}\left|\frac{b}{a}\right|\right|$

Vector Operations

$\vec{v} = \langle a, b \rangle$; $\vec{w} = \langle c, d \rangle$; $k \in \mathbb{R}$

1. $|\vec{v}| = \sqrt{a^2 + b^2}$
2. $k\vec{v} = k\langle a, b \rangle = \langle ka, kb \rangle$
   "scalar multiplication"
3. $\vec{v} + \vec{w} = \langle a+c, b+d \rangle$



4. $-\vec{v} = \langle -a, -b \rangle$
5. $\vec{v} - \vec{w} = \langle a-c, b-d \rangle$
6. $\vec{0} = \langle 0, 0 \rangle$ "zero vector"

$\vec{v} = \langle 12, -5 \rangle$; $\vec{w} = \langle 2, 7 \rangle$

a. $|\vec{v}| = \sqrt{12^2 + (-5)^2} = \boxed{13}$

b. $\vec{v} + \vec{w} = \langle 12+2, -5+7 \rangle = \boxed{\langle 14, 2 \rangle}$

c. $-5\vec{v} = \langle -5(12), -5(-5) \rangle = \boxed{\langle -60, 25 \rangle}$

d. $3\vec{v} - 4\vec{w} = \langle 36, -15 \rangle - \langle 8, 28 \rangle$
$= \boxed{\langle 28, -43 \rangle}$

vector multiplication

$\vec{v} \cdot \vec{w}$ vs. $\vec{v} \times \vec{w}$

dot product

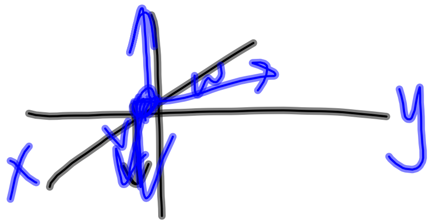
result is a scalar (#)

$\vec{v} = \langle a, b \rangle ; \vec{w} = \langle c, d \rangle$

$\vec{v} \cdot \vec{w} = ac + bd$

cross product

result is a vector



$\vec{v} = \langle 1, 2 \rangle$, $\vec{w} = \langle -3, 4 \rangle$

$\vec{v} \cdot \vec{w} = 1(-3) + 2(4) = -3 + 8 = \boxed{5}$

$\vec{v}_1 = \langle 1, 2 \rangle$, $\vec{v}_2 = \langle -3, 4 \rangle$, $\vec{v}_3 = \langle 5, -6 \rangle$

$\vec{v}_1 \cdot \left(\vec{v}_2 + \vec{v}_3 \right) = \langle 1, 2 \rangle \cdot \langle 2, -2 \rangle$

$= 1(2) + 2(-2) = 2 + (-4) = \boxed{-2}$

7.6 book

#9-26

$\mathbf{u} = \vec{u}$

$\vec{u}$ $\hat{u}$