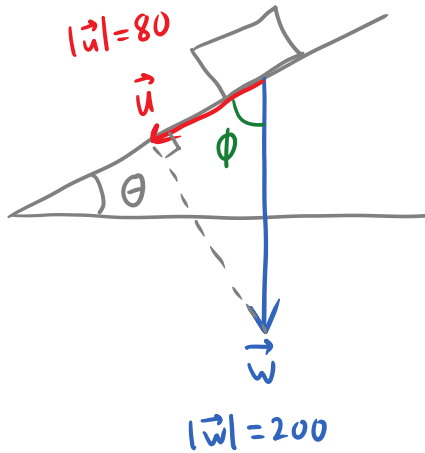


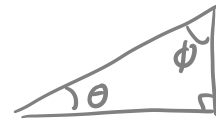
1. A 200-lb box is on a ramp. If a force of 80 lbs is just sufficient to keep the box from sliding, find the angle of inclination of the plane. (Assume no friction on the ramp.)



$$\cos \phi = \frac{|\vec{u}|}{|\vec{w}|} = \frac{80}{200}$$

$$\phi = \cos^{-1} \frac{80}{200} \approx 66.42^\circ$$

$$\begin{aligned} \theta &= 90^\circ - \phi \\ &= 90^\circ - 66.42^\circ \\ &= \boxed{23.58^\circ} \end{aligned}$$



2. Suppose $\vec{u} = \langle -2, 1 \rangle$ and $\vec{v} = \langle 0, 3 \rangle$.

a) Find $|\vec{u}|$.

$$|\vec{u}| = \sqrt{(-2)^2 + (1)^2} = \boxed{\sqrt{5}}$$

b) Find $5\vec{v} - 2\vec{u}$.

$$\begin{aligned} 5\vec{v} - 2\vec{u} &= 5\langle 0, 3 \rangle - 2\langle -2, 1 \rangle \\ &= \langle 0, 15 \rangle - \langle -4, 2 \rangle \\ &= \boxed{\langle 4, 13 \rangle} \end{aligned}$$

c) Write \vec{v} in terms of \vec{i} and \vec{j} .

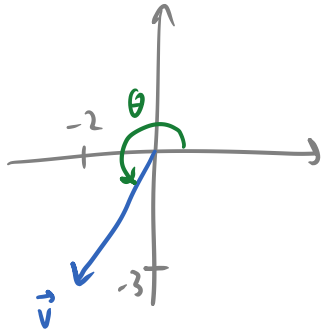
$$\vec{v} = 0\vec{i} + 3\vec{j} = \boxed{3\vec{j}}$$

3. Find the magnitudes of the horizontal and vertical components of \vec{v} given that $|\vec{v}| = 50$ and $\theta = 120^\circ$.

$$\text{Horizontal: } |\vec{v}| \cos \theta = 50 \cos 120^\circ = 50 \left(-\frac{1}{2}\right) = \boxed{-25}$$

$$\text{Vertical: } |\vec{v}| \sin \theta = 50 \sin 120^\circ = 50 \left(\frac{\sqrt{3}}{2}\right) = \boxed{25\sqrt{3}}$$

4. Find the direction (in degrees) of $\vec{v} = \langle -2, -3 \rangle$.



$$\tan \theta = \frac{-3}{-2} = \frac{3}{2}$$

$$\tan^{-1}\left(\frac{3}{2}\right) \approx 56.31^\circ$$

$$\text{ref angle } 56.31^\circ$$

$$\theta \approx 180^\circ + 56.31^\circ = \boxed{236.31^\circ}$$

5. Let $\vec{u} = \langle 3, -1 \rangle$ and $\vec{v} = \langle 2, 4 \rangle$.

a) Find $\vec{u} \cdot \vec{v}$.

$$\vec{u} \cdot \vec{v} = (3)(2) + (-1)(4) = 6 + (-4) = \boxed{2}$$

b) Find the angle between \vec{u} and \vec{v} .

$$\cos \theta = \frac{\vec{u} \cdot \vec{v}}{|\vec{u}| |\vec{v}|} = \frac{2}{\sqrt{9+1} \sqrt{4+16}} = \frac{2}{\sqrt{10} \sqrt{20}} = \frac{2}{\sqrt{200}} = \frac{2}{10\sqrt{2}} = \frac{1}{5\sqrt{2}}$$

$$\theta = \cos^{-1}\left(\frac{1}{5\sqrt{2}}\right) \approx \boxed{81.87^\circ}$$

6. Determine if $\vec{u} = \langle 2, -5 \rangle$ and $\vec{v} = \langle 10, -4 \rangle$ are orthogonal.

$$\vec{u} \cdot \vec{v} = (2)(10) + (-5)(-4) = 20 + 20 = 40 \leftarrow \text{not } 0, \text{ so } \boxed{\text{not orthogonal}}$$

Q: A man while looking at a photograph said, "Brothers and sisters have I none. That man's father is my father's son." Who was the person in the photograph?