Pre-Calculus **HW#6.6-3** **Name:** Key

Find the dot product of u and v.

1. $\mathbf{u} = 3\mathbf{i} + 4\mathbf{j}$, $\mathbf{v} = 2\mathbf{i} - 3\mathbf{j}$

$u \cdot v = 3 \cdot 2 + 4 \cdot -3$

$= \boxed{-6}$

2. $\mathbf{u} = 5\mathbf{i} + 12\mathbf{j}$, $\mathbf{v} = -3\mathbf{i} + 2\mathbf{j}$

$u \cdot v = 5 \cdot -3 + 12 \cdot 2$

$= \boxed{9}$

Find the angle, θ, between the vectors.

3. $\mathbf{u} = \mathbf{i} + 0\mathbf{j}$, $\mathbf{v} = 0\mathbf{i} - 2\mathbf{j}$

$u \cdot v = 0 + 0$

$\boxed{\theta = 90°}$

4. $\mathbf{u} = 4\mathbf{i} + 4\mathbf{j}$, $\mathbf{v} = 2\mathbf{i} + 0\mathbf{j}$

$u \cdot v = 8$

$\|u\| = 4\sqrt{2}$

$\|v\| = 2$

$\cos\theta = \frac{8}{8\sqrt{2}} = \frac{\sqrt{2}}{2}$

$\boxed{\theta = 45°}$

5. $\mathbf{u} = 3\mathbf{i} + 4\mathbf{j}$, $\mathbf{v} = -2\mathbf{j}$

$u \cdot v = -8$

$\|u\| = 5$

$\|v\| = 2$

$\cos\theta = \frac{-8}{10}$

$\boxed{\theta = 143°}$

6. $\mathbf{u} = 2\mathbf{i} - 3\mathbf{j}$, $\mathbf{v} = \mathbf{i} - 2\mathbf{j}$

$u \cdot v = 8$

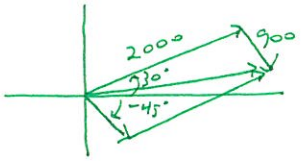
$\|u\| = \sqrt{13}$

$\|v\| = \sqrt{5}$

$\cos\theta = \frac{8}{\sqrt{65}}$

$\boxed{\theta = 7°}$

7. Forces with magnitudes of 2000 newtons and 900 newtons act on a machine part at angles of 30° and -45°, respectively, with the x-axis. Find the direction and magnitude of the resultant force.



$\langle 2000\cos 30°, 2000\sin 30° \rangle + \langle 900\cos(-45°), 900\sin(-45°) \rangle$

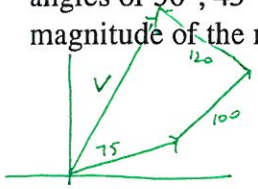
$\langle 2368.5, 363.6 \rangle$

$\tan\theta = \frac{363.6}{2368.5}$

MAG. = $\boxed{2396.2 \text{ NEWTONS}}$

$\boxed{\theta = 9°}$

8. Three forces with magnitudes of 75 lbs, 100 lbs, and 125 lbs act on an object at angles of 30°, 45°, and 120°, respectively, with the x-axis. Find the direction and magnitude of the resultant force.



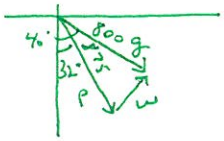
$V = \langle 75\cos 30°, 75\sin 30° \rangle + \langle 100\cos 45°, 100\sin 45° \rangle + \langle 125\cos 120°, 125\sin 120° \rangle$

$= \langle 73.2, 216.5 \rangle$

MAG. = $\boxed{228.5 \text{ lbs}}$

$\boxed{\theta = 71°}$

9. An airplane is flying in the direction S 32° E, with an airspeed of 875 km/hr. Because of the wind, its ground speed and direction are actually 800 km/hr and S 40° E. Find the direction and speed of the wind.



$\vec{p} + \vec{w} = \vec{g}$

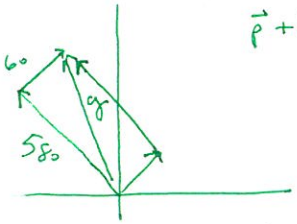
$\vec{w} = \vec{g} - \vec{p}$

$= \langle 800\cos(-50°), 800\sin(-50°) \rangle - \langle 875\cos(-58°), 875\sin(-58°) \rangle = \langle 50.6, 129.2 \rangle$

Mag. = $\boxed{138.8 \text{ km/h}}$

$\theta = 69° \rightarrow \boxed{N21°E}$

10. An airplane's velocity with respect to the air is 580 mph, and it is heading N 60° W. The wind is from the southwest and has a velocity of 60 mph. What is the true direction of the plane, and what is its speed with respect to the ground?



$\vec{p} + \vec{w} = \vec{g} = \langle 580\cos 150°, 580\sin 150° \rangle + \langle 60\cos 45°, 60\sin 45° \rangle$

$= \langle -459.9, 332.4 \rangle$

Mag. = $\boxed{567.4 \text{ mph}}$

$\theta = -35.9°$ in QII $\rightarrow 144°$

$\boxed{N54°W}$