

For the following problems find the dot product of the two vectors:

1. $\vec{a} = \langle 3, 5 \rangle$ and $\vec{b} = \langle -2, 3 \rangle$

$$3(-2) + 5(3)$$

$$-6 + 15$$

$$\boxed{9}$$

2. $\vec{c} = \langle 1, -7 \rangle$ and $\vec{d} = \langle -2, -4 \rangle$

$$1(-2) + (-7)(-4)$$

$$-2 + 28$$

$$\boxed{26}$$

3. $\vec{e} = \frac{2}{3}\vec{i} + \frac{3}{2}\vec{j}$ and $\vec{f} = -\frac{5}{2}\vec{i} + \frac{4}{3}\vec{j}$

$$\frac{2}{3}(-\frac{5}{2}) + \frac{3}{2}(\frac{4}{3})$$

$$-\frac{5}{3} + 2 = \boxed{\frac{1}{3}}$$

4. $\vec{g} = -3\vec{i} + 5\vec{j}$ and $\vec{h} = -5\vec{i} - 3\vec{j}$

$$-3(-5) + 5(-3)$$

$$15 - 15$$

$$\boxed{0}$$

For the following problems find the angle between the two given vectors (round to the nearest hundredth):

5. $\vec{u} = 3\vec{i} - 5\vec{j}$ and $\vec{v} = -6\vec{i} - 2\vec{j}$ $\cos\theta = \frac{u \cdot v}{\|u\| \|v\|}$

$$\cos\theta = \frac{-18 + 10}{\sqrt{9+25} \sqrt{36+4}}$$

$$\cos\theta = \frac{-8}{\sqrt{34} \sqrt{40}}$$

$$\theta = \cos^{-1}\left(\frac{-8}{\sqrt{1360}}\right)$$

$$\boxed{\theta = 102.53^\circ}$$

6. $\vec{v} = \langle -8, -3 \rangle$ and $\vec{w} = \langle 3, -8 \rangle$

$$\cos\theta = \frac{-24 + 24}{\sqrt{64+9} \sqrt{9+64}}$$

$$\cos\theta = 0$$

$$\theta = \cos^{-1}(0)$$

$$\boxed{\theta = 90^\circ}$$

7. $\vec{u} = \vec{i} + 3\vec{j}$ and $\vec{v} = -2\vec{j}$

$$\cos\theta = \frac{0 - 6}{\sqrt{1+9} \sqrt{0+4}}$$

$$\cos\theta = \frac{-6}{\sqrt{10} \sqrt{4}}$$

$$\theta = \cos^{-1}\left(\frac{-6}{2\sqrt{10}}\right)$$

$$\theta = \cos^{-1}\left(\frac{-3}{\sqrt{10}}\right) \quad \boxed{\theta = 161.57^\circ}$$

8. $\vec{v} = \frac{2}{3}\vec{i} + \frac{3}{2}\vec{j}$ and $\vec{w} = -\frac{5}{2}\vec{i} + \frac{4}{3}\vec{j}$

$$\cos\theta = \frac{-\frac{5}{3} + 2}{\sqrt{\frac{4}{9} + \frac{9}{4}} \sqrt{\frac{25}{4} + \frac{16}{9}}}$$

$$\cos\theta = \frac{1/3}{\sqrt{\frac{97}{36}} \sqrt{\frac{289}{36}}}$$

$$\theta = \cos^{-1}\left(\frac{1/3}{\sqrt{\frac{28033}{1296}}}\right)$$

$$\boxed{\theta = 85.89^\circ}$$

For the following problems determine if the vectors are orthogonal (explain mathematically):

9. $\vec{v} = \langle -8, -3 \rangle$ and $\vec{w} = \langle 3, -8 \rangle$

$$-24 + 24 = 0 \text{ yes}$$

10. $\vec{v} = \langle 0, -7 \rangle$ and $\vec{w} = \langle 11, -2 \rangle$

$$0 + 14 = 14 \text{ no}$$

11. $\vec{u} = \vec{i} + 2\vec{j}$ and $\vec{v} = 2\vec{i} - \vec{j}$

$$2 - 2 = 0 \text{ yes}$$

12. $\vec{u} = 10\vec{i} - 2\vec{j}$ and $\vec{v} = 2\vec{i} + 9\vec{j}$

$$20 - 18 = 2 \text{ no}$$

* When dot product equals 0 then \perp . If it doesn't = 0, then not \perp .

or the following problems find the dot product of the vectors given their magnitude and the angle in between the two vectors (round to the nearest hundredth):

$$\cos \theta = \frac{a \cdot b}{\|a\| \cdot \|b\|}$$

3. If $\|\vec{a}\| = 7$, $\|\vec{b}\| = 8$, and $\theta = 155^\circ$

$$\cos 155^\circ = \frac{a \cdot b}{7 \cdot 8}$$

$$a \cdot b = \boxed{-50.75}$$

14. If $\|\vec{c}\| = 3$, $\|\vec{d}\| = 11$, and $\theta = 65^\circ$

$$\cos 65^\circ = \frac{c \cdot d}{3 \cdot 11}$$

$$c \cdot d = \boxed{13.95}$$

15. If $\|\vec{e}\| = 5$, $\|\vec{f}\| = 7$, and $\theta = 102^\circ$

$$\cos 102^\circ = \frac{e \cdot f}{5 \cdot 7}$$

$$e \cdot f = \boxed{-7.28}$$

16. If $\|\vec{g}\| = 11$, $\|\vec{h}\| = 2$, and $\theta = 14^\circ$

$$\cos 14^\circ = \frac{g \cdot h}{11 \cdot 2}$$

$$g \cdot h = \boxed{21.35}$$

For the following problems find the angle between the two vectors given their dot product (round to the nearest hundredth):

17. If $\|\vec{g}\| = 10$, $\|\vec{h}\| = 20$, and $\vec{g} \cdot \vec{h} = -35$

$$\text{find } \theta = \boxed{100.08^\circ}$$

$$\cos \theta = \frac{g \cdot h}{\|g\| \|h\|}$$

$$\cos \theta = \frac{-35}{200}$$

$$\theta = \cos^{-1}\left(\frac{-7}{40}\right)$$

$$\cos \theta = \frac{-35}{10 \cdot 20}$$

18. If $\|\vec{v}\| = 12$, $\|\vec{w}\| = 6$, and $\vec{v} \cdot \vec{w} = 67$

$$\text{find } \theta = \boxed{21.48^\circ}$$

$$\cos \theta = \frac{67}{12 \cdot 6}$$

$$\theta = \cos^{-1}\left(\frac{67}{72}\right)$$

Answers:

1) 9 2) 26 3) 1/3 4) 0 5) 102.53° 6) 90° 7) 161.57° 8) 85.89° 9) yes 10) no

11) yes 12) no 13) -50.75 14) 13.95 15) -7.28 16) 21.35 17) 100.08° 18) 21.48°