PreCalculus Test Review
Vectors - Extra Practice WS

Name Key

<u>To prepare for the test, be sure you review/practice ALL problems from the quiz AND worksheets!!!</u>

Use the following vectors to find the requested information for # 1-13 on this worksheet. Round to the hundredth, if necessary. Write answers as the same vector format as it appears in the problem, unless otherwise stated.

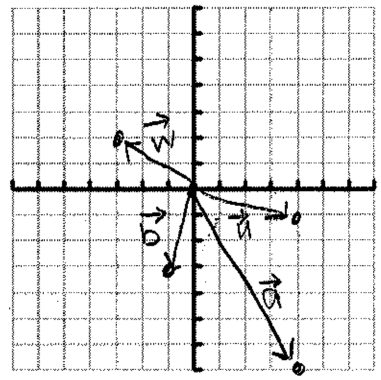
$\vec{a} = \langle 4, -7 \rangle$

$\vec{b} = \langle -1, -3 \rangle$

$\vec{w} = -3\vec{i} + 2\vec{j}$

$\vec{u} = 4\vec{i} - \vec{j}$

1. Graph and label each vector.



2. The direction of vector $\vec{b}$

3. The magnitude of vector $\vec{a}$

4. $\|\vec{w}\|$

5. $\vec{a} \bullet \vec{b}$

6. $\frac{1}{2}\vec{b} - 4\vec{a}$

7. $3\vec{w} + 6\vec{u}$

8. $\vec{w} \bullet \vec{u}$

9. A unit vector in the same direction as $\vec{b}$ (give an EXACT answer here—no decimals)

10. A vector with magnitude 7 and the same direction as vector $\vec{w}$

11. The angle between vectors $\vec{w}$ and $\vec{u}$ when the vectors are placed tail to tail.

12. Write vector $\vec{b}$ in trig form.

13. Are vectors $\vec{a}$ and $\vec{b}$ orthogonal? Why or why not? What are orthogonal vectors?

2. $\theta = \tan^{-1}\left(\frac{-3}{-1}\right)$

$= \tan^{-1}(3)$

$= 71.56 + 180 = \boxed{251.57^\circ}$

3. $\sqrt{4^2 + (-7)^2} = \sqrt{16 + 49} = \boxed{\sqrt{65} \approx 8.06}$

4. $\sqrt{(-3)^2 + (2)^2} = \sqrt{9 + 4} = \boxed{\sqrt{13} \approx 3.61}$

5. $\langle 4, -7 \rangle \cdot \langle -1, -3 \rangle$

$4(-1) + -7(-3) = -4 + 21 = \boxed{17}$

6. $\frac{1}{2}\langle -1, -3 \rangle + 4\langle 4, -7 \rangle$

$\langle -\frac{1}{2}, -\frac{3}{2} \rangle + \langle -16, 28 \rangle = \boxed{\langle -16.5, 26.5 \rangle}$

7. $3(-3i + 2j) + 6(4i - j)$

$-9i + 6j + 24i - 6j = 15i + 0j = \boxed{15i}$

8. $(-3i + 2j) \cdot (4i - j) = -3(4) + 2(-1) = -12 - 2 = \boxed{-14}$

9. $\frac{\langle -1, -3 \rangle}{\sqrt{(-1)^2 + (-3)^2}} = \frac{\langle -1, -3 \rangle}{\sqrt{1 + 9}} = \frac{\langle -1, -3 \rangle}{\sqrt{10}} = \left\langle \frac{-1}{\sqrt{10}}, \frac{-3}{\sqrt{10}} \right\rangle = \boxed{\left\langle \frac{-\sqrt{10}}{10}, \frac{-3\sqrt{10}}{10} \right\rangle}$

10. $\vec{w} = -3i + 2j$

unit vector $= \frac{-3i + 2j}{\sqrt{(-3)^2 + 2^2}} = \frac{-3i + 2j}{\sqrt{9 + 4}} = \frac{-3i + 2j}{\sqrt{13}} = \frac{-3}{\sqrt{13}}i + \frac{2}{\sqrt{13}}j =$

$\frac{-3\sqrt{13}}{13}i + \frac{2\sqrt{13}}{13}j$

length 7 $= 7 \cdot$ unit vector

$= 7 \cdot \left(\frac{-3\sqrt{13}}{13}i + \frac{2\sqrt{13}}{13}j\right) = \boxed{\frac{-21\sqrt{13}}{13}i + \frac{14\sqrt{13}}{13}j}$ or $\boxed{-5.82i + 3.88j}$

11. $\cos\theta = \dfrac{w \cdot u}{\|w\|\|u\|}$ $\leftarrow w \cdot u = \text{see } \#8 = -14$

$\leftarrow \|w\| = \text{see } \#4 = \sqrt{13}$

$\cos\theta = \dfrac{-14}{\sqrt{13} \cdot \sqrt{17}}$ $\leftarrow \|u\| = \sqrt{4^2 + (-1)^2}$

$= \sqrt{16+1}$

$\cos\theta = \dfrac{-14}{\sqrt{221}}$ $= \sqrt{17}$

$\rightarrow \theta = \cos^{-1}\left(\frac{-14}{\sqrt{221}}\right) \rightarrow \boxed{\theta = 160.35°}$

12. $\langle -1, -3 \rangle$

$r = \sqrt{(-1)^2 + (-3)^2} = \sqrt{1+9} = \sqrt{10}$

$\theta = \text{see } \#2 = 251.57°$

$r\langle \cos\theta, \sin\theta \rangle$

$\boxed{\sqrt{10}\langle \cos 251.57°, \sin 251.57° \rangle}$

13. See #5 = 17.

No, dot product does not = 0.

Orthogonal means vectors are perpendicular.

14. $\overrightarrow{PR} = \langle 3 + 2, -2 - 4 \rangle$

$= \boxed{\langle 5, -6 \rangle \text{ or } 5i - 6j}$

15. $d\langle \cos\theta, \sin\theta \rangle$

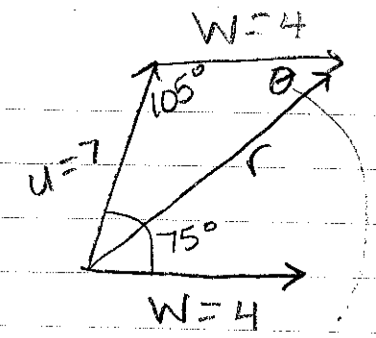
$3\sqrt{2}\langle \cos 150°, \sin 150° \rangle$

$3\sqrt{2}\left\langle -\frac{\sqrt{3}}{2}, \frac{1}{2} \right\rangle$

$\boxed{\left\langle -\frac{3\sqrt{6}}{2}, \frac{3\sqrt{2}}{2} \right\rangle}$

$$\begin{array}{r} 180 \\ -75 \\ \hline 105^\circ \end{array}$$

16. a.)



$r = \sqrt{u^2 + w^2 - 2uw\cos R}$

$r = \sqrt{7^2 + 4^2 - 2(7)(4)\cos 105^\circ}$

$r = \boxed{8.92}$

b.) $u^2 = w^2 + r^2 - 2wr\cos u$

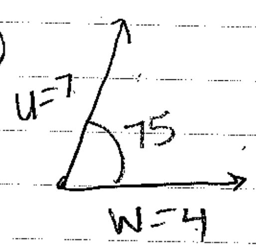
$7^2 = 4^2 + 8.92^2 - 2(4)(8.92)\cos u$

$-46.5664 = -71.36\cos u$

$.65 = \cos u$

$\boxed{49.27^\circ} = u$

c.)



$u \cdot w = \|u\|\,\|w\|\cos\theta$

$u \cdot w = 7 \cdot 4\cos 75^\circ$

$u \cdot w = \boxed{7.25}$

17. $w \cdot v = \|w\|\,\|v\|\cos\theta$

$12 = 5 \cdot 3\cos\theta$

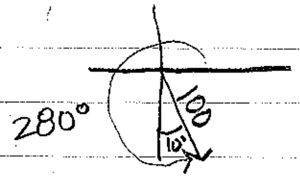
$12 = 15\cos\theta$

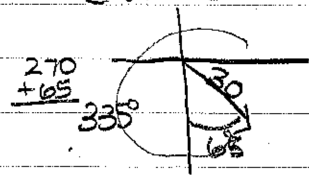
$.8 = \cos\theta$

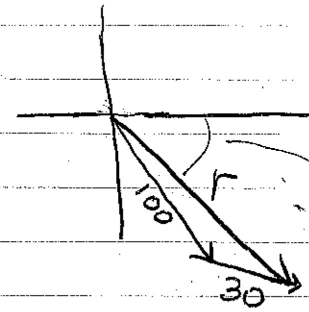
$\theta = \boxed{36.87^\circ}$

$$\begin{array}{r} 270 \\ +10 \\ \hline 280 \end{array}$$

18. a.) Scuba Current







b.) $100\langle \cos 280°, \sin 280° \rangle$
$+\ 30\langle \cos 335°, \sin 335° \rangle$
$\langle 44.55, -111.16 \rangle$

$\sqrt{44.55^2 + (-111.16)^2} \approx \boxed{119.75 \text{ ft/min}}$

c.) $\theta = \tan^{-1}\left(\dfrac{-111.16}{44.55}\right)$
$= -68.16°$

$\boxed{E\ 68.16°\ S}$