PreCalculus Test Review
Vectors - Extra Practice WS

Name ____________________

<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.

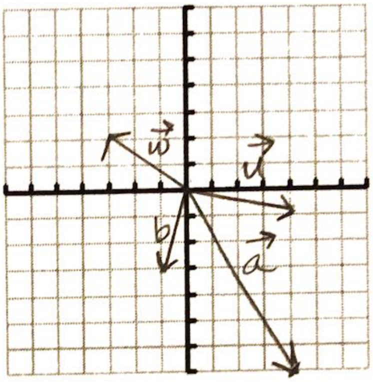
$\vec{a} = \langle 4, -7 \rangle$

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

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

$\vec{u} = 4\vec{i} - \vec{j}$ $\langle 4, -1 \rangle$

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

$\theta = \tan^{-1}(3) = 71.56$

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

$180 + 71.56$

$= \boxed{251.57^\circ}$

3. $\vec{a} = \langle 4, -7 \rangle \quad \sqrt{(4)^2 + (-7)^2} = \sqrt{16+49} = \sqrt{65} \approx \boxed{8.06}$

4. $\vec{w} = -3i + 2j \quad \|w\| = \sqrt{(-3)^2 + (2)^2} = \sqrt{9+4} = \sqrt{13} \approx \boxed{3.61}$

5. $\vec{a} \cdot \vec{b} \quad \langle 4, -7 \rangle \langle -1, -3 \rangle = 4(-1) + -7(-3) =$

$-4 + 21 = \boxed{17}$

6. $\frac{1}{2}\vec{b} - 4\vec{a} \quad \frac{1}{2}\langle -1, -3 \rangle - 4\langle 4, -7 \rangle = \langle -\frac{1}{2}, -\frac{3}{2} \rangle + \langle -16, 28 \rangle$

$= \boxed{\langle -16.5, 26.5 \rangle}$

7. $3\vec{w} + 6\vec{u} \quad 3(-3i + 2j) + 6(4i - j)$

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

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

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

$= \left\langle -\dfrac{\sqrt{10}}{10}, -\dfrac{3\sqrt{10}}{10} \right\rangle$

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

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

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

length of 7: $7(\text{unit vector}) = 7\left(-\dfrac{3\sqrt{13}}{13}i + \dfrac{2\sqrt{13}}{13}j\right)$

$= \boxed{-\dfrac{21\sqrt{13}}{13}i + \dfrac{14\sqrt{13}}{13}j}$ or $\boxed{-5.82i + 3.88j}$

11. $\cos\theta = \dfrac{\vec{w}\cdot\vec{u}}{\|\vec{w}\|\,\|\vec{u}\|}$

$\vec{w}\cdot\vec{u}$ (see #8) $= -14$

$\|w\|$ (see #4) $= \sqrt{13}$

$\|\vec{u}\| = \sqrt{(4)^2+(-1)^2} = \sqrt{16+1} = \sqrt{17}$

$\cos\theta = \dfrac{-14}{\sqrt{13}\sqrt{17}}$

$\theta = \cos^{-1}\left(\dfrac{-14}{\sqrt{221}}\right)$ $\boxed{\theta = 160.35^\circ}$

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

Direction of $\vec{b}$ (see #2) $= 251.57^\circ$

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

$\boxed{\vec{b} = \sqrt{10}\langle \cos 251.57^\circ, \sin 251.57^\circ\rangle}$

13. $\langle 4,-7\rangle\cdot\langle -1,-3\rangle$ (see #5) $= 17$

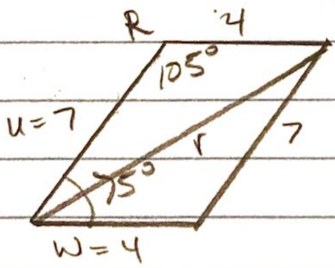
Dot product does not equal zero so these vectors are not orthogonal (perpendicular)

14. $\langle 3-{}^-2, -2-4\rangle = \boxed{\langle 5,-6\rangle}$

15. $\vec{d} = 3\sqrt{2}\langle \cos 150^\circ, \sin 150^\circ\rangle$

$= 3\sqrt{2}\left\langle -\dfrac{\sqrt{3}}{2}, \dfrac{1}{2}\right\rangle = \boxed{\left\langle -\dfrac{3\sqrt{6}}{2}, \dfrac{3\sqrt{2}}{2}\right\rangle}$

16.



$180^\circ - 75^\circ = 105^\circ$

a) $r = \sqrt{u^2 + w^2 - 2\cdot u\cdot w\cdot \cos R}$

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

$\boxed{r = 8.92}$

b) $u^2 = w^2 + r^2 - 2(w)(r)\cos U$

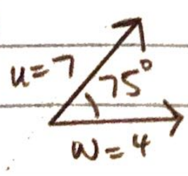
$7^2 = \underbrace{4^2 + 8.92^2}\ - \underbrace{2(4)(8.92)}\cos U$

$49 = 95.5664 - 71.36\cos U$

$-46.5664 = -71.36\cos U$

$U = \cos^{-1}\left(\dfrac{46.5664}{71.36}\right)$ $\boxed{U = 49.27^\circ}$

c)



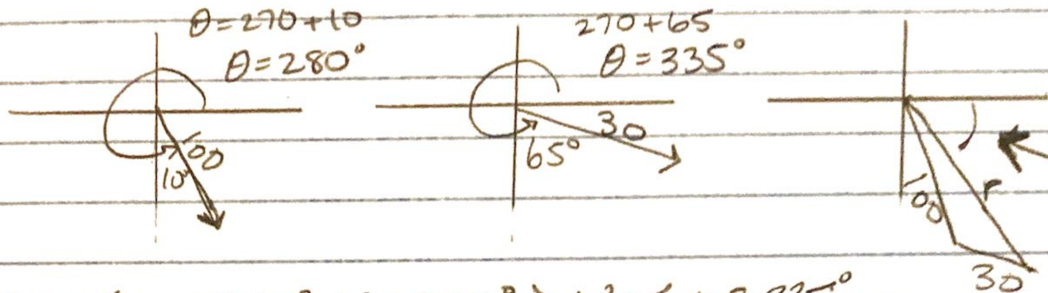
$u\cdot w = \|u\|\,\|w\|\cos\theta$

$u\cdot w = 7\cdot 4\cdot\cos 75^\circ = \boxed{7.25}$

17. $\cos\theta = \dfrac{\vec{w}\cdot\vec{v}}{\|w\|\,\|v\|}$

$\cos\theta = \dfrac{12}{5\cdot 3}$ $\cos\theta = \dfrac{12}{15}$ $\theta = \cos^{-1}\left(\frac{4}{5}\right)$ $\boxed{\theta = 36.87^\circ}$

18. a.



b. $r = 100\langle \cos 280^\circ, \sin 280^\circ\rangle + 30\langle \cos 335^\circ, \sin 335^\circ\rangle$

$\langle 44.55, -111.16\rangle$

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

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

$\theta = \tan^{-1}(-2.495)$

$\theta = -68.16$ $\boxed{\text{E } 68.16 \text{ S}}$