

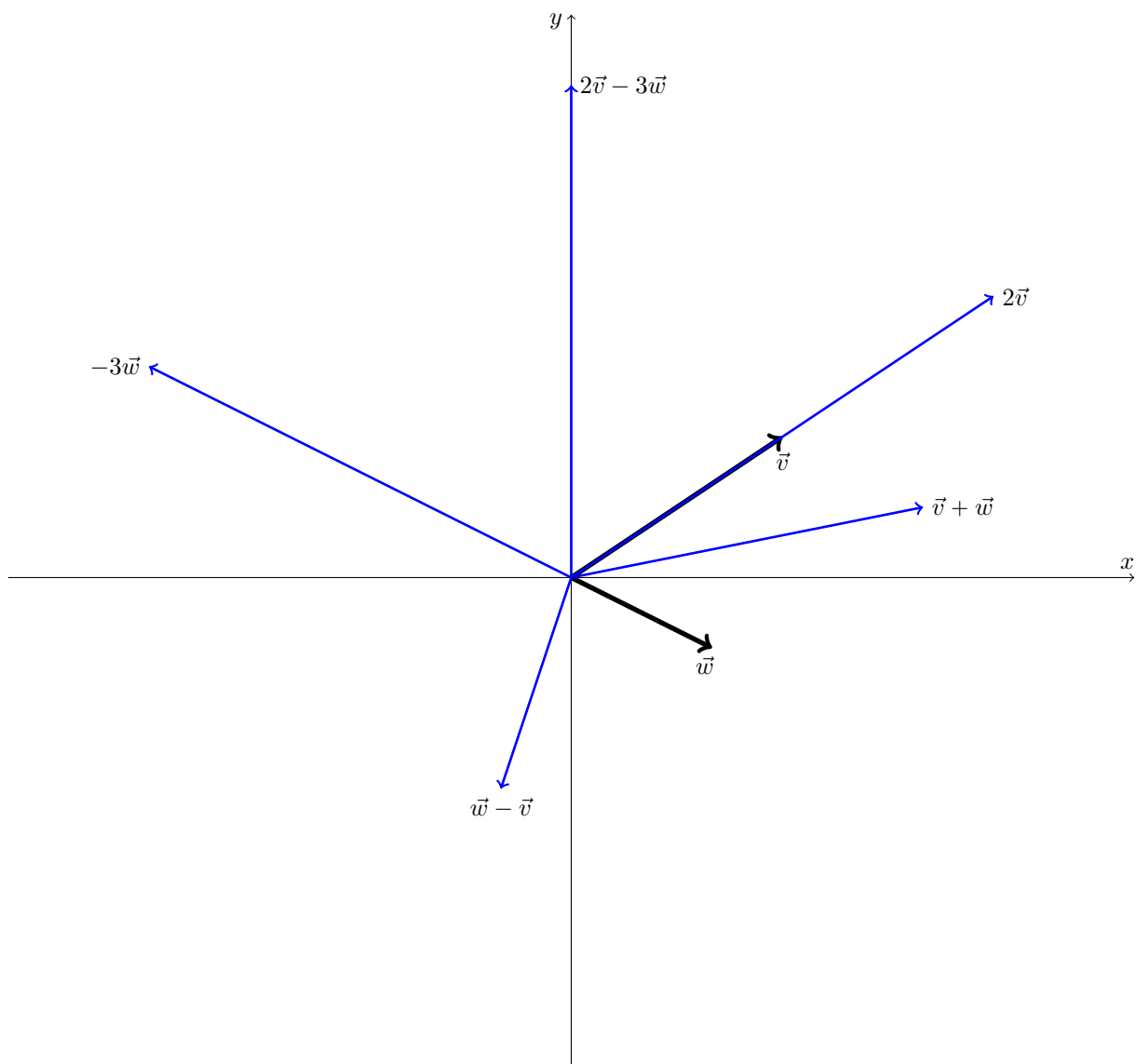
Name: _____

Score: _____ /20

Practice with Vectors

Please staple your work and use this page as a cover page.

1. On the given set of axes, sketch $\vec{v} + \vec{w}$, $\vec{w} - \vec{v}$, $2\vec{v}$, $-3\vec{w}$, and $2\vec{v} - 3\vec{w}$.



2. $\vec{v} - \vec{w} = \langle 3, 3, -3 \rangle$

$$\vec{u} = \frac{\vec{v} - \vec{w}}{|\vec{v} - \vec{w}|} = \frac{\langle 3, 3, -3 \rangle}{\sqrt{9+9+9}} = \left\langle \frac{3}{\sqrt{27}}, \frac{3}{\sqrt{27}}, -\frac{3}{\sqrt{27}} \right\rangle.$$

3. (a) $\cos \theta = \frac{\langle 2, 7 \rangle \cdot \langle 3, -1 \rangle}{|\langle 2, 7 \rangle| |\langle 3, -1 \rangle|} = \frac{-1}{\sqrt{53}\sqrt{10}}$ so $\theta = 1.61$ rad (2 dec plcs)

(b) $\cos \theta = \frac{-15 - 12 + 2}{\sqrt{14}\sqrt{65}}$ so $\theta = 2.55$ rad (2 dec plcs).

4. Find a vector that is orthogonal to each given pair of vectors.

(a) $\vec{a} \times \vec{b} = (4 + 18)\hat{i} + (18 - 2)\hat{j} + (-6 - 12)\hat{k} = 22\hat{i} + 16\hat{j} - 18\hat{k}$.

(b) $\langle 10, 5, -3 \rangle \times \langle 4, 7, 2 \rangle = \langle 10 + 21, -12 - 20, 70 - 20 \rangle = \langle 31, -32, 50 \rangle$

5. Direction from Bond to Green: $\langle -4, -2 \rangle - \langle 1, 6 \rangle = \langle -5, -8 \rangle$

$$\cos \theta = \frac{\langle -5, -8 \rangle \cdot \langle -1, 2 \rangle}{|\langle -5, -8 \rangle| |\langle -1, 2 \rangle|} = \frac{-11}{\sqrt{89}\sqrt{5}} \text{ so } \theta = 2.12 \text{ rad (2 dec plcs).}$$

6. Displacement $\vec{D} = \langle 8 - 4, 1 + 3, 7 + 3 \rangle = \langle 4, 4, 10 \rangle$

$$W = \vec{F} \cdot \vec{D} = -24 + 4 + 110 = 90 \text{ Joules.}$$

7. (a) For example, $\vec{b} = \langle 1, 2, -3 \rangle$

(b) Let $\vec{c} = \vec{a} \times \vec{b} = \langle -15 - 4, 2 - 12, -8 - 5 \rangle = \langle -19, -10, -13 \rangle$

8. $0 = \langle 1, -3, -2 \rangle \cdot \langle 2a, a, 3 \rangle = -a - 6$ so $a = -6$.