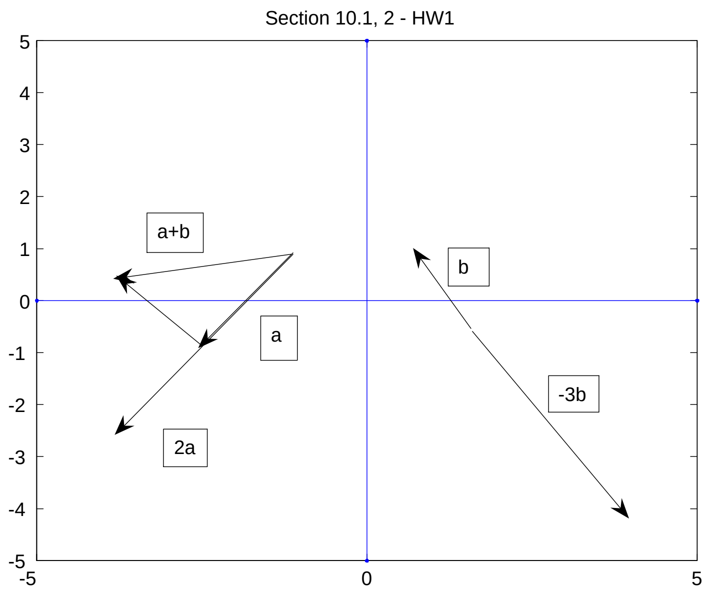
Homework Assignment 1 - (10.1) - Solutions

Page 794: 1, 2*, 3, 4*, 9, 10*, 17, 18*, 19, 20(a)*, 25, 26*

2.



4. $\vec{a} = \langle 3,-2\rangle,\ \vec{b} = \langle 2,0\rangle$

- $\vec{a} + \vec{b} = \langle 3,-2\rangle + \langle 2,0\rangle = \langle 5,-2\rangle$
- $\vec{a} - 2\vec{b} = \langle 3,-2\rangle - \langle 4,0\rangle = \langle -1,-2\rangle$
- $3\vec{a} = 3\langle 3,-2\rangle = \langle 9,-6\rangle$
- $5\vec{b} - 2\vec{a} = 5\langle 2,0\rangle - 2\langle 3,-2\rangle = \langle 10,0\rangle - \langle 6,-4\rangle = \langle 4,4\rangle$

  $\left\| 5\vec{b} - 2\vec{a} \right\| = \sqrt{(4)^2 + (4)^2} = \sqrt{32} = 4\sqrt{2}$

10. $\vec{a} = \langle 1,-2\rangle,\ \vec{b} = \langle 2,1\rangle$

Since $\frac{u_1}{v_1} = \frac{1}{2} \neq \frac{u_2}{v_2} = \frac{-2}{1}$, $\vec{a}$ and $\vec{b}$ are not parallel.

18. $A(1,1),\ B(-2,4)$

$\vec{u} = \langle -2-1,\ 4-1\rangle = \langle -3,3\rangle$

20(a). $\vec{u} = \langle 3,6\rangle$,

a. $\|\vec{u}\| = \sqrt{3^2+6^2} = 3\sqrt{5}$, the unit vector $= \frac{1}{3\sqrt{5}}\langle 3,6\rangle = \left\langle \frac{1}{\sqrt{5}}, \frac{2}{\sqrt{5}} \right\rangle$

b. Extra points: $r = \|\vec{u}\| = 3\sqrt{5}$, $\cos(\theta) = \frac{3}{3\sqrt{5}} = \frac{1}{\sqrt{5}}$, and $\sin(\theta) = \frac{6}{3\sqrt{5}} = \frac{2}{\sqrt{5}}$,

$\theta = \arctan\left(\frac{6}{3}\right) = \arctan(2)$

Polar form: $\vec{u} = 3\sqrt{5}\left\langle \frac{1}{\sqrt{5}}, \frac{2}{\sqrt{5}} \right\rangle$

26. magnitude 4, $\vec{v} = 2\vec{i} - \vec{j}$

Find $\vec{u}$ such that $\vec{u} = c\vec{v}$, $c > 0$ and $||\vec{u}|| = 4$

$$||\vec{u}|| = c||\vec{v}|| = c\sqrt{2^2 + (-1)^2} = c\sqrt{5} = 4,\ c = \frac{4}{\sqrt{5}},$$

$$\vec{u} = \frac{4}{\sqrt{5}}\left(2\vec{i} - \vec{j}\right) = \frac{8}{\sqrt{5}}\vec{i} - \frac{4}{\sqrt{5}}\vec{j} = \left\langle \frac{8}{\sqrt{5}}, -\frac{4}{\sqrt{5}} \right\rangle$$

32. Extra points: $f_1 = \langle 0, -200 \rangle$, $f_2 = \langle 0, 180 \rangle$, $f_3 = \langle 40, 0 \rangle$

the net of forces: $f = f_1 + f_2 + f_3 = \langle 0, -200 \rangle + \langle 0, 180 \rangle + \langle 40, 0 \rangle = \langle 40, -20 \rangle$

48. $(1,2)$, $(3,1)$, $(4,3)$ and $(2,4)$

$\vec{u} = \langle 3-1, 1-2 \rangle = \langle 2, -1 \rangle$, $\vec{v} = \langle 4-3, 3-1 \rangle = \langle 1, 2 \rangle$, $\vec{w} = \langle 2-4, 4-3 \rangle = \langle -2, 1 \rangle$, $\vec{x} = \langle 1-2, 2-4 \rangle$

Since $\vec{u} \| \vec{w}$ and $\vec{v} \| \vec{x}$, these 4 points form a parallelogram.

47. $\left\|\vec{a} + \vec{b}\right\| \leq \|\vec{a}\| + \left\|\vec{b}\right\| = 3 + 4 = 7$

$\left\|\vec{a} + \vec{b}\right\| \geq \left\|\vec{b}\right\| - \|\vec{a}\| = 1$

When $\vec{a}$ and $\vec{b}$ are perpendicular, $\left\|\vec{a} + \vec{b}\right\| = \sqrt{\|\vec{a}\|^2 + \left\|\vec{b}\right\|^2} = \sqrt{9 + 16} = 5$