Homework 1.2

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1. - Magnitude: $\sqrt{3^2+4^2} = 5$ feet per second
   - Direction: $\frac{1}{5}\langle 3,4\rangle = \langle \frac{3}{5}, \frac{4}{5}\rangle$

3. - Magnitude: $\sqrt{(-6)^2+(1)^2+(6)^2} = \sqrt{73}$ meters per second
   - Direction: $\frac{1}{\sqrt{73}}\langle -6,1,6\rangle = \langle \frac{-6}{\sqrt{73}}, \frac{1}{\sqrt{73}}, \frac{6}{\sqrt{73}}\rangle$

5. - Magnitude: $\sqrt{(1)^2+(-1)^2+(1)^2+(-1)^2} = 2$
   - Direction: $\frac{1}{2}\langle 1,-1,1,-1\rangle = \langle \frac{1}{2}, -\frac{1}{2}, \frac{1}{2}, -\frac{1}{2}\rangle$

7. - Magnitude: $\sqrt{(2)^2+(-3)^2+(1)^2} = \sqrt{14}$
   - Direction: $\frac{1}{14}(2\mathbf{i} - 3\mathbf{j} + \mathbf{k}) = \frac{2}{14}\mathbf{i} - \frac{3}{14}\mathbf{j} + \frac{1}{14}\mathbf{k}$

9.

10.

13. $1\left(-\frac{1}{2}\right)+2(-1) = -2.5 \Rightarrow \left(\frac{-2.5}{\sqrt{5}}\right)\left(\frac{\sqrt{5}}{2}\right) = -1 \Rightarrow \cos^{-1}(-1) = 0$, thus the angle between them is zero. Because one of the vectors is negative and one is positive, they are in opposite directions.

14. $3(-6)+4(-7) = -46 \Rightarrow \frac{-46}{(5)(\sqrt{85})} \neq \pm 1$, so they are not parallel

15. $1(2)+(-2)(-4)+3(5) = 25 \Rightarrow \frac{25}{(\sqrt{14})(\sqrt{45})} \neq \pm 1$, so they are not parallel

16. The second vector is a scaled, positive multiple of the first one ($3\overline{v}_1 = \overline{v}_2$), so they are parallel and in the same direction

19. $a = \frac{\sum \overline{F}}{m} = \frac{1}{2}\left(\langle 0,4\rangle\right) = \langle 0,2\rangle$

20. $a = \frac{1}{2}\left(\langle -1,10,7\rangle\right) = \langle -.5,5,3.5\rangle$

21. $a = \frac{1}{2}\left(\mathbf{i}+\mathbf{j}+\mathbf{k}\right) = \frac{1}{2}\mathbf{i} + \frac{1}{2}\mathbf{j} + \frac{1}{2}\mathbf{k}$

23. $\langle 6,-9\rangle \Rightarrow \sqrt{36+81}=\sqrt{117}$ feet per second

24. $\langle 7,4,-2\rangle \Rightarrow \sqrt{49+16+4}=\sqrt{69}$ feet per second

27. $\overline{d}=b-a=\langle -3,-5\rangle$

- Magnitude: $\sqrt{9+25}=\sqrt{34}$
- Direction: $\frac{1}{\sqrt{34}}\langle -3,-5\rangle=\langle -\frac{3}{\sqrt{34}},-\frac{5}{\sqrt{34}}\rangle$

29. $\overline{d}=\langle -1,-4,-3\rangle$

- Magnitude: $\sqrt{1+16+9}=\sqrt{26}$
- Direction: $\frac{1}{\sqrt{26}}\langle -1,-4,-3\rangle=\langle -\frac{1}{\sqrt{26}},-\frac{4}{\sqrt{26}},-\frac{3}{\sqrt{26}}\rangle$

33. $\overline{u}=\frac{\langle 3,4\rangle}{5}=\langle \frac{3}{5},\frac{4}{5}\rangle$

- Magnitude of 3: $3\langle \frac{3}{5},\frac{4}{5}\rangle=\langle \frac{9}{5},\frac{12}{5}\rangle$
- Magnitude of 7: $7\langle \frac{3}{5},\frac{4}{5}\rangle=\langle \frac{21}{5},\frac{28}{5}\rangle$

36. $\overline{u}=\frac{\langle 2,-1,3\rangle}{\sqrt{1+4+9}}=\langle \frac{2}{\sqrt{14}},-\frac{1}{\sqrt{14}},\frac{3}{\sqrt{14}}\rangle$

- Magnitude of 3: $3\langle \frac{2}{\sqrt{14}},-\frac{1}{\sqrt{14}},\frac{3}{\sqrt{14}}\rangle=\langle \frac{6}{\sqrt{14}},-\frac{3}{\sqrt{14}},\frac{9}{\sqrt{14}}\rangle$
- Magnitude of 7: $7\langle \frac{2}{\sqrt{14}},-\frac{1}{\sqrt{14}},\frac{3}{\sqrt{14}}\rangle=\langle \frac{14}{\sqrt{14}},-\frac{7}{\sqrt{14}},\frac{21}{\sqrt{14}}\rangle$

41. It becomes -15

42. It is 13

43. $\overline{v}=\langle \sqrt{3},\sqrt{3}\rangle$

45. $\overline{a}_i=\frac{30\mathbf{j}}{3}=10\mathbf{j}\Rightarrow \overline{g}=-9.81\overline{j}\Rightarrow \sum\overline{a}=10\mathbf{j}-9.81\mathbf{j}=.19\mathbf{j}$, so it has an upward acceleration of .19 $\left[\frac{\mathrm{m}}{\mathrm{s}^2}\right]$, but the direction of movement can not be determined

46. $F_g=\frac{Gm_1m_2}{r^2}=\frac{6.674(10)^{-11}(3)(5)}{\langle 1,3,4\rangle^2}=G\langle 15,135,240\rangle$