

Homework 1.3

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1. $2(-1) + 3(2) = 4 \Rightarrow 4 > 0$, so the angle is acute
2. $\sqrt{2}(\sqrt{18}) + (3)(-2) = 0$, so the angle is right
3. $1(3) + 2(-2) + 3(1) = 8 \Rightarrow 8 > 0$, so the angle is acute
4. $6(-3) + 4(-2) + 2(-1) = -28 \Rightarrow -28 < 0$, so the angle is obtuse
9. $2(-1) + 3(2) = 4 \Rightarrow \frac{4}{\sqrt{13}\sqrt{5}} \Rightarrow \theta = \cos^{-1}\left(\frac{4}{\sqrt{65}}\right)$
10. $\sqrt{2}(\sqrt{18}) + 3(-2) = 0 \Rightarrow \theta = \cos^{-1}(0) = \frac{\pi}{2}$
11. $1(3) + 2(-2) + 3(1) = 8 \Rightarrow \frac{8}{14} \Rightarrow \theta = \cos^{-1}\left(\frac{4}{7}\right)$
12. $6(-3) + 4(-2) + 2(-1) = -28 \Rightarrow \frac{-28}{\sqrt{56}\sqrt{14}} = -1 \Rightarrow \theta = \cos^{-1}(-1) = \pi$
17. $2(3) - 3(-1) = 3$
18. $2(3) - 3(0) = 6$
19. $0 - 3 + 1 - (-1) = 5$
22. $\frac{3}{(2)(5)} = .3$
23. $\sqrt{(4) + 10(0) + 25} = \sqrt{29}$
27. $(-1)(6) + 3(2) = 0 \Rightarrow \langle -1, 3 \rangle$ is $\perp \langle 6, 2 \rangle$
28. $1(\pi) + (-1)(\pi) = 0 \Rightarrow \langle 1, -1 \rangle$ is $\perp \langle \pi, \pi \rangle$
29. $3(2) + (-2)(3) + 1(0) = 0 \Rightarrow \langle 3, -2, 1 \rangle$ is $\perp \langle 2, 3, 0 \rangle$
30. None of the vectors are parallel or perpendicular to any of the other ones
33. $\overline{u_v} = \frac{\langle 1, -1 \rangle}{\sqrt{2}} = \langle \frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}} \rangle \Rightarrow \overline{F_v} = \left(\frac{2}{\sqrt{2}} + -\frac{3}{\sqrt{2}}\right) \langle \frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}} \rangle = \langle -\frac{1}{2}, \frac{1}{2} \rangle \Rightarrow \overline{F_n} = \langle 2, 3 \rangle - \langle -.5, .5 \rangle = \langle 2.5, 2.5 \rangle$

- $\overline{F}_v \cdot \overline{F}_n = (-.5)(2.5) + (.5)(2.5) = 0 \Rightarrow \text{Orthogonal} \checkmark$

34. $\overline{u} = \frac{\langle -2, 2 \rangle}{\sqrt{8}} = \langle -\frac{2}{\sqrt{8}}, \frac{2}{\sqrt{8}} \rangle \Rightarrow \overline{F}_v = \left(-\frac{4}{\sqrt{8}} + \frac{6}{\sqrt{8}} \right) \langle -\frac{2}{\sqrt{8}}, \frac{2}{\sqrt{8}} \rangle = \langle -.5, .5 \rangle \Rightarrow \overline{F}_n = \langle 2, 3 \rangle - \langle -.5, .5 \rangle = \langle 2.5, 2.5 \rangle$

- $\overline{F}_v \cdot \overline{F}_n = (-.5)(2.5) + (.5)(2.5) = 0 \Rightarrow \text{Orthogonal} \checkmark$

35. $\overline{u} = \frac{\langle 1, -1, 0 \rangle}{\sqrt{2}} = \langle \frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}, 0 \rangle \Rightarrow \overline{F}_v = \left(\frac{1}{\sqrt{2}} - \frac{2}{\sqrt{2}} + 0 \right) \langle \frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}, 0 \rangle = \langle -.5, .5, 0 \rangle \Rightarrow \overline{F}_n = \langle 1, 2, 3 \rangle - \langle -.5, .5, 0 \rangle = \langle 1.5, 1.5, 3 \rangle$

- $\overline{F}_v \cdot \overline{F}_n = (-.5)(1.5) + (.5)(1.5) + (3)(0) = 0 \Rightarrow \text{Orthogonal} \checkmark$

45. $W = \overline{F} \cdot \overline{d} = (5)(2) + (-1)(3) = 7 \text{ Joules}$

46. $W = (2)(-1) + (3)(2) + (1)(-4) = 0 \text{ Joules}$

47. $\overline{d} = \langle 1, 7, 6 \rangle \Rightarrow W = (1)(1) + (1)(7) + (1)(6) = 14 \text{ Joules}$

48. $\overline{d} = \langle -1, 0, 1 \rangle \Rightarrow W = (2)(-1) + (3)(0) + (1)(1) = -1 \text{ Joule}$