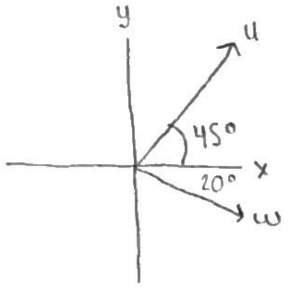
12.1 - # 5, 7, 9, 11, 15, 21, 41, 47

5. components of u = ?



$V_x = U\cos(45)$

$V_y = U\sin(45)$

$\vec{u} = \langle u\cos(45, u\sin(45)\rangle$

7. components of w = ?

$V_x = w\cos(340)$

$V_y = w\sin(340)$

$\vec{w} = \langle w\cos(340), w\sin(340)\rangle$

9. Components of $\vec{PQ}$ = ?

$P = (3,2)$ $\quad d(P,Q) = \sqrt{(2-3)^2 + (7-2)^2}$

$Q = (2,7)$ $\quad = \sqrt{(-1)^2 + (5)^2}$

$|\vec{PQ}| = \sqrt{26}$ units

$\vec{PQ} = (x_Q - x_P)\hat{\imath} + (y_Q - y_P)\hat{\jmath}$

$= (2-3)\hat{\imath} + (7-2)\hat{\jmath}$

$= -1\hat{\imath} + 5\hat{\jmath}$

$\vec{PQ} = \langle -1, 5\rangle$

11. $P = (3,5)$

$Q = (1,-4)$

$\vec{PQ} = (x_Q - x_P)\hat{\imath} + (y_Q - y_P)\hat{\jmath}$

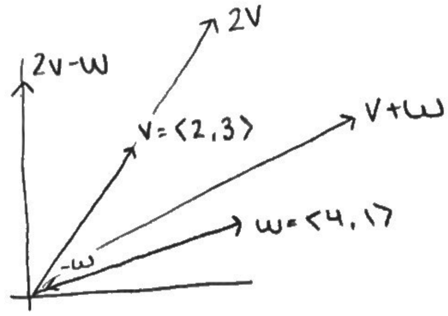
$= (1-3)\hat{\imath} + (-4-5)\hat{\jmath}$

$= -2\hat{\imath} - 9\hat{\jmath}$

$\vec{PQ} = \langle -2, -9\rangle$

15. $5\langle 6,2\rangle = \langle 30,10\rangle$

21.



$V + w = \langle 2+4, 3+1\rangle = \langle 6,4$

$2v - w = 2\langle 2,3\rangle - \langle 4,1\rangle$

$= \langle 4,6\rangle - \langle 4,1\rangle$

$= \langle 0,5\rangle$

41. unit vector e_v where $v = \langle 3,4\rangle$

$e_v = \frac{V}{|V|} = \frac{\langle 3,4\rangle}{5} \rightarrow e_v = \frac{3}{5}\hat{\imath} + \frac{4}{5}\hat{\jmath}$

$|V| = \sqrt{(3)^2 + (4)^2}$

$|V| = \sqrt{9+16}$

$|V| = \sqrt{25}$

$|V| = 5$ units

47. unit vector e making $\theta = \frac{4\pi}{7}$ w/ x-axis:

$\vec{e} = |\vec{v}|(\cos\theta\,\hat{\imath} + \sin\theta\,\hat{\jmath})$

$\vec{e} = |1|(\cos(\frac{4\pi}{7})\,\hat{\imath} + \sin(\frac{4\pi}{7})\hat{\jmath})$

$\vec{e} = -0.22\hat{\imath} + 0.97\hat{\jmath}$

12.2 - # 11, 13, 19, 25, 27, 31, 49, 51

11. $R = (1,4,3)$

$w = \overrightarrow{PR} = \langle 3,-2,3 \rangle$

$\overrightarrow{PR} = \langle x_R - x_P, y_R - y_P, z_R - z_P \rangle$

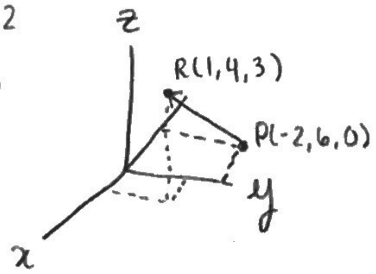
$\langle 3,-2,3 \rangle = \langle 1 - x_P, 4 - y_P, 3 - z_P \rangle$

$1 - x_P = 3 \rightarrow x_P = -2$

$4 - y_P = -2 \rightarrow y_P = 6$

$3 - z_P = 3 \rightarrow z_P = 0$

$P = (-2,6,0)$



13. $V = \langle 4,8,12 \rangle$ $\quad |V| = \sqrt{(4)^2 + 8^2 + 12^2} = \sqrt{224}$

$\frac{A \cdot B}{|A||B|} = +1 \rightarrow$ vectors are parallel

a) $\langle 2,4,6 \rangle \rightarrow \frac{(4)(2) + (8)(4) + 12(6)}{\sqrt{224} \times \sqrt{56}} = \frac{112}{112} = +1$

PARALLEL

b) $\langle -1,-2,3 \rangle \rightarrow \frac{(-1)(4) + (-2)(8) + (12)(3)}{\sqrt{224} \times \sqrt{14}} = \frac{16}{56}$

c) $\langle -7,-14,-21 \rangle \rightarrow \frac{(-7)(4) + (-14)(8) + (12)(-21)}{\sqrt{224} \times \sqrt{686}} = \frac{-392}{392} = -1$

ANTI-PARALLEL

d) $\langle 6,10,14 \rangle \rightarrow \frac{(6)(4) + (8)(10) + (14)(12)}{\sqrt{224} \times \sqrt{332}} = \frac{272}{272.7} = 0.997$

≈ PARALLEL

19. $-2\langle 8,11,3 \rangle + 4\langle 2,1,1 \rangle = \langle -16,-22,-6 \rangle + \langle 8,4,4 \rangle$

$= \langle -8,-18,-2 \rangle$

25. $u = \langle 4,2,-6 \rangle$ $\quad v = \langle 2,-1,3 \rangle$

$\frac{u \cdot v}{|u||v|} = \frac{(4)(2) + 2(-1) + (-6)(3)}{\sqrt{4^2+2^2+6^2} \times \sqrt{2^2+1^2+3^2}} = \frac{-12}{28}$

$\hookrightarrow \frac{-12}{28} \neq +1 \rightarrow$ not parallel

27. $u = \langle -3,1,4 \rangle$ $\quad v = \langle 6,-2,8 \rangle$

$\frac{u \cdot v}{|u||v|} = \frac{(-3)(6) + (1)(-2) + (4)(8)}{\sqrt{3^2+1^2+4^2} \times \sqrt{6^2+2^2+8^2}} = \frac{16}{52}$

$+1 \neq \frac{16}{52} \rightarrow$ not parallel

31. Unit vector in the opp direction to $v = \langle -4,4,2 \rangle$

opp direction

$-v = \langle 4,-4,-2 \rangle$

unit vector:

$\frac{4\hat{i} - 4\hat{j} - 2\hat{k}}{\sqrt{(4)^2 + (-4)^2 + (-2)^2}} = \frac{4\hat{i} - 4\hat{j} - 2\hat{k}}{36}$

unit vector $= \frac{4}{36}\hat{i} - \frac{4}{36}\hat{j} - \frac{2}{36}\hat{k}$

49. $P = (5,5,2)$

$\vec{v} = \langle 0,-2,1 \rangle$

Parametrization $= (5,5,2) + t\langle 0,-2,1 \rangle$

$= (5,5,2) + \langle 0,-2t,t \rangle$

$= (5, 5-2t, 2+t)$

51. $r_1(t) = \langle 1,0,0 \rangle + t\langle -3,1,0 \rangle$

$s(t) = \langle 0,1,1 \rangle + t\langle 2,0,1 \rangle$

$r_1(t) = \langle 1,0,0 \rangle + \langle -3t, t, 0 \rangle$

$= \langle 1-3s, s, 0 \rangle$

$s(t) = \langle 0,1,1 \rangle + t\langle 2,0,1 \rangle$

$= \langle 0,1,1 \rangle + \langle 2t, 0, t \rangle$

$= \langle 2t, 1, 1+t \rangle$

$1 + t = 0 \rightarrow t = 1 \rightarrow$ $\quad 2t = 1 - 3s$

$2(1) = 1 - 3s$

$s = -1/3$

Lines cannot meet

$s = 1$ $\quad 1 \neq -1/3$