12.1

2. It's a line going across $(-1, 0, 0)$ parallel to y-axis

9. $x^2+y^2+z^2=1$ is a unit shell ~~of~~ $x=0$ is the y-z plane.

So it's a unit circle centered at $(0,0,0)$ lying on y-z plane with radius 1.

15. It's a qudratic curve $y=x^2$ lying on x-y plane.

17.(a).

It's the first quadrant of x-y plane.

25(a). It's a plane parallel to y-z plane

12.2.

3. a) $\vec{u}+\vec{v} = \langle 3, -2\rangle + \langle -2, 5\rangle$

$= \langle 1, 3\rangle$

b) $\|\vec{u}+\vec{v}\| = \sqrt{1^2+3^2} = \sqrt{10}$.

10. $R=(2,-1)$ $S=(-4,3)$

$\Rightarrow P = \left(\frac{2-4}{2}, \frac{-1+3}{2}\right)$

$= (-1, 1)$

$\Rightarrow \vec{OP} = \langle -1, 1\rangle$

41. $a=\frac{3}{2}$ $b=\frac{1}{2}$

$\Rightarrow u = \frac{3}{2}\cdot v + \frac{1}{2}w$.

46. $F_1 \cdot \cos\alpha = F_2 \cdot \cos 60^\circ$

$F_1 \cdot \sin\alpha + F_2 \cdot \sin 60^\circ = 50$

$F_1 = 35N$

$\Rightarrow \quad 35 \cdot \cos\alpha = F_2 \cdot \frac{1}{2}$

$35 \cdot \sin\alpha + F_2 \cdot \frac{\sqrt{3}}{2} = 50$

$\Rightarrow \quad \cancel{F_1 \cdot \cos}$

$35 \sin\alpha + 35 \cdot \sqrt{3} \cdot \cos\alpha = 50$

$\Rightarrow \quad \sin(\alpha + 60^\circ) = \frac{5}{7}$

$\Rightarrow \quad \alpha = \cancel{\arcsin\frac{5}{7} - 60} \quad \frac{2\pi}{3} - \arcsin\frac{5}{7}$

For F_2. we have

$$\left(\frac{1}{70} \cdot F_2\right)^2 + \left(\frac{50 - F_2 \cdot \frac{\sqrt{3}}{2}}{35}\right)^2 = 1$$

$\Rightarrow \quad 4F_2^2 - 200\sqrt{3}F_2 + 5100 = 0$

$\Rightarrow \quad F_2 = 25\sqrt{3} \pm 10\sqrt{6}$.

since $\cancel{F_2 \cdot \frac{1}{2} < 35}$ $\alpha = \arcsin\frac{5}{7} - 60^\circ$

$\Rightarrow \quad F_2 = 25\sqrt{3} - 10\sqrt{6} \approx 18.8N$.

12.3

a. $\vec{v}\cdot\vec{u} = 2\cdot(-2) + (-4)4 + \sqrt{5}\cdot(-\sqrt{5})$

$= -4 - 16 - 5$

$= -25$

b. $\dfrac{\vec{u}\cdot\vec{v}}{\|\vec{u}\|\cdot\|\vec{v}\|} = \dfrac{-25}{(2^2+4^2+5)} = -1 \Rightarrow \cos\alpha = -1$

c. $\dfrac{u\cdot v}{\|\vec{v}\|} = \dfrac{-25}{\sqrt{25}} = -\sqrt{25}$

d. it's $\vec{v}$ itself

3 a). By definition.

$\cos\alpha = \dfrac{a}{|v|} \quad \cos\beta = \dfrac{b}{|v|} \quad \cos\gamma = \dfrac{c}{|v|}$

and we know $a^2+b^2+c^2 = |v|^2$

$\Rightarrow \cos^2\alpha + \cos^2\beta + \cos^2\gamma = \dfrac{a^2+b^2+c^2}{|v|^2} = 1.$

24. The angle between force and inclined is 17°.

$\Rightarrow$ ~~WH~~ $w\cdot\cos 17^\circ = 2.5$ lb

$\Rightarrow w = \dfrac{2.5}{\cos 17^\circ}$

28. We can't.

If $u = (1.0)$

$v_1 = (0.2)$

$v_2 = (0.1)$

$u \cdot v_1 = u \cdot v_2$

But $v_1 \neq v_2$

12.4. 1).

$$u \times v = \begin{vmatrix} i & j & k \\ 2 & -2 & -1 \\ 1 & 0 & -1 \end{vmatrix}$$

$$= 2 \cdot i - (-2+1) \cdot j + 2 \cdot k$$

$$= 2i + j + 2k.$$

$$v \times u = \begin{vmatrix} i & j & k \\ 1 & 0 & -1 \\ 2 & -2 & -1 \end{vmatrix}$$

$$= -2i - j - 2k.$$

15 . a). $\vec{PQ} = (2,0,-1) - (1,-1,2)$

$= (2,1,-3)$

$\vec{PR} = (0.2.+1) - (1-1.2)$

$= \cancel{(2/.+2/+2)}\ (1\ 3,-1)$

$|\vec{PQ} \times \vec{PR}| = \cancel{\sqrt{84}} = \cancel{2\sqrt{21}}\ \sqrt{150}$

b) $\vec{PQ} \times \vec{PR} \perp \vec{PQ}, \vec{PR}$

$\Rightarrow \vec{PQ} \times \vec{PR} = \langle -10, 5 \cdot 5 \rangle$

The unit vector is $\frac{1}{\sqrt{150}} \cdot \langle -10, 5 \cdot 5 \rangle$.

23. $u \parallel w$.

$u \perp v$

$w \perp v$.

28. a). True

b) True

c). True

d). True

f) True

g) True

h) True.

31. a). ✓

b). X $v \cdot w$ is a scalar

c). ✓

d). X. $v \cdot w$ is a scalar

33 Let $u = (1, 0, 0)$

$v = (2, 0, 0)$

$w = (3, 0, 0)$

$u \times v = u \times w = 0$

But $v \neq w$.

35

The side length of the square is $\sqrt{2}$.

$\Rightarrow$ Area $= 2$.

12.5

1). $x = 3 + t$

$y = -4 + t$

$z = -1 + t$

2). $\overrightarrow{QP} = (1, 2, -1) - (-1, 0, 1)$

$= (2, 2, -2)$

$\Rightarrow$ $x = 1 + 2t$

$y = 2 + 2t$

6. $x = 3 + 2t$

$y = -2 - t$

$z = 1 + 3t$.

9. $x = t$

$y = -7 + 2t$

$z = 2t$.

21. Let the plane be $3x + (-2)y + (-1)z = k$

plug in $(0.2.-1)$

$\Rightarrow 3 \cdot 0 - 2 \cdot 2 - 1 \cdot (-1) = -3$

$\Rightarrow 3x - 2y - z = -3$.

23 Find a vector perpendicular to the plane.

$\vec{PQ} = (1.1.-1) - (2.0.2) = (-1.1.-3)$

$\vec{PR} = (0.-2.1) - (2.0.2) = (-2,-2.-1)$

$\vec{PQ} \times \vec{PR} = (-7.5.4)$

$\Rightarrow -7x + 5y + 4z = k$

plug in $(2.0.2)$

$\Rightarrow k = -6$

$\Rightarrow -7x + 5y + 4z = -6$

33. Let P be the point on the line minimizing the distance

$P = (4t, -2t, 2t) \quad O = (0, 0, 12)$

$\Rightarrow \vec{OP} \perp$ the line

$\Rightarrow (4t, -2t, (2t-12)) \cdot (4t, -2t, 2t) = 0$

$\Rightarrow 16t^2 + 4t^2 + 4t^2 - 24t = 0$

$\Rightarrow t = 0$ or $t = 1$.

when $t=0$, $|\vec{PO}| = 12$

$t = 1 \quad |\vec{PO}| = \sqrt{4^2+2^2+10^2} = \sqrt{120}$

$\Rightarrow$ distance is $\sqrt{120}$.

39. $dis = \dfrac{|2 + 2\cdot(-3) + 2\cdot 4 - 13|}{\sqrt{1^2+2^2+2^2}}$

$= 3.$

47. The perpendicular vectors are $(1, 1, 0)$ and $(2, 1, -2)$

The angle between them is $\dfrac{2+1}{\sqrt{2}\cdot 3} = \dfrac{\sqrt{2}}{2} = \cos\alpha \Rightarrow \alpha = 45^\circ$.

So the angle between two planes is 45°.

~~44~~ 53. plug in $x = 1-t \quad y = 3t \quad z = 1+t$

$\Rightarrow 2 - 2t - 3t + 3 + 3t = 6 \quad \Rightarrow \quad t = -\frac{1}{2} \quad \Rightarrow \quad (\frac{3}{2}, -\frac{3}{2}, \frac{1}{2})$

67. The direction vetor is $(-2, 5, -3)$

The perpendicalar vector of plane is $(2, 1, -1)$

$(-2, 5, -3) \cdot (2, 1, -1) = -4+5+3 \neq 0$

$\Rightarrow$ Not parallel.