Exam 1

1. (a) $\bar{u} = \langle 1, 3, -1 \rangle$, $\bar{v} = \langle 2, -3, 1 \rangle$

(b) $3\bar{u} - \bar{v} = \langle 1, 12, -4 \rangle$ (c) $\bar{u} \cdot \bar{v} = -8$

(d) $\cos\theta = \dfrac{-8}{\sqrt{11} \cdot \sqrt{14}} < 0 \Rightarrow \theta$ obtuse

(e) $\text{Proj}_{\bar{v}} \bar{u} = \dfrac{-8}{14} \langle 2, -3, 1 \rangle = \left\langle \dfrac{-8}{7}, \dfrac{12}{7}, \dfrac{-4}{7} \right\rangle$

(f) $\bar{u} \times \bar{v} = \begin{vmatrix} i & j & k \\ 1 & 3 & -1 \\ 2 & -3 & 1 \end{vmatrix} = \langle 0, -3, -9 \rangle$

(g) $\pm \left\langle 0, \dfrac{1}{\sqrt{10}}, \dfrac{3}{\sqrt{10}} \right\rangle$

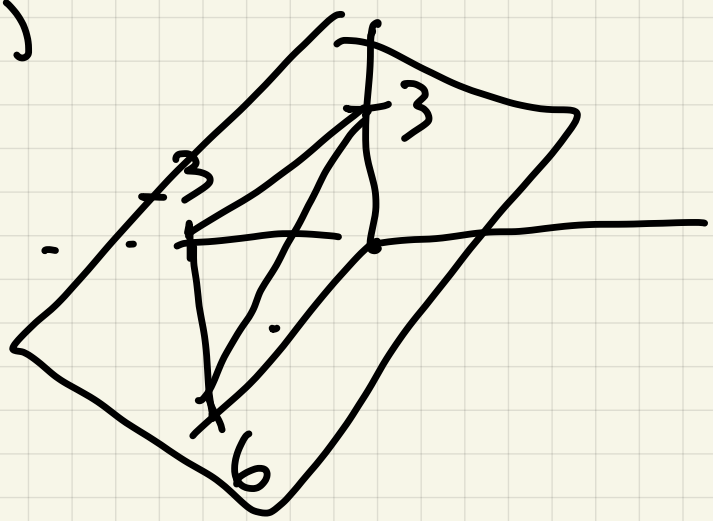
(h) $|\langle 0, -3, -9 \rangle| = 3\sqrt{10}$

(i) $(0,1,2) + \langle 2, -3, 1 \rangle - \langle 1, 3, -1 \rangle = \langle 1, -5, 4 \rangle$

2. (a) $(x-4) - 2(y-1) + 2(z-2) = 0 \Rightarrow$

$x - 2y + 2z = 6$

(b)



(c) $\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 5+t \\ -3-2t \\ 11+2t \end{pmatrix}$

(d) $(5+t)-2(-3-2t)+2(11+2t)=6 \Rightarrow$

$5+t+6+4t+22+4t=6 \Rightarrow$

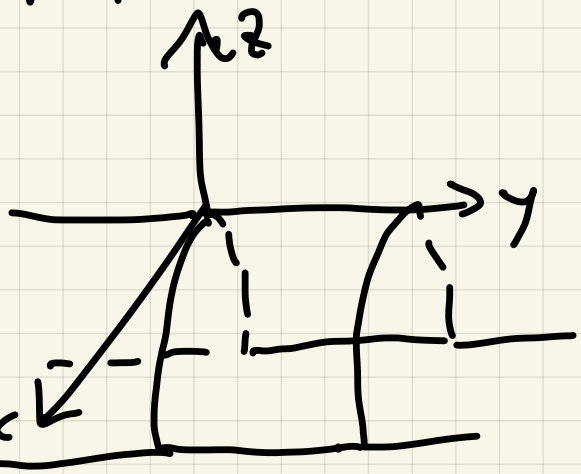
$9t=-27 \Rightarrow t=-3$, so

$B=(2,3,5)$

(e) Since line is $\perp$ to P, B is closest point to A, so dist $=|\overrightarrow{BA}|=$

$|\langle 3,-6,6\rangle| = 3|\langle 1,-2,2\rangle| = 3\cdot 3 = 9$

3. (a) Cylinder:



(b)

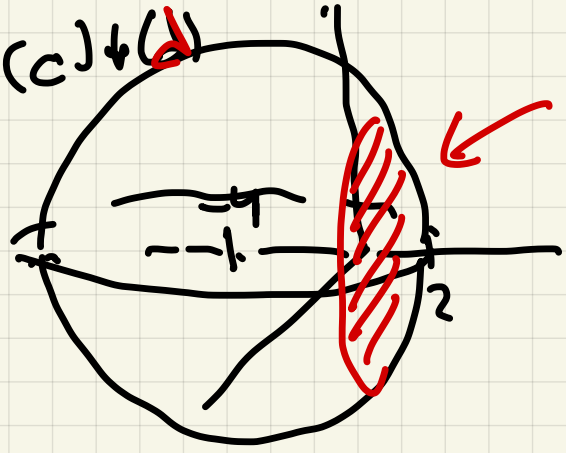
$x^2+y^2+8y+16+z^2=$

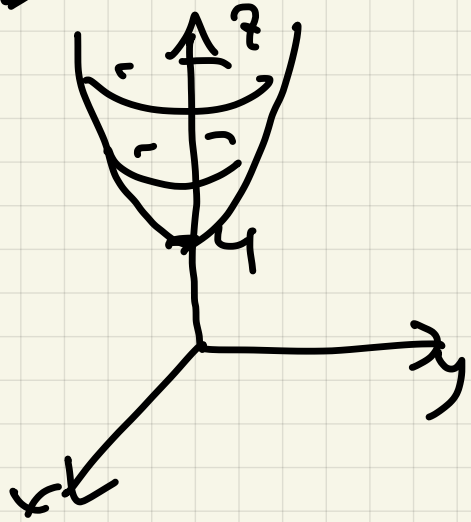
$x^2+(y+4)^2+z^2 = 20+16 = 36$

ctr $=(0,-4,0)$

radius $=6$

(c)+(d)



(d) solid cap of sphere on right

(e)