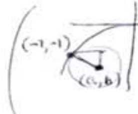
8(c) $\vec{n} = \langle 1,1,1\rangle$, $\vec{v} = \langle 1,-2,1\rangle$, so $\cos\theta = \frac{\vec{n}\cdot\vec{v}}{|\vec{n}||\vec{v}|} = 0$ so $\theta = 90^\circ = \pi/2$

(d) $\vec{a} = \langle 0,2,0\rangle$, so: $a_T = v' = \frac{4t}{\sqrt{2+4t^2}}$, $a_N = \frac{|\vec{v}\times\vec{a}|}{v} = \frac{\sqrt{8}}{\sqrt{2+4t^2}} = \frac{2}{\sqrt{1+2t^2}}$.

$v = \sqrt{2+4t^2}$



$a = -1 + \frac{15}{3} = 4$

$b = -1 - \frac{5}{3} = -\frac{8}{3}$

$r = \frac{5\sqrt{10}}{3}$

9 $K = \frac{6}{\sqrt{1+9}^3} = \frac{3}{5\sqrt{10}}$ so $r = \frac{5\sqrt{10}}{3}$, so $(x-4)^2 + (y+\frac{8}{3})^2 = \frac{250}{9}$

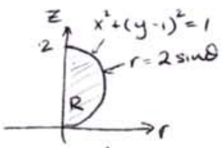
10 $\frac{\partial z}{\partial x} = -\frac{f_x}{f_z} = -\frac{y+z}{2yz+x}\Big|_{(1,1,1)} = -\frac{2}{3}$

11 $\frac{\partial z}{\partial x} = f' - g'$, $\frac{\partial z}{\partial y} = af' + ag'$; $\frac{\partial^2 z}{\partial x^2} = f'' - g''$, $\frac{\partial^2 z}{\partial y^2} = a^2 f'' - a^2 g''$ so qed

12 $\vec{\nabla} f = \langle 24x^2 - 12x , 3y^2 - 12y \rangle = \vec{0}$ if $x = 0, \frac{1}{2}$, $y = 0, 4$.

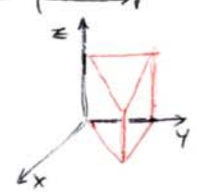
$D = \begin{vmatrix} 48x-12 & 0 \\ 0 & 6y-12 \end{vmatrix} = 72(4x-1)(y-2)$. At $(0,0)$ ($D>0$, $f_{xx}<0$) MAX . At $(\frac{1}{2},0)$ and $(0,4)$ ($D<0$) saddle , at $(\frac{1}{2},4)$ ($D>0$, $f_{xx}>0$) MIN.

13 $\begin{cases} 1 = 2x\lambda \\ 2 = 2y\lambda \\ 2 = 2z\lambda \\ x^2+y^2+z^2 = 3 \end{cases}$ $y = z = \frac{1}{\lambda}$, $x = \frac{1}{2\lambda} = \frac{1}{2}y$ so $\frac{1}{4}y^2 + y^2 + y^2 = 3 \rightarrow y^2 = \frac{4}{3}$ } So pts are $(-\frac{1}{\sqrt{3}}, -\frac{2}{\sqrt{3}}, -\frac{2}{\sqrt{3}})$ (min) and $(\frac{1}{\sqrt{3}}, \frac{2}{\sqrt{3}}, \frac{2}{\sqrt{3}})$ (max)

14 

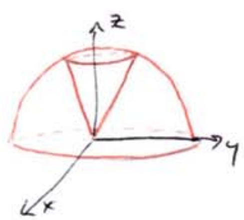
$R: 0 \le \theta \le \frac{\pi}{2}$, $0 \le r \le 2\sin\theta$ } so integral $= \int_0^{\frac{\pi}{2}} \int_0^{2\sin\theta} r^2\, dr\, d\theta = \frac{8}{3}\int_0^{\frac{\pi}{2}} \sin^3\theta\, d\theta$

$= \frac{8}{3}\left(\frac{1}{3}\cos^3\theta - \cos\theta \right]_0^{\pi/2} = \frac{16}{9}$

15 

$V = \int_0^4 \int_0^{y/2} (4-x)\, dx\, dy = \int_0^2 \int_{2x}^4 (4-x)\, dy\, dx$

$= \int_0^4 \int_0^{y/2} \int_0^{4-x} dz\, dx\, dy$ $= \frac{40}{3}$

16 

S = the region in the top hemisphere of radius = 4 with the cone ($\varphi = \pi/6$) removed

17 mass $= \iiint_S \sqrt{x^2+y^2+z^2}\, dV = \int_0^{2\pi} \int_0^{\pi/4} \int_0^3 \rho^3 \sin\varphi\, d\rho\, d\varphi\, d\theta$

$= 2\pi \cdot (1 - \frac{1}{\sqrt{2}}) \cdot \frac{81}{4}$ $(= 37.266)$