Calc III - Ch 12 - Required Practice **ANSWERS ONLY**

12.1

#1. (3D graph)

#2. A plane.

#3. Side lengths: 6, 6, $\sqrt{40}$, isosceles, but not a right triangle.

#4. $(x-1)^2+(y+4)^2+(z-3)^2=25$
Intersection is the circle $(x-1)^2+(z-3)^2=9$

#5. $(x-2)^2+(y-0)^2+(z+6)^2=\frac{81}{2}$
center: $(2,0,-6)$, radius = $\sqrt{\frac{81}{2}}$

#6. $(x-3)^2+(y-2)^2+(z-7)^2=11$

#7. All point inside a sphere centered at the origin with radius = $\sqrt{3}$.

12.2

#1. (sketches)

#2. A sketch.

#3. Find a unit vector that has the same direction as the given vector
$\frac{1}{\sqrt{98}}\langle 9,-1,4\rangle$ *or* $\left\langle \frac{9}{\sqrt{98}},\frac{-1}{\sqrt{98}},\frac{4}{\sqrt{98}}\right\rangle$.

#4. 22.204 mi/hr, 8°West of North (N8°W)..

#5. $\vec{T}_1=\langle -4.112,\ 7.121\rangle$ *lbs*
$\vec{T}_2=\langle 4.112,\ 2.879\rangle$ *lbs*

#6. 30.091 N (Newtons)

12.3

#1. Meaningless, meaningful, meaningful.

#2. 14

#3. $7st-2s^2t^2$

#4. 32

#5. $\frac{1}{2},\ -\frac{1}{2}$

#6. $\cos^{-1}\left(\frac{-8\sqrt{7}+18}{40}\right)\approx 94.5°$

#7. $\cos^{-1}\left(\frac{-1}{\sqrt{28}}\right)\approx 100.89°$

#8. Neither, orthogonal, parallel

#9. $b=0,\ b=2,\ b=-2$

#10. $\left\langle \frac{1}{\sqrt{3}},\frac{-1}{\sqrt{3}},\frac{-1}{\sqrt{3}}\right\rangle$

#11. 1838.5 ft-lbs

12.4

#1. $\langle 10,-8,2\rangle$

#2. Scalar, Meaningless, Vector.

#3. $25\sqrt{3}$, into the page

#4. $\langle 5,-3,1\rangle$, $\langle -5,3,-1\rangle$,

#5. (make $\vec{a}=\langle a_1,a_2,a_3\rangle$ and write out the cross-products)

#6. 16

#7. $\langle 6,3,2\rangle$, $\frac{7}{2}$

#8. 3

#9. (triple product = 0)

12.5

#1.

$\vec{r}=\langle 2,2.4,3.5\rangle+t\langle 3,2,-1\rangle$ *or* $\vec{r}=\langle 2+3t,\ 2.4+2t,\ 3.5-t\rangle$

$$\begin{cases} x=2+3t \\ y=2.4+2t \\ z=3.5-t \end{cases} \quad -\infty<t<\infty$$

#2.

$\vec{r}=\langle 1,3,2\rangle+t\langle -5,0,-2\rangle$ *or* $\vec{r}=\langle 1-5t,\ 3,\ 2-2t\rangle$

$$\begin{cases} x=1-5t \\ y=3 \\ z=2-2t \end{cases} \quad -\infty<t<\infty$$

$\frac{1-x}{5}=\frac{2-z}{2}$, $y=3$

#3.

$$\begin{cases} x=2+t \\ y=1-t \\ z=t \end{cases} \quad -\infty<t<\infty$$

$x-2=1-y=z$

#4. Cross-product = zero vector, so yes, is parallel

#5. $\vec{r}=\langle 2+2t,\ -1+7t,\ 4-3t\rangle \quad 0\le t\le 1$

#6. $x+y-z=-1$

#7. $-9x+12y+11z=0$ $(\textit{many possible answers})$

#8. $x+y+z=4$ (very challenging)

#9. $-x+2y-4z=1$ (very challenging)

#10. $(7,-4,3)$

#11. perpendicular

#12. $4x+8y+4z=20$ *or* $x+2y+z=5$

12.6

(for day 1 problems, see filled-in notes)

#1. Elliptical cylinder (sketch)

#2. Parabolic cylinder (sketch)

#3. Cylinder with cosine rulings (sketch)

#4. xy-hyperbola sketches, xz-hyperbola sketches, yz-ellipse sketches, elliptical paraboloid (3D sketch)

#5. $(x-2)^2-(y+1)^2+(z-1)^2=0$ circular cone (sketch)

#6. Region between a circular cylinder and a cone between z = 1 and z = 2 (sketch)

#7. Elliptical paraboloid: $x^2+z^2=y$

Ch12 Test Review

#1. 6, 6, $\sqrt{40}$, isosceles, but not a right triangle.

#2. Not on a line, Yes on a line

#3. $\langle 2,-18\rangle$, $\langle 1,-42\rangle$, 10

#4. $\left\langle -\frac{2}{3},\frac{1}{3},\frac{2}{3}\right\rangle$

#5. $\vec{T}_1 = \langle -23.124,\ 29.597\rangle$ *Newtons*
$\vec{T}_2 = \langle 23.124,\ 19.403\rangle$ *Newtons*

#6. $\vec{T}_1 = \langle -196.16,\ 3.92\rangle$ *Newtons*
$\vec{T}_2 = \langle 196.16,\ 3.92\rangle$ *Newtons*

#7. $\cos^{-1}\left(\frac{4}{5}\right) \approx 36.87°$

#8. $b=0,\ b=2,\ b=-2$

#9. $\langle 5,-3,1\rangle$, $\langle -5,3,-1\rangle$

#10. $\left\langle \frac{-8}{\sqrt{96}},\frac{-4}{\sqrt{96}},\frac{4}{\sqrt{96}}\right\rangle$, $\left\langle \frac{8}{\sqrt{96}},\frac{4}{\sqrt{96}},\frac{-4}{\sqrt{96}}\right\rangle$

#11.
$\vec{r} = \langle 6,1,-3\rangle + t\langle -4,3,8\rangle$ *or* $\vec{r} = \langle 6-4t,\ 1+3t,\ -3+8t\rangle$

$$\begin{cases} x = 6-4t \\ y = 1+3t \\ z = -3+8t \end{cases} \quad -\infty < t < \infty$$

$$\frac{6-x}{4} = \frac{y-1}{3} = \frac{z+3}{8}$$

#12. $\vec{r} = \langle -t,\ 1,\ t\rangle \quad -\infty < t < \infty$

#13. $x+2y-3z=-16$

#14. $x+2y+4z=35$

#15. xy-hyperbola sketches, xz-elllipse sketches, yz-hyperbola sketches, hyperboloid of one sheet, y-axis is main axis, (3D sketch)

#16. $3\sqrt{2}$, $3\sqrt{2}$, out of the page

#17. $\langle 11,-4,-1\rangle$, $\sqrt{14}$, -1, $\langle -3,-7,-5\rangle$