Copying answers and steps is strictly forbidden. Evidence of copying results in zero for copied and copier. Working together is encouraged, share ideas not calculations. Explain your steps. This sheet must be printed and attached to your assignment as a cover sheet. The calculations and answers should be written neatly on one-side of paper which is attached and neatly stapled in the upper left corner. Box your answers where appropriate. Please do not fold. Thanks!

Problem 21 Your signature below indicates you have:

(a.) I have read §$1.5 - 1.6, 2.1 - 2.3$ of Cook: ____________________.

(b.) I have attempted homeworks from Salas and Hille as listed below:________________.

The following homeworks from the text are good rudimentary skill problems. These are not collected or graded. However, they are all odd problems thus there are answers given within Salas, Hille and Etgen's text:

§ 9.3 #'s 21, 43, 61
§ 13.1 #'s 3, 5, 7, 15, 19, 25, 35, 43
§ 13.2 #'s 1,7,11, 17, 23, 29
§ 13.3 #'s 3,7,15
§ 13.4 #'s 5, 11, 13
§ 13.5 #'s 3, 11, 21
§ 13.7 #'s 7, 23, 27, 35
§ 14.1 #'s 3,7
§ 14.2 #'s 3,5,7,9,11,15,19,27,37
§ 14.3 #'s 3,5,11,17, 25, 29, 37,39,41

Problem 22 Find the parametric equations of the left half of a counterclockwise oriented circle of radius 4 which has center at $(2, 2)$. Please include the domain of the parameter. Also, find the Cartesian equation of the whole circle.

Problem 23 Find the parametric equations of the curve of intersection of $ax + by + cz = d$ and the cylinder $y^2 + z^2 = R^2$. You may assume $a \neq 0$.

Problem 24 Consider the level surface $x^2 + 9y^2 = z^2$.

(a.) sketch the surface by hand and name the surface

(b.) find a parametrization of the surface.

Problem 25 Find the Cartesian equation of the surface with parametric equations:

$$x = \cosh\alpha \sin\beta, \qquad y = 2\cosh\alpha\cos\beta, \qquad z = \sinh\alpha.$$

Hint: $\cosh^2\alpha - \sinh^2\alpha = 1$.

Problem 26 Find the polar coordinate equations for

(a.) the ellipse $x^2/a^2 + y^2/b^2 = 1$,

(b.) the line $y = 1 - 2x$

Problem 27 Consider the point $P = (\sqrt{3}, 1, 2)$. Find the

(a.) cylindrical coordinates of P

(b.) spherical coordinates of P

Problem 28 Write the vector $\vec{v} = \langle 1, 2, 3 \rangle$ in terms of the spherical frame at an arbitrary point with cylindrical coordinates r, θ, z. In other words, find functions a, b, c of cylindrical coordinates such that $\vec{v} = a\widehat{r} + b\widehat{\theta} + c\,\widehat{z}$.
Hint: dot-products with respect to $\widehat{r}, \widehat{\theta}, \widehat{z}$ *nicely isolate* a, b *and* c *if you make use of the fact that* $\widehat{r}, \widehat{\theta}, \widehat{z}$ *forms an orthonormal frame.*

Problem 29 Find the intersection of $\phi = \pi/3$ and $z = 4$ and provide a parametrization which covers this curve of intersection.

Problem 30 Find the intersection of $\theta = \pi/4$ and $\rho = 4$ and provide a parametrization which covers this curve of intersection.

Problem 31 Let $\vec{A}(t) = \langle te^t,\, 2 + 3t,\, \sin(t^2) \rangle$ and calculate $\frac{d\vec{A}}{dt}$ and $\frac{d^2\vec{A}}{dt^2}$.

Problem 32 Suppose the velocity of Jeff is $\vec{v}(t) = \langle e^t, t, \sin t \rangle$ and Jeff is at the origin $(0, 0, 0)$ at $t = 0$. Find the acceleration, position and speed of Jeff at time t. Also, give the distance travelled during $[0, t]$ in terms of an integral.

Problem 33 Suppose a curve C is parametrized by $\vec{r}(t) = \langle 1 + t^2,\, \sqrt{t},\, \frac{1}{t+1} \rangle$. Find the parametrization of the tangent line to the given curve at $\vec{r}(2)$.

Problem 34 Show Theorem 2.1.16 part (1.) is true.

Problem 35 Let $\vec{r}(t) = \langle t, t^2, t^3 \rangle$ give the position at time t. Find the tangential and normal components of the acceleration as described towards the conclusion of §2.3.

Problem 36 Find the tangent, normal and binormal vector fields for $\vec{\gamma}(t) = \langle 3t, 2\cos t, 2\sin t \rangle$.

Problem 37 Reparametrize the curve given in the previous problem with respect to arclength.

Problem 38 Find the curvature and torsion for $\vec{\gamma}(t) = \langle 3t, 2\cos t, 2\sin t \rangle$.

Problem 39 The vector equation for the position $\vec{r}$ fixed on circle is given by $(\vec{r} - \vec{r}_o) \bullet (\vec{r} - \vec{r}_o) = R^2$ where R is a constant and $\vec{r}_o$ is the fixed center of the circle. Differentiate this equation directly and interpret your results in terms of centripetal and tangential acceleration.

Problem 40 Suppose $\frac{d\vec{A}}{dt} = \vec{A}$. Find the general solution. You should be able to solve this with separation of variables which is part of calculus II (a prerequisite of this course)