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 16 Your PRINTED NAME below indicates you have:

(a.) I finished reading Chapters 1 and 2 of Cook: ____________________.

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

Same deal as Mission 1. Enjoy:

§ 14.1 #'s 3, 5, 7, 15, 19, 39, 41, 45, 47, 57

§ 14.2 #'s 1, 5, 7, 9, 11, 17, 23, 29, 33

§ 14.3 #'s 3, 7, 15, 19, 29, 33, 35, 39

§ 14.4 #'s 3, 5, 23

§ 14.5 #'s 3, 11, 19, 21, 39

§ 15.1 #'s 19, 21, 23,

§ 15.2 #'s 3,5,7, 9,11,15,19,27,37, 53a, 55a

§ 15.3 #'s save for later, we have much more to say about graphs of functions of several variables after Test 1.

Problem 17 Find parametrizations of the curves described below: (if the curve has more than one connected piece you may need to parametrize each piece separately)

(a) the hyperbola $(x-1)^2 - (y+3)^2 = 1$ in the plane.

(b) a circle of radius 7 centered at $(1, 1, 3)$ in the $z = 3$ plane.

(c) a circle of radius 7 centered at $(3, 4, 5)$ in the $x + y + z = 12$ plane.

Problem 18 Name the following surfaces: (use Mathematica or Sage etc. to plot these)

(a) $x^2 + z^2 = y^2$

(b) $x^2 + 2y^2 + 4z^2 = 1$

(c) $y - x^2 = z^2$

(d) $(24 + x^2 + y^2 + z^2)^2 = 100(x^2 + y^2)$

Problem 19 Find a parametrization of the cylinder $y^2 + 3z^2 = 1$ for $1 \leq x \leq 4$. Use t, θ as the notation for your parameters.

Problem 20 Find the cylindrical and spherical coordinates of the point $P = (1, 1, 4)$.

Problem 21 Parametrize the tangent line to $\vec{r}(t) = \langle t^2, \cos(t^2), \sin(t^2)\rangle$ at the point $(1, \cos 1, \sin 1)$.

Problem 22 Calculate the derivative $\frac{d}{dt}$ of $\langle t^2, e^t, \cosh t^2\rangle \times \langle t, t^2, t^3\rangle$.

Problem 23 Show $\dfrac{d^2}{dt^2}\left(\vec{A} \bullet \vec{B}\right) = \dfrac{d^2\vec{A}}{dt^2} \bullet \vec{B} + 2\dfrac{d\vec{A}}{dt} \bullet \dfrac{d\vec{B}}{dt} + \vec{A} \bullet \dfrac{d^2\vec{B}}{dt^2}$. Conjecture the result for the n-th derivative.

Problem 24 Let $\vec{C}$ be a constant vector. Calculate $\displaystyle\int \left(t\vec{C} + t^2\,\widehat{x}\right)\,dt$. If it helps, let $\vec{C} = \langle a, b, c\rangle$, but, you can solve this without resorting to components.

Problem 25 Find the arclength function based at the origin for the curve parametrized by $x = 2t^3$, $y = 2t^3$ and $z = t^3$ for $t \geq 0$. Name this curve and provide its parametrization with respect to arclength.

Problem 26 Find the T, N, B frame for the curve $\vec{\gamma}(t) = \langle 2 + 3t, 2 + 4\cos t, 1 + 4\sin t\rangle$. Also, calculate the curvature and torsion of the curve.

Problem 27 Suppose $x = e^{-t}\cos(t)$ and $y = e^{-t}\sin(t)$ and $z = e^{-t}$ for $0 \leq t \leq 4\pi$. Calculate and simplify the tangent, normal and binormal vector fields for the curve parametrized by the given scalar parametric equations.

Problem 28 Suppose two ninja begin travelling the paths given below. To begin, at $t = 0$, a relatively slow genin level ninja sets off in a NE direction given by

$$\vec{r}_1(t) = \langle -10 + t, 1 + t\rangle.$$

However, at the same time $t = 0$, an enemy Jonin sets off in a NW direction given by

$$\vec{r}_2(t) = \langle 20 - 4t, 6 + t\rangle.$$

Both of these paths are placed in a forest thick with a mist which lowers visability to near zero. Suppose the Jonin level ninja has advanced tracking skills that allow his to pick up on the faintest of scents. If he crosses the path of an enemy he can smell it and then alter his path to pursue and attack the enemy genin. Should the genin worry? Is he in danger? (a Jonin is no match for a typical genin in a usual battle, if the Jonin catches the genin it's game over for the lowly genin)

Problem 29 Suppose the velocity is given by $\vec{v}(t) = \langle t, 3, t\sinh(t^2)\rangle$ for some particle which has initial position $(1, 2, 3)$. Find for $t \geq 0$ the:

(a) acceleration at time t

(b) position at time t

(c) speed at time t

(d) distance travelled at time t (in terms of an integral)

Problem 30 Suppose $\vec{\gamma}(t) = \langle 3\cos(t^2), 3\sin(t^2), 2t + 1\rangle$ is the position of a particle at time t. Find a_T and a_N components of the acceleration of this particle at time t. Verify that $\vec{a} = a_T T + a_N N$ for the T, N fields of the given curve.