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 1 Your signature below indicates you have:

(a.) I have read §1.1 – 1.4 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:

§ 12.1 #'s 3, 9, 15, 17

§ 12.3 #'s 1, 5, 11, 21, 25, 27, 31, 35, 39

§ 12.4 #'s 3, 5, 9, 11, 13, 21, 29

§ 12.5 #'s 1, 7, 9, 17, 21, 25, 27

§ 12.6 #'s 7, 13, 19, 35

§ 12.7 #'s 3, 5, 9, 21

Problem 2 Find the midpoint of $P = (1, 2, 3)$ and $Q = (5, 5, 0)$. Then, find the equation of the sphere centered on the midpoint which has $\overrightarrow{PQ}$ as a diameter.

Problem 3 Let $P = (-3, -2)$ and $Q = (1, 4)$. Find the Cartesian components of $\vec{A} = \overrightarrow{PQ}$. In addition, find the length of $\vec{A}$, its direction vector, and its standard angle.

Problem 4 Suppose a tetrahedron is formed by joining four equilateral triangles of side length 1. If the base face of the tetrahedron is on the xy-plane and one vertex is at the origin and another at $(1, 0, 0)$ then find the coordinates of the remaining vertices.

Problem 5 Prove Proposition 1.1.12 part (4.) then use that result to show $||c\vec{A}|| = |c|||\vec{A}||$ where $|c|$ denotes absolute value of c.

Problem 6 Consider the triangle formed by the points $P = (2, 0, 1)$, $Q = (3, 1, 1)$ and $R = (-3, -3, -3)$. Find the interior angle at each vertex of the triangle. Hint: use vectors!

Problem 7 Suppose $\vec{A}$ is a vector for which $\vec{A} \bullet \widehat{x} = 2$ and $\vec{A} \bullet \widehat{y} = 1$. If $\vec{A}$ is perpendicular to $\vec{B} = \langle 1, 2, 3 \rangle$ then specify the form of $\vec{A}$ as much as possible. If there are inifinitely many cases or no solutions then explain.

Problem 8 Suppose a vector has magnitude[1] $v = 10$ and a standard angle of $\theta = 130^o$. Find the Cartesian components of $\vec{v}$. Also, find $\hat{v}$ for which $\vec{v} = v\hat{v}$.

Problem 9 Let $\vec{A} = \langle 1, 0, 1\rangle$ and $\vec{B} = \langle 2, 2, 2\rangle$ and $\vec{C} = \langle 0, 0, 1\rangle$. Find the volume of the parallel-piped with edges $\vec{A}, \vec{B}, \vec{C}$.

Problem 10 Let $\vec{A} = \langle 1, 0, 1\rangle$ and $\vec{B} = \langle 2, 2, 2\rangle$. Find the area of the parallelogram with sides $\vec{A}$ and $\vec{B}$. Also, find the angle between the given vectors.

Problem 11 Find the parametric equations of a line through $P = (2, 3, 4)$ and $Q = (5, 0, -4)$. Also, find the symmetric equations of the line.

Problem 12 Find the parametric equations of a plane containing points $P = (2, 2, 2)$ and $Q = (3, 3, 3)$ and $R = (0, 4, 0)$. Also, find the Cartesian equations of the plane.

Problem 13 Find the point on $2x + 3y - 6z = 10$ which is closest the point $(7, 7, 7)$ by finding the intersection of the normal line to the plane which goes through $(7, 7, 7)$. (it is geometrically clear this gives the closest point, although, later we prove this by other methods)

Problem 14 Suppose A, B, C are not all zero and $\alpha \neq \beta$. Find the distance between the parallel planes $Ax + By + Cz + \alpha = 0$ and $Ax + By + Cz + \beta = 0$.

Problem 15 Consider $\vec{r}(t) = \langle 3 + t, 2 + 5t, -4 + 6t\rangle$. Does this line intersect the plane $x + y + z = 10$. If so, where, and for what value of t?

Problem 16 If $\vec{A} = \frac{1}{5}\langle 3, 4, 0\rangle$ and $\vec{B} = \frac{1}{5}\langle 4, -3, 0\rangle$. If $\{\vec{A}, \vec{B}, \vec{C}\}$ forms a right-handed frame of vectors then find $\vec{C}$.

Problem 17 Show that if $\vec{A}$ is a vector such that $\vec{A} \times \widehat{x} = 0$ and $\vec{A} \times \widehat{y} = 0$ then $\vec{A} = 0$.

Problem 18 Find k for which $(a\vec{A} + b\vec{B}) \times (c\vec{A} + d\vec{B}) = k\vec{A} \times \vec{B}$.

Problem 19 Proposition 1.2.11 part (1.). Show that $\vec{A} \times (\vec{B} \times \vec{C}) = (\vec{A} \bullet \vec{C})\vec{B} - (\vec{A} \bullet \vec{B})\vec{C}$. Note: if you use the idea of the proof for the other difficult identity there it is much easier than brute force.

Problem 20 Let $\hat{u}$ be a unit-vector. Let $\vec{A}$ be an arbitrary vector. Show that:

$$\vec{A} = [\,\vec{A} \bullet \hat{u}\,]\hat{u} + [\,\hat{u} \times \vec{A}\,] \times \hat{u}.$$

Then, identify the given formulas with proj and orth operations as discussed in my notes (Defnition 1.1.24)

[1] pop pop