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<u>Homework H04 simplified</u>
MATH 3110/5110 (Barsamian)
Due at the start of class Fri Feb 21, 2020

Problem:	**1**	**2**	**3**	**4**	**5**	**Total**	**Rescaled**
Your Score:							
Possible:	**20**	**20**	**20**	**20**	**20**	**100**	**10**

Suggested Exercises for the sixth week. (The whole list of suggested exercises for the course can be found on the web page.These exercises are not to be turned in and are not graded, but you should write down solutions for as many of them as possible and keep your solutions in a notebook for study.)

3.1 # 5, 7 (Some of this content was discussed in the 5th week.)
3.2 # 3, 10
3.3 # 2, 3, 4, 9, 10

[1] Let $A = (2,1)$ and $B = (4,3)$ the Euclidean plane.

a) Find $\langle \vec{A}, \vec{A} \rangle$ (See page 42)
b) Find $\vec{B} - \vec{A}$ (See page 42)
c) Find $\langle \vec{B} - \vec{A}, \vec{B} - \vec{A} \rangle$ (See page 42)
d) Find $\|\vec{B} - \vec{A}\|$ (See page 42)
e) Find $d_E(A, B)$ (See chapter 2)
f) Do your results of d,e confirm the prediction of Proposition 3.1.3? Explain?
g) Find the parametric presentation for the line L_{AB} through A and B. (See page 43)
h) Find $|\langle \vec{A}, \vec{B} \rangle|$
i) Find $\|\vec{A}\| \cdot \|\vec{B}\|$
j) Do your results of h,i agree with the prediction of the Cauchy Schwarz Inequality Proposition 3.1.5?

[2] Betweenness in the Taxicab Plane.

a) Let $A = (1,8)$ and $B = (5,6)$ and $C = (7,5)$. Prove that $A - B - C$ in the taxicab plane
b) In the taxicab plane, find three points A, B, C which are not collinear but such that
$$d_T(A, C) = d_T(A, B) + d_T(B, C)$$
This problem shows why the definition of between requires collinear points.

[3] Prove Theorem 3.3.4: In a *metric geometry*,

(i) if $C \in \overrightarrow{AB}$ and $C \neq A$, then $\overrightarrow{AC} = \overrightarrow{AB}$;
(ii) if $\overrightarrow{AB} = \overrightarrow{CD}$, then $A = C$.

[4] Prove that *congruence* is an *equivalence relation* on the set of all line segments in a metric geometry.

[5] Examples illustrating Theorem 3.3.6 (Segment Construction)

a) **(simplified)** In the Poincaré Plane, let $P = (1,1)$ and $Q = (1,3)$ and $A = (6,5)$ and $B = (9,4)$. Find the point $C \in \overrightarrow{AB}$ such that $\overline{AC} \simeq \overline{PQ}$.
b) In the Taxicab Plane, let $P = (2,1)$ and $Q = (4,7)$ and $A = (3,1)$ and $B = (5,5)$. Find the point $C \in \overrightarrow{AB}$ such that $\overline{AC} \simeq \overline{PQ}$.

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