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Homework H08
MATH 3110/5110
Due Friday, March 25, 2022

Problem:	1	2	3	4	Total	Rescaled
Your Score:						
Possible:	25	25	25	25	100	10

***Suggested Exercises*:** 5.1#1, 2, 3, 7

5.3#2, 3, 4, 5, 6, 8, 9, 10, 11, 15, 16, 18, 19, 20, 21

[1] Justify and Illustrate this given proof of

Theorem 5.3.4 (Converse of the Linear Pair Theorem) In a protractor geometry,

If points A and D lie on opposite sides of $\overleftrightarrow{BC}$ and $m(\angle ABC) + m(\angle CBD) = 180$,

then $A - B - D$ and the two angles form a linear pair.

Proof

(1) Suppose that in a protractor geometry, points A and D lie on opposite sides of $\overleftrightarrow{BC}$ and $m(\angle ABC) + m(\angle CBD) = 180$. **(Illustrate)**

(2) Let $m(\angle CBD) = r$. Observe that $r = 180 - m(\angle ABC)$

(3) There exists a point E such that $A - B - E$. **(Justify) (Illustrate)**

(4) Angles $\angle ABC$ and $\angle CBE$ form a linear pair. **(Justify)**

(5) $m(\angle ABC) + m(\angle CBE) = 180$. **(Justify) (Illustrate)**

(6) So $m(\angle CBE) = 180 - m(\angle ABC)$. (by (5) and arithmetic)

(7) Point $E \in H_{\overleftrightarrow{BC},D}$ **(Justify) (Illustrate)**

(8) Observe that $E \in H_{\overleftrightarrow{BC},D}$ and $m(\angle CBE) = r$. (by (6),(2),(7))

(9) Therefore ray $\overrightarrow{BE}$ must be the same ray as ray $\overrightarrow{BD}$. **(Justify) (Illustrate)** So B is on line $\overleftrightarrow{AB}$.

(10) $A - B - D$. **(Justify) (Illustrate)** So the two angles form a linear pair.

End of Proof

[2] (exercise 5.3#4) Prove Corollary 5.3.7 Existence of a Unique Perpendicular Bisector

If $\overline{AB}$ is a segment in a protractor geometry, then $\overline{AB}$ has a *unique perpendicular bisector*.

[3] (exercise 5.3#5) In Video 5.3b, I provide a proof strategy and a detailed proof of

Corollary 5.3.8 Existence of a Unique Angle Bisector

If $\angle ABC$ is an angle in a protractor geometry, then $\angle ABC$ has a *unique angle bisector*.

Provide justifications and illustrations for the steps of that proof.

[4] (exercise 5.3#11) Let $A = (0,5), B = (0,3), C \in \left(2, \sqrt{21}\right)$. Find the angle bisector of $\angle ABC$ in the Poincaré plane $\mathcal{H}$. Show all details clearly and draw the angle & bisector. (Hint: Study similar example 5.3.6 on p. 107)