Chapter 5 Study Facts

Perpendicular Bisector

- Bisects line – Perpendicular to a segment at its midpoint
- **90°**
- Doesn't have to go through vertex
- Point of Intersection: **Circumcenter**
- Same distance to all endpoints (vertices) from the circumcenter.

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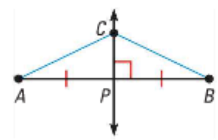
THEOREM 5.2 Perpendicular Bisector Theorem

In a plane, if a point is on the perpendicular bisector of a segment, then it is equidistant from the endpoints of the segment.

If $\overleftrightarrow{CP}$ is the $\perp$ bisector of $\overline{AB}$, then $CA = CB$.

Proof: Ex. 26, p. 308

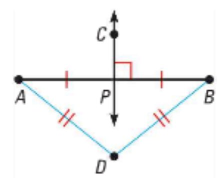


THEOREM 5.3 Converse of the Perpendicular Bisector Theorem

In a plane, if a point is equidistant from the endpoints of a segment, then it is on the perpendicular bisector of the segment.

If $DA = DB$, then D lies on the $\perp$ bisector of $\overline{AB}$.

Proof: Ex. 27, p. 308



Angle Bisector

- Cuts angle in half
- Doesn't have to bisect line on other side
- Point of Intersection: **Incenter**
- Same distance to sides

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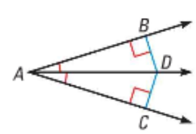
THEOREM 5.5 Angle Bisector Theorem

If a point is on the bisector of an angle, then it is equidistant from the two sides of the angle.

If $\overrightarrow{AD}$ bisects $\angle BAC$ and $\overline{DB} \perp \overrightarrow{AB}$ and $\overline{DC} \perp \overrightarrow{AC}$, then $DB = DC$.

Proof: Ex. 34, p. 315

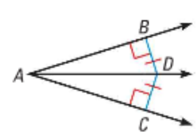


THEOREM 5.6 Converse of the Angle Bisector Theorem

If a point is in the interior of an angle and is equidistant from the sides of the angle, then it lies on the bisector of the angle.

If $\overline{DB} \perp \overrightarrow{AB}$ and $\overline{DC} \perp \overrightarrow{AC}$ and $DB = DC$, then $\overrightarrow{AD}$ bisects $\angle BAC$.

Proof: Ex. 35, p. 315



Medians

- Vertex to midpoint of opposite side
- Bisects, not necessarily 90°
- Point of Intersection: **Centroid (always <u>inside</u>)**
    - From **vertex to centroid** is $\frac{2}{3}$ of the line

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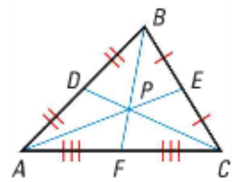
THEOREM 5.8 Concurrency of Medians of a Triangle

The medians of a triangle intersect at a point that is two thirds of the distance from each vertex to the midpoint of the opposite side.

The medians of $\triangle ABC$ meet at P and $AP = \frac{2}{3}AE$, $BP = \frac{2}{3}BF$, and $CP = \frac{2}{3}CD$.



Proof: Ex. 32, p. 323; p. 934

Altitude

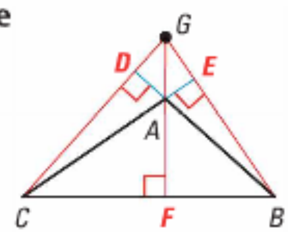
- Vertex to opposite side
- **Must have 90°**
- Point of Intersection: **Orthocenter**
    - Can intersect anywhere –
        - inside triangle - acute
        - on line – right triangle
        - outside triangle - obtuse

THEOREM *For Your Notebook*

THEOREM 5.9 Concurrency of Altitudes of a Triangle

The lines containing the altitudes of a triangle are concurrent.

The lines containing $\overline{AF}$, $\overline{BE}$, and $\overline{CD}$ meet at G.



Proof: Exs. 29–31, p. 323; p. 936