

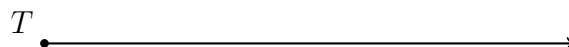
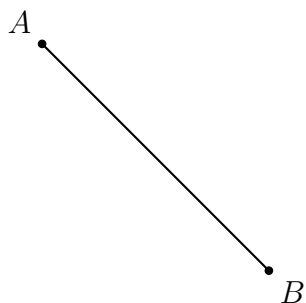
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### Learning Trajectory: Classical constructions

1. Elementary, single constuctions
  - (a) Equilateral Triangle
  - (b) Duplicate a line segment
  - (c) Perpendicular (bisector, through a point on/off the line)
  - (d) Bisect an angle
  - (e) Duplicate an angle
2. Triangle centers (perpendicular, bisectors, altitudes, medians)
3. Hexagon and square inscribed in a circle.

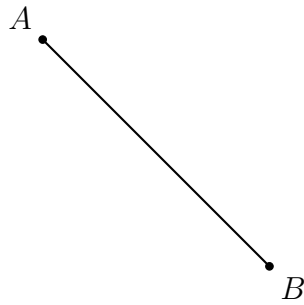
#### Equilateral triangle

1. Construct an equilateral triangle having one side on  $\overrightarrow{T}$  with each leg congruent to  $\overline{AB}$ .  
[Leave all construction marks.]

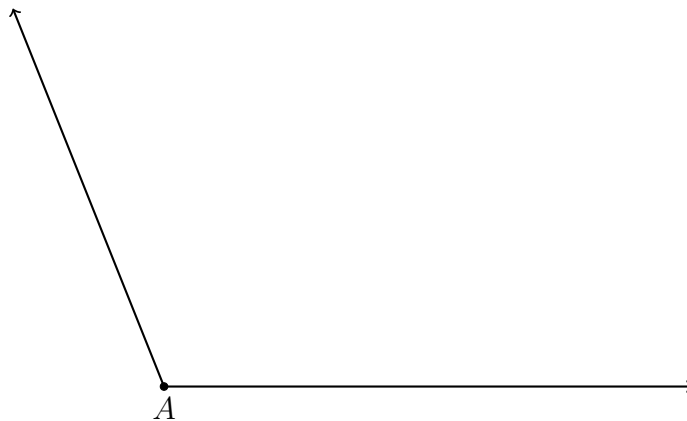


**Perpendicular (bisector, through a point on/off the line)**

2. Construct a perpendicular bisector the given line segment  $\overline{AB}$ . Label the midpoint of  $\overline{AB}$  as  $M$ . [Leave all construction marks.]

**Angle bisector**

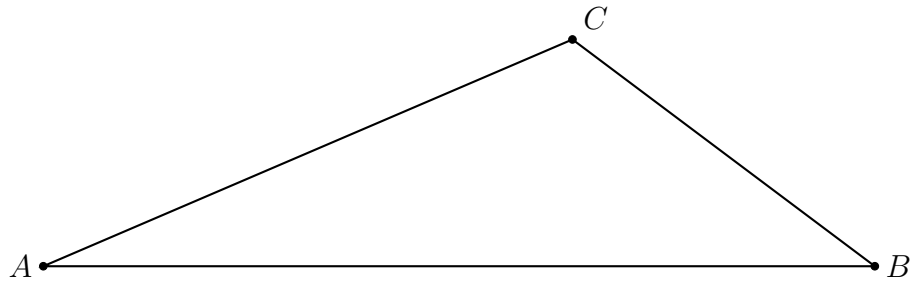
3. Construct an angle bisector the given angle  $A$ . [Leave all construction marks.]



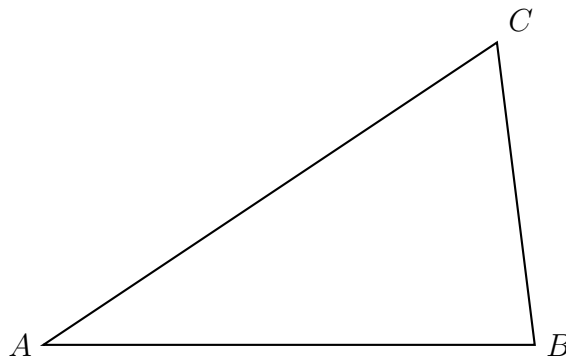
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**Triangle centers**

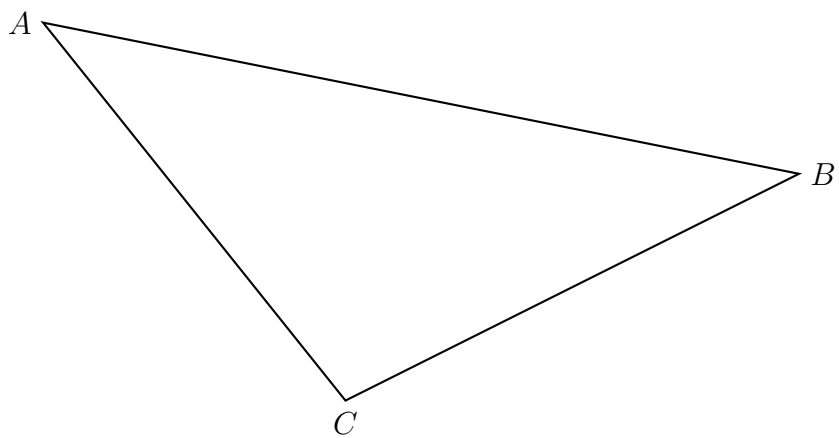
4. Construct a perpendicular to  $\overline{AB}$  through  $C$ .



5. Construct the midpoint  $M$  of  $\overline{AC}$  by using the perpendicular bisector construction.  
Draw  $\overline{BM}$ , a *median* of  $\triangle ABC$ .  
Spicy: Construct the other two medians, and hence, the centroid.

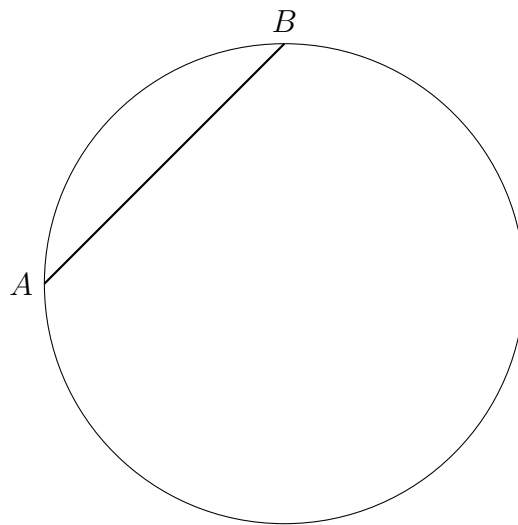


6. Using a compass and straightedge, construct the median to side  $\overline{AC}$  in  $\triangle ABC$  below.  
(Leave all construction marks.)

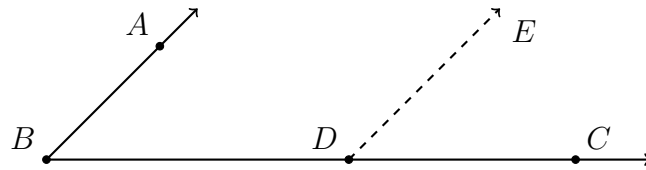


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7. In the circle below,  $\overline{AB}$  is a chord. Using a compass and straightedge, construct a perpendicular bisector of  $\overline{AB}$ , and hence, a diameter of the circle. [Leave all construction marks.]



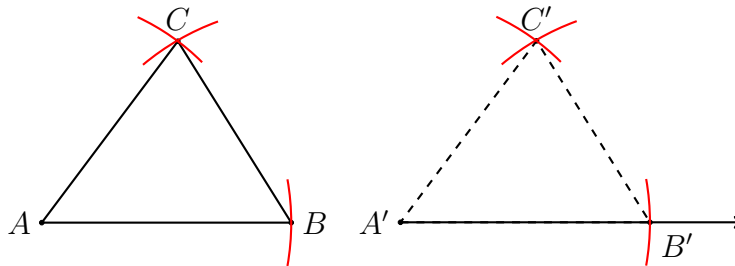
8. Spicy: Given  $\angle ABC$ , construct duplicate  $\angle CDE$ . (Leave all construction marks.)



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**Triangle congruence ( $\triangle \cong$ )**

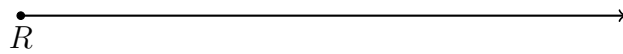
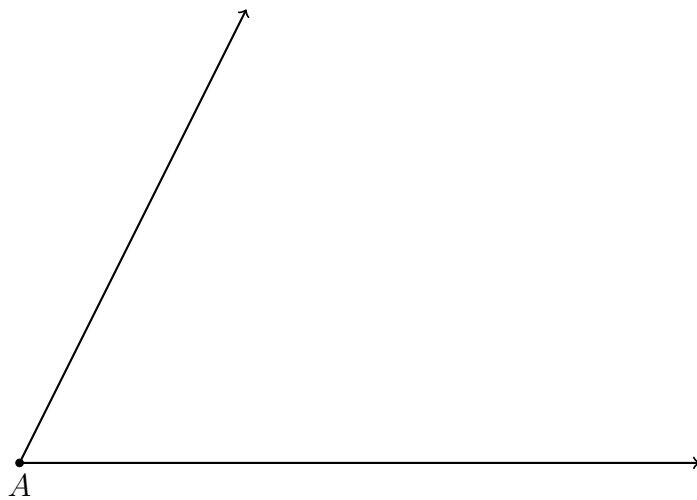
9. Function notation:  $A \rightarrow A'$  is pronounced “A gets mapped to A prime,” or “A corresponds to A prime.”
10. Given  $\triangle ABC$ , duplicate  $\triangle ABC$  by duplicating each side. (“side-side-side” or “SSS”)
  - (a) Construct  $\vec{A'}$ .
  - (b) Circle  $A'$  with radius  $AB$ .
  - (c) Intersection  $B'$ .
  - (d) Circle  $A'$  with radius  $AC$ .
  - (e) Circle  $B'$  with radius  $BC$ .
  - (f) Intersection  $C'$ .
  - (g)  $\triangle ABC \cong \triangle A'B'C'$  by the SSS  $\triangle \cong$  Postulate.



11. The Side-side-side triangle congruence postulate (SSS  $\triangle \cong$ ).  
 $\triangle ABC \cong \triangle A'B'C'$  iff  $\overline{AB} \cong \overline{A'B'}$ ,  $\overline{BC} \cong \overline{B'C'}$ , and  $\overline{AC} \cong \overline{A'C'}$
12. Duplicate a given angle.

Construct an angle with vertex  $R$  and one leg the ray  $\vec{R}$ , congruent to  $\angle A$ . Show all construction marks.

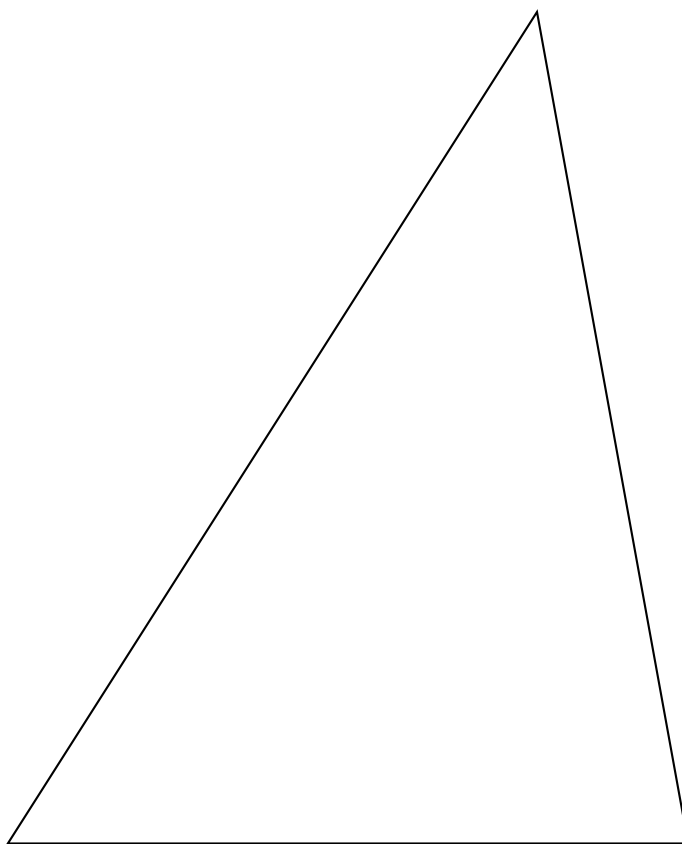
Spicy: List the steps



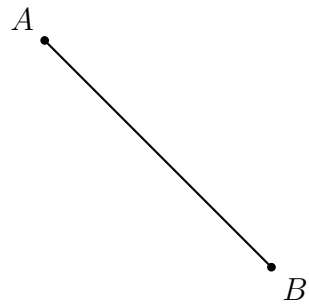


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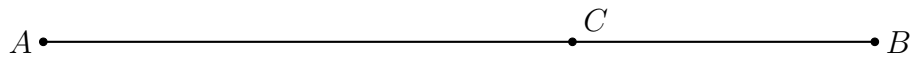
13. Spicy: Construct the perpendicular bisectors of the legs of a triangle and, hence, the circumcenter.



14. Construct a perpendicular bisector the given line segment  $\overline{AB}$ . Label the midpoint of  $\overline{AB}$  as  $M$ . [Leave all construction marks.]



15. Spicy: Construct a perpendicular to  $\overline{AB}$  through  $C$ .  
Hint: Start with a circle centered on  $C$ .

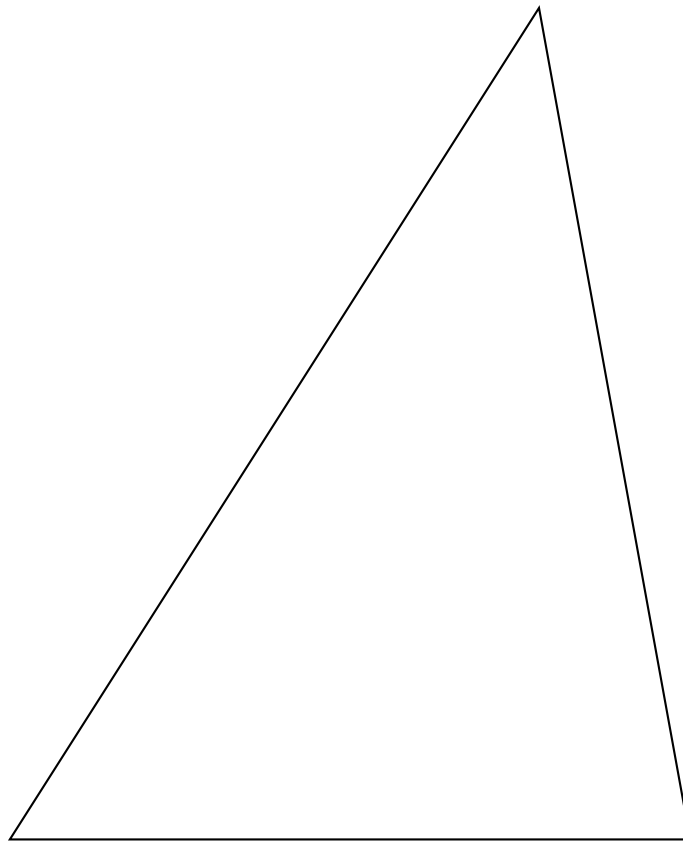


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**Construct a triangle's circumcenter**

16. Construct a perpendicular bisector of each of the legs of the triangle. Show their intersection, the circumcenter.

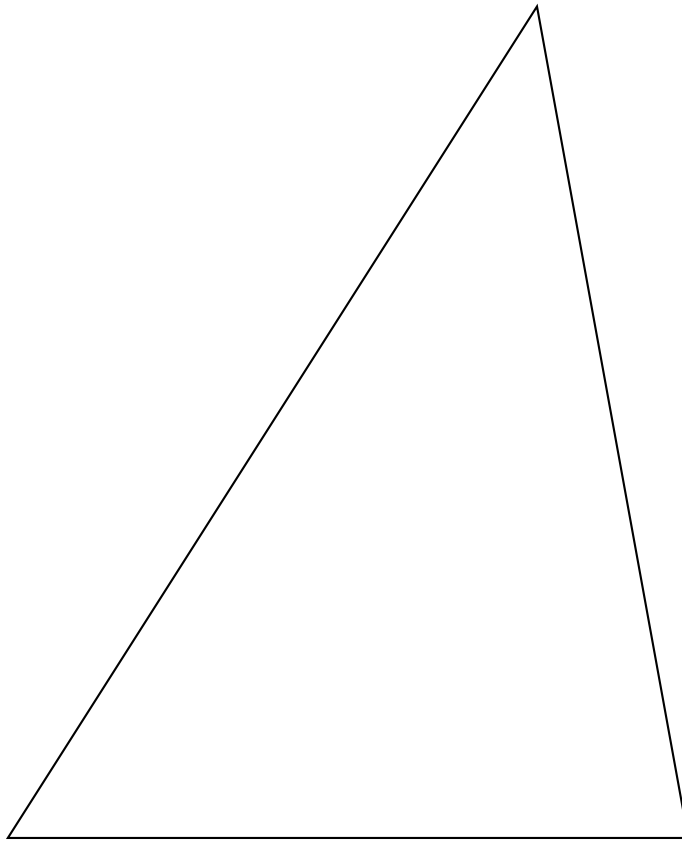
Hint: Circles should be centered at the triangle vertices, but should only be sufficiently large to intersect the other circles.



**Construct a triangle's centroid**

17. Bisect each leg of the triangle using only a compass and straightedge. Mark each midpoint, and draw a line (a *median*) connecting it to the opposite vertex. Show the medians' intersection, the centroid.

Hint: Circles should be centered at the triangle vertices, but should only be sufficiently large to intersect the other circles.

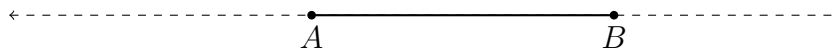


18. Construct a perpendicular to  $\overline{AB}$  through  $C$ .

Hint: Start with a circle centered on  $C$  that intersects  $\overleftrightarrow{AB}$  in two places.

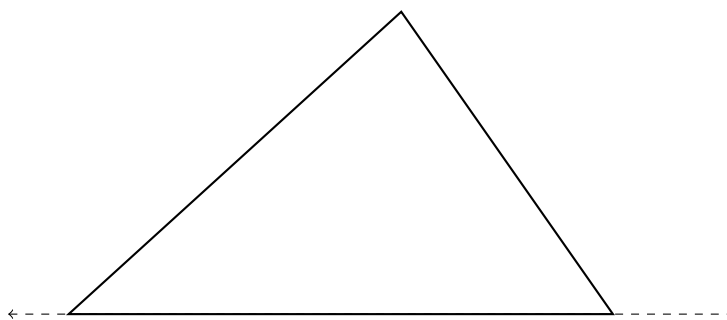
Name:

•  $C$



**Construct a triangle's orthocenter**

19. Construct a perpendicular to each of the leg of the triangle from the opposite vertex. Show their intersection, the orthocenter. Hint: you may extend the triangle sides as has been done for you on one side.



**Spicy: Construct a hexagon inscribed in a circle**

20. Construct an equilateral triangle on  $\overline{AB}$  by drawing a circle centered on  $A$ . Continue with a second equilateral triangle on  $\overline{AC}$  by drawing a circle centered on  $C$ . Work around the circle  $B$  four more times to construct the hexagon.

