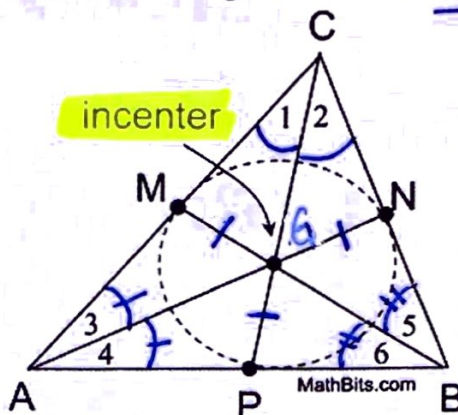


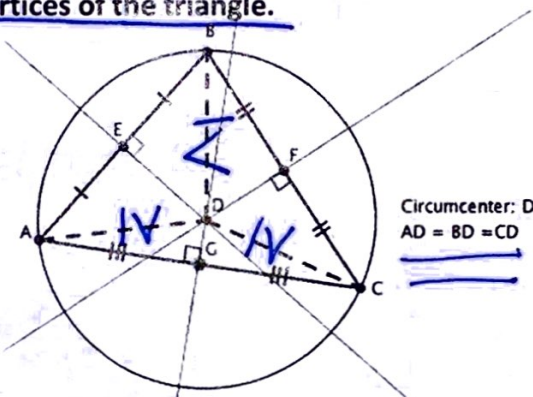
Three or more lines are **CONCURRENT** if and only if they intersect in the same point. Several kinds of lines associated with triangles are concurrent and each intersection point has a special name

I. **THEOREM** - The bisectors of the angles of a triangle intersect in a point that is equidistant from the 3 sides of the triangle.



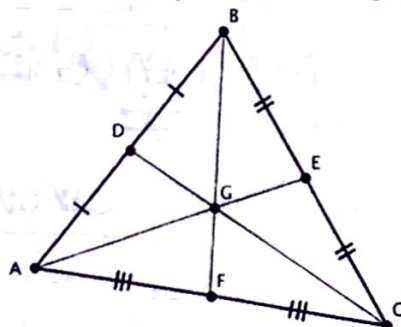
- The point of concurrency of the **ANGLE BISECTORS** of a triangle is called the incenter.

II. **THEOREM** - The perpendicular bisectors of the sides of a triangle intersect in a point that is equidistant from the vertices of the triangle.



- The point of concurrency of the **PERPENDICULAR BISECTORS** of a triangle is called the circumcenter.

III. **THEOREM** - The medians of a triangle are concurrent. The length of a segment of a median from the vertex to the point of concurrency is  $\frac{2}{3}$  the length of the entire median.



Medians: AE, BF, CD  
Centroid: G

$$BG = \frac{2}{3} BF$$

$$CG = \frac{2}{3} CD$$

$$AG = \frac{2}{3} AE$$

- The point of concurrency of the **MEDIANS** of a triangle is a centroid.

## Practice

Give the name the point of concurrency for each of the following **and sketch**.

1. Angle Bisectors of a Triangle INCENTER

2. Medians of a Triangle CENTROID

4. Perpendicular Bisectors of a Triangle CIRCUMCENTER

Complete each of the following statements.

5. The **incenter** of a triangle is equidistant from the 3 sides of the triangle.

6. The **circumcenter** of a triangle is equidistant from the 3 vertices of the triangle.

7. The **centroid** is  $\frac{2}{3}$  of the distance from each vertex to the midpoint of the opposite side.

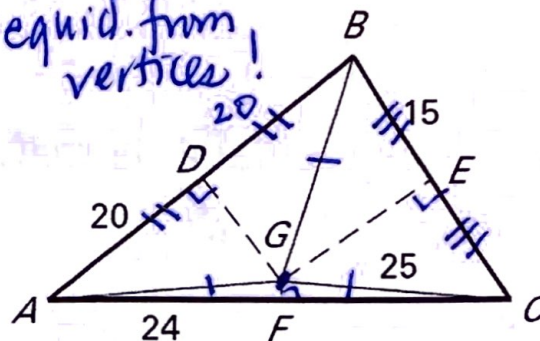
8. To **inscribe** a circle about a triangle, you use the **incenter**

9. To **circumscribe** a circle about a triangle, you use the **circumcenter**

In the diagram, the perpendicular bisectors (shown with dashed segments) of  $\triangle ABC$  meet at point  $G$ —the circumcenter. and are shown dashed. Find the indicated measure.

$\perp$  bisector  $\rightarrow$  equid. from vertices!

10.  $AG =$  25      11.  $BD =$  20  
 12.  $CF =$  24      13.  $AB =$  40  
 14.  $CE =$  15      15.  $AC =$  48  
 16.  $m\angle ADG =$  90



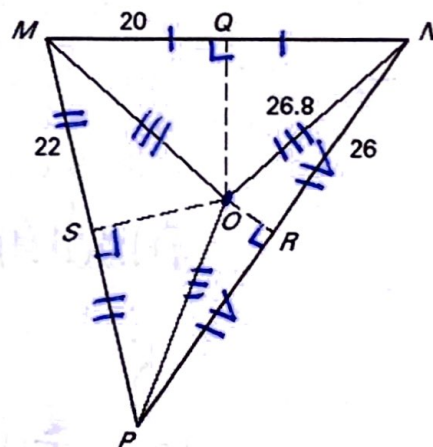
17. If  $BG = (2x - 15)$ , find  $x$ .

$$\begin{aligned} 2x - 15 &= 25 \\ 2x &= 40 \end{aligned}$$

$$x = \underline{20}$$

In the diagram, the perpendicular bisectors (shown with dashed segments) of  $\triangle MNP$  meet at point  $O$ —the circumcenter. Find the indicated measure.

18.  $MO =$  26.8      19.  $PR =$  26  
 20.  $MN =$  40      21.  $SP =$  22  
 22.  $m\angle MQO =$  90



23. If  $OP = 2x$ , find  $x$ .

$$2x = 26.8$$

$$x = \underline{13.4}$$



→ angle bisector → equid. from sides

Point T is the incenter of  $\triangle PQR$ .

24. If Point T is the incenter, then Point T is the point of concurrency of

the angle bisectors.

25.  $ST =$  15

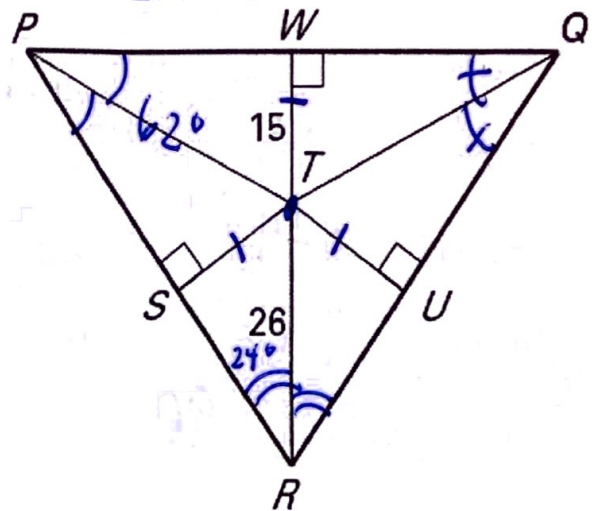
26. If  $TU = (2x - 1)$ , find x.

$$\begin{aligned} 2x - 1 &= 15 \\ 2x &= 16 \end{aligned}$$

$$x = \underline{8}$$

27. If  $m\angle PRT = 24^\circ$ , then  $m\angle QRT =$   $24^\circ$

28. If  $m\angle RPQ = 62^\circ$ , then  $m\angle RPT =$   $31^\circ$



Point G is the centroid of  $\triangle ABC$ ,  $AD = 8$ ,  $AG = 10$ ,  $BE = 10$ ,  $AC = 16$  and  $CD = 18$ . Find the length of each segment.

29. If Point G is the centroid, then Point T is the point of concurrency of

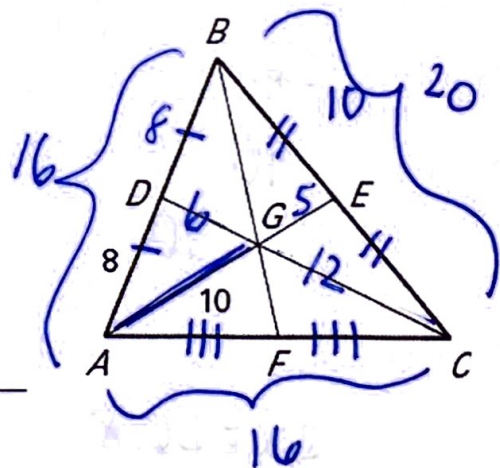
the medians.

30.  $DB =$  8 31.  $EA =$  15

32.  $CG =$   $12 \frac{2}{3} (18)$  33.  $BA =$  16

34.  $GE =$  5 35.  $GD =$  6

36.  $BC =$  20 37.  $AF =$  8

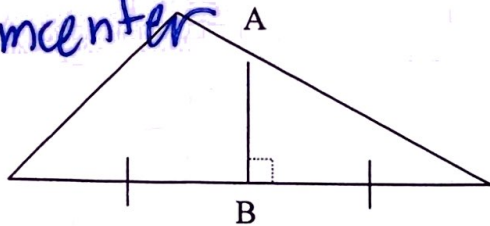


Is segment AB a perpendicular bisector, angle bisector, median, altitude, or none of these? *these segment*

*midpoint*  
*perp. (⊥)*

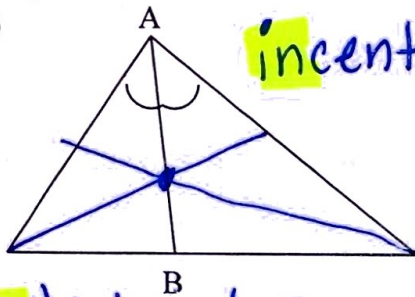
46)

*circumcenter*



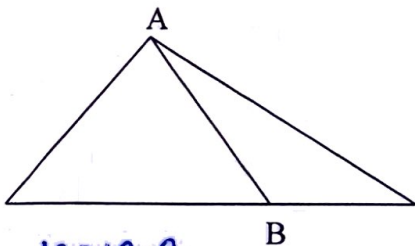
perpendicular bisector

48)



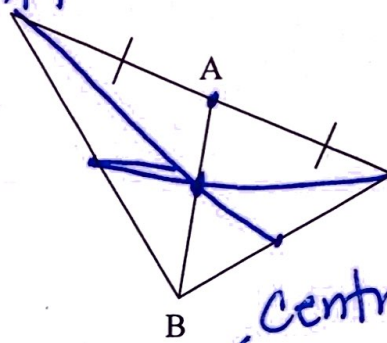
angle bisector

50)



none

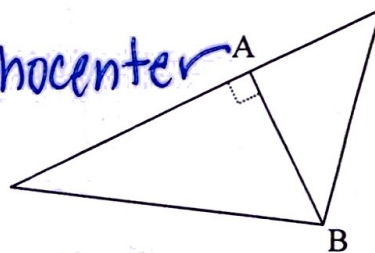
47)



median

49)

*orthocenter*



altitude

*centroid*