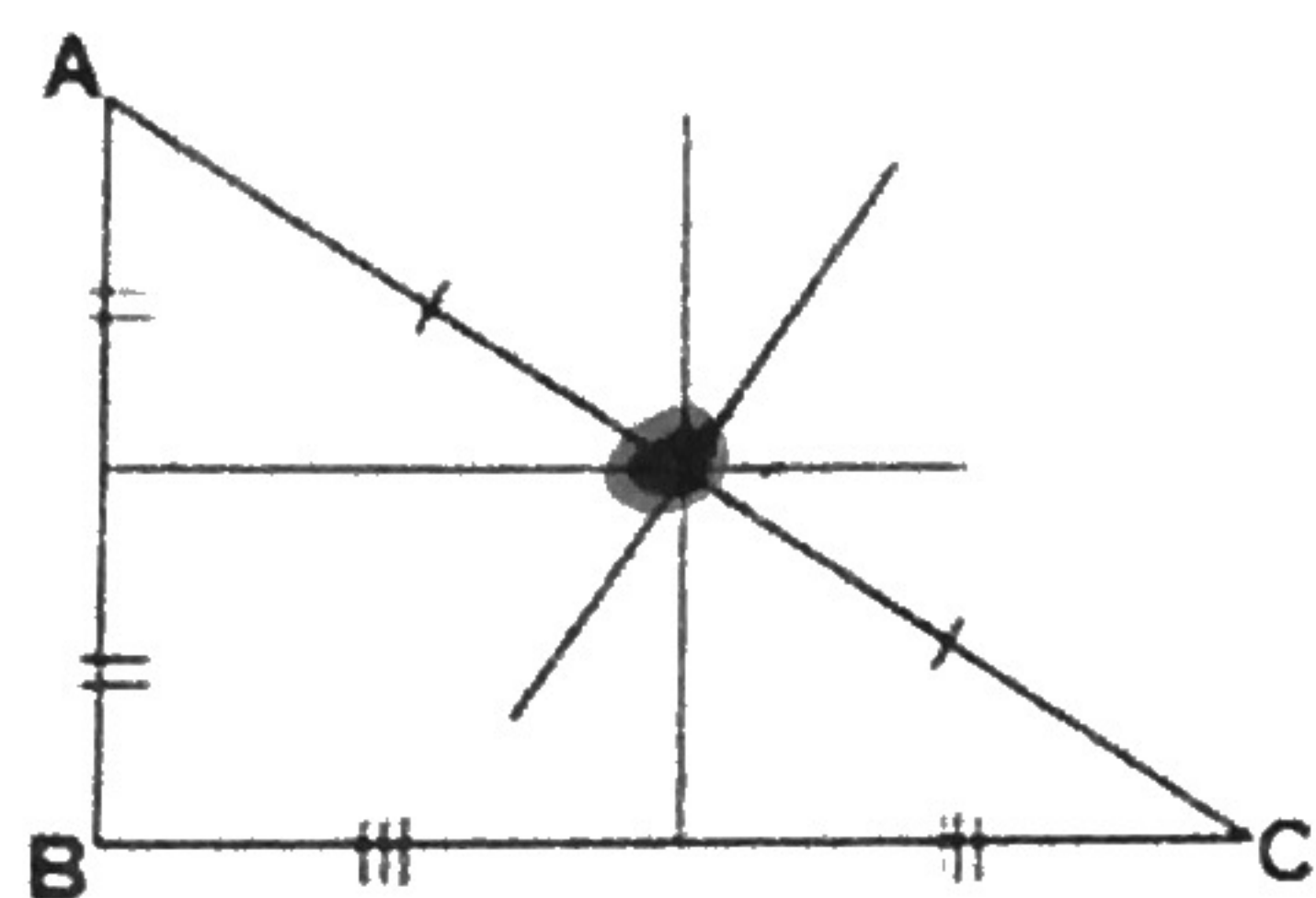


When three or more lines intersect at one point, the lines are said to be concurrent

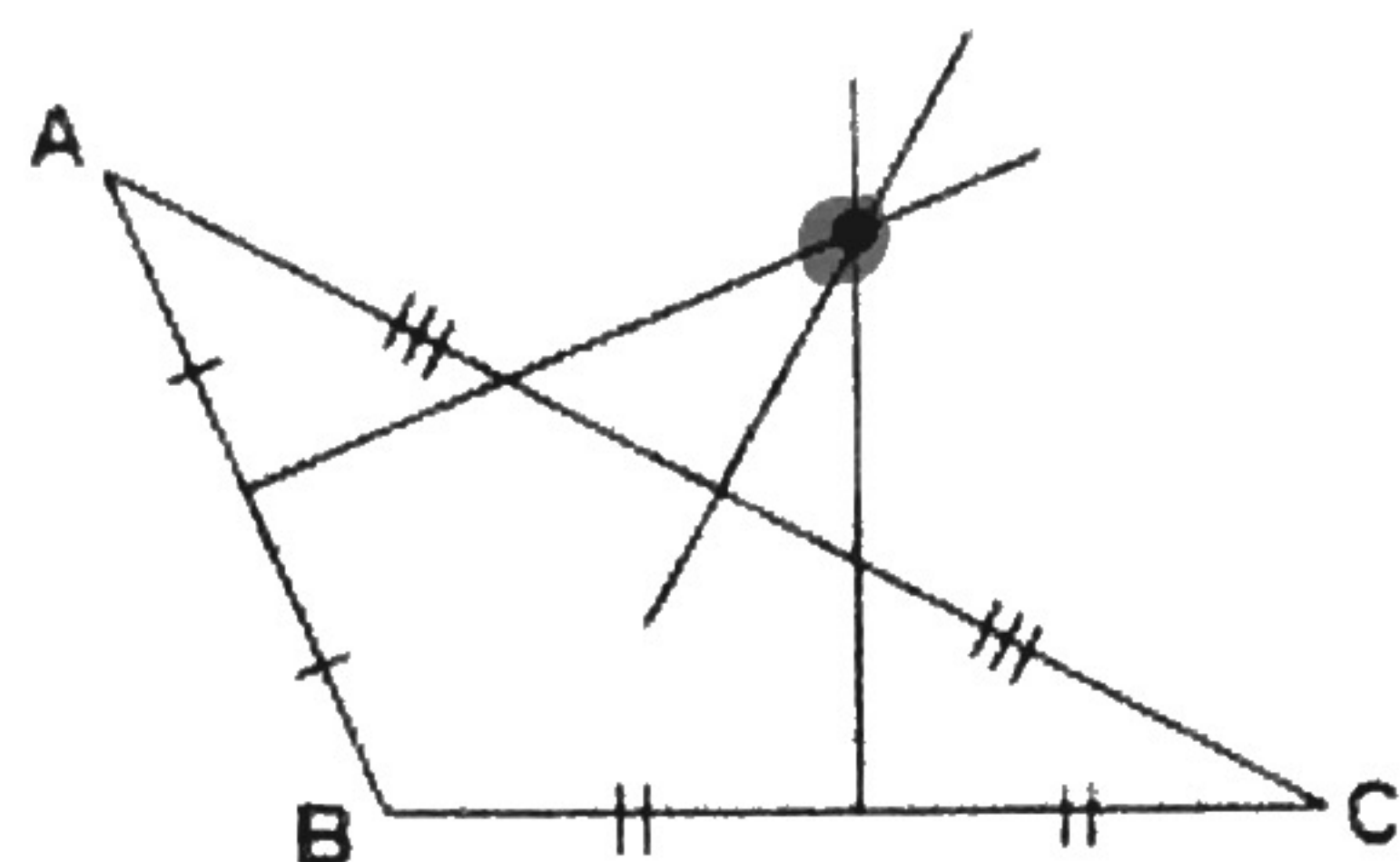
The point of concurrency is the point where they intersect.

I. Circumcenter

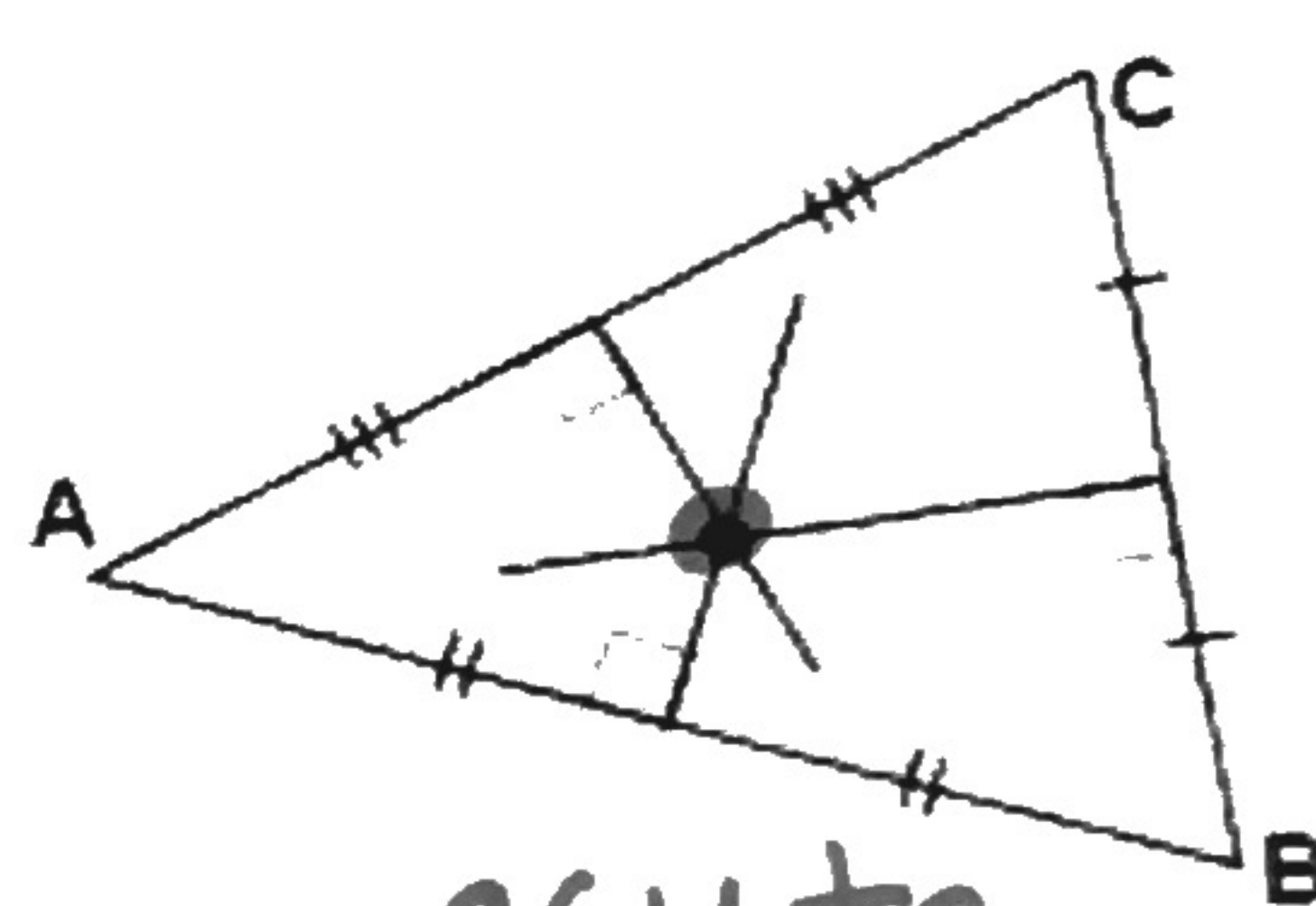
When you find the three perpendicular bisectors of a triangle, one for each side, they will intersect at a single point. This point is called the circumcenter of the triangle



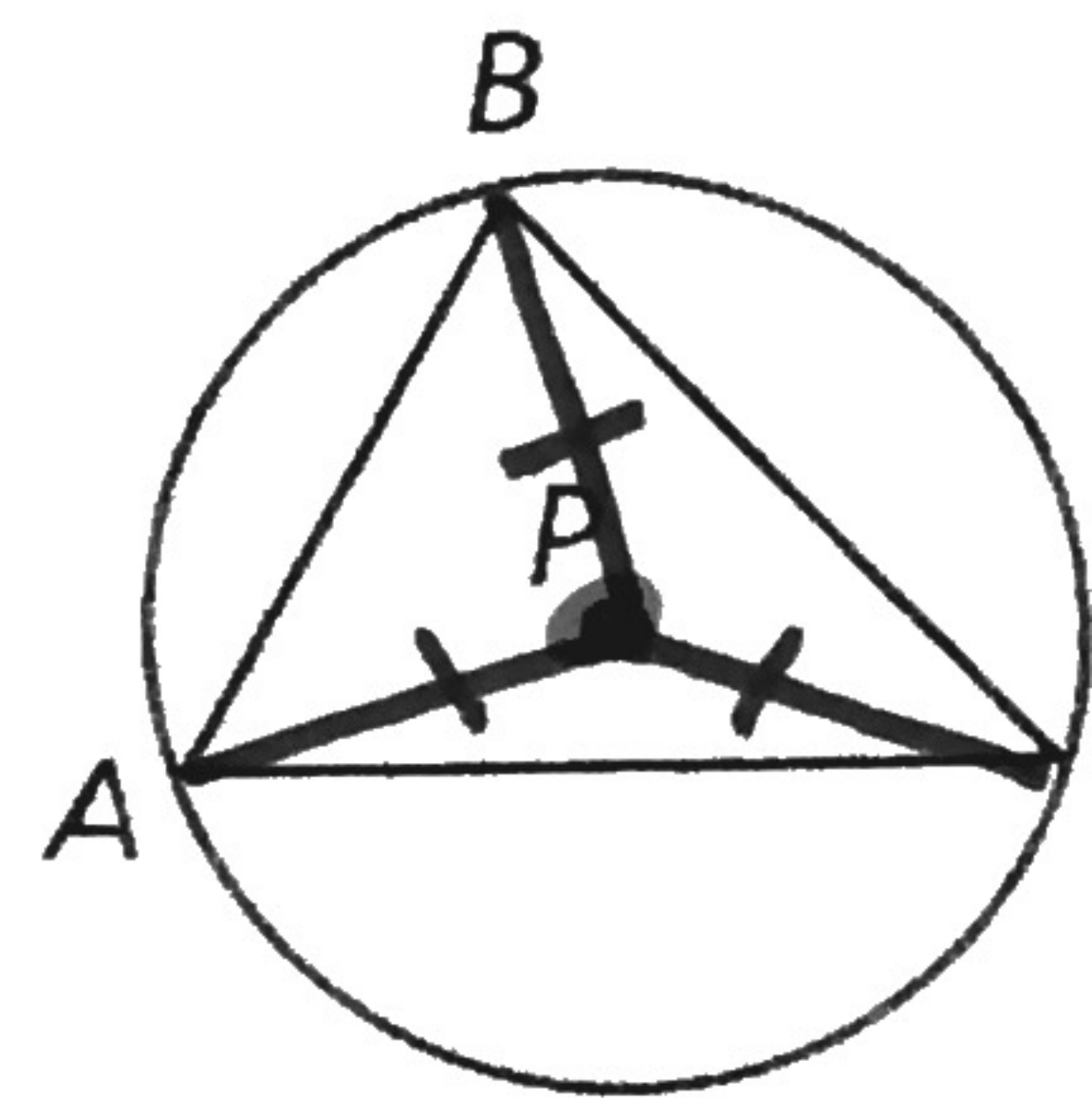
right
@ midpoint of the longest side.



obtuse
outside



acute
inside *



Important Facts:

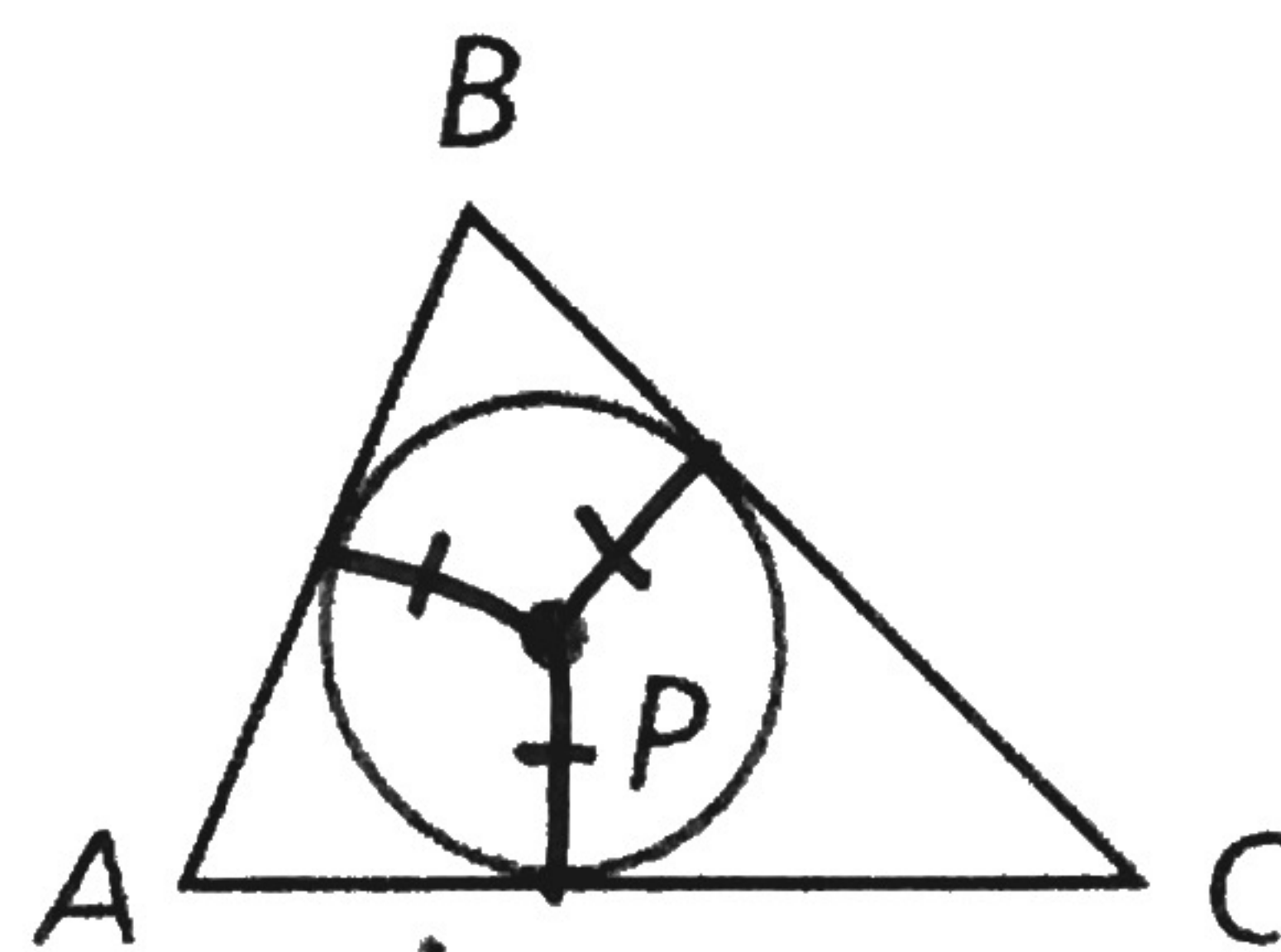
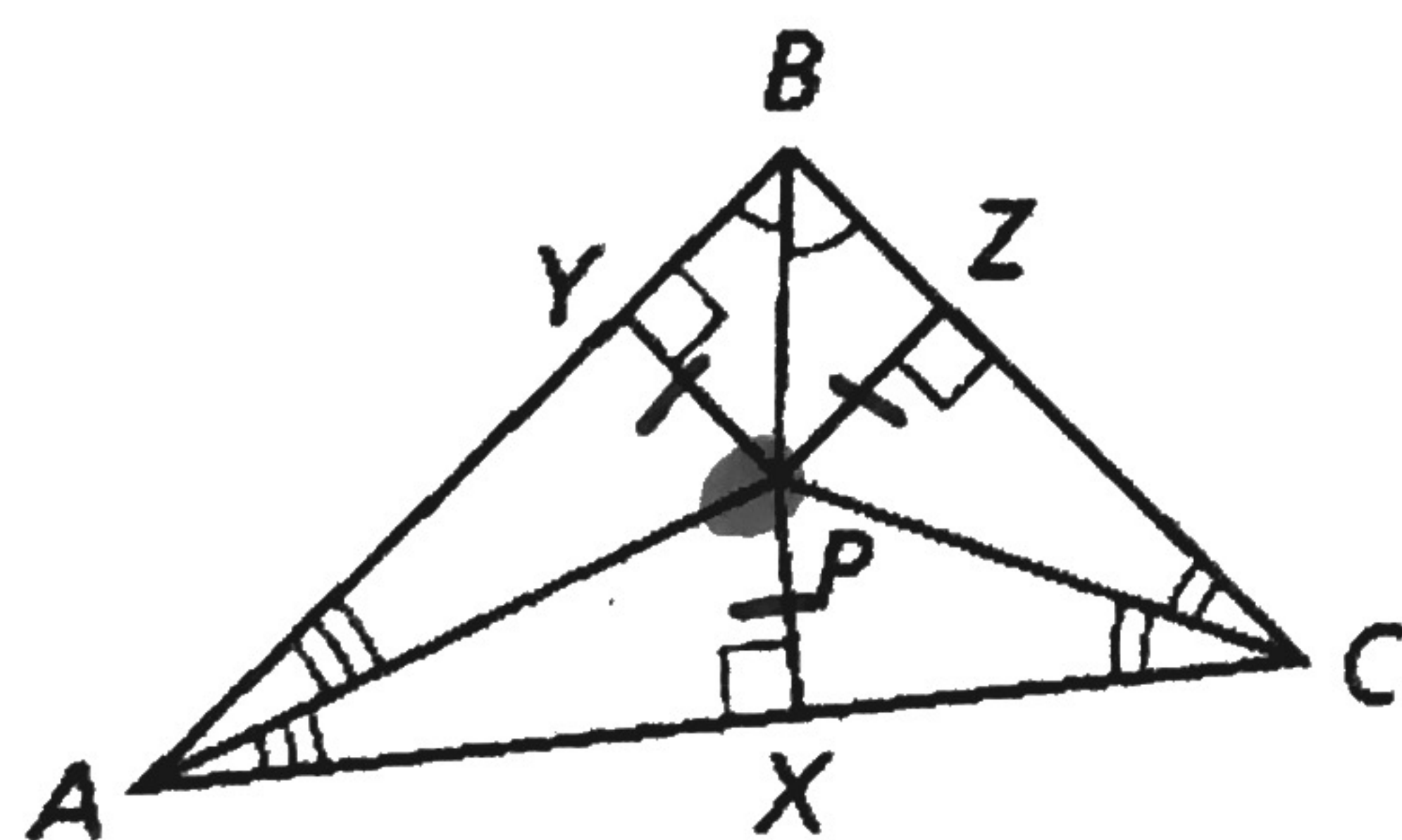
The circumcenter of $\triangle ABC$ is the center of its circumscribed circle.

The circumcenter is always equidistant to each vertex of the triangle

It can be located inside, outside or on the triangle depending on the type of triangle. (see above)

II. Incenter

The three angle bisectors of a triangle intersect to form a point called the Incenter



Important Facts:

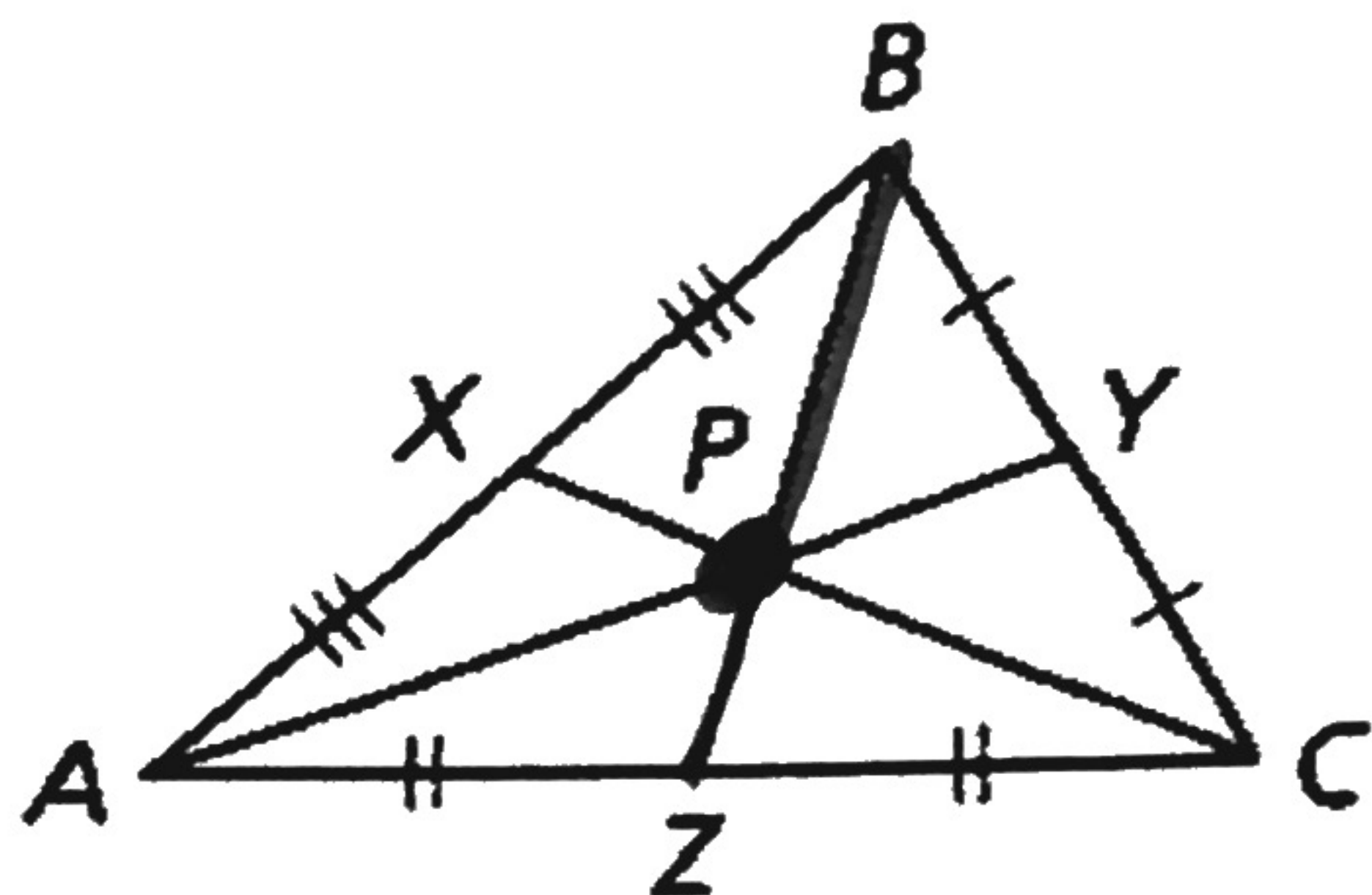
The incenter is the center of the triangle's inscribed circle.

The incenter is always equidistant to each side of the triangle.

The incenter is always located inside the triangle.

III. Centroid

The Centroid of the triangle is the point of concurrency of the three medians of the triangle.



Important Facts:

The Centroid is also known as the center of gravity.

The Centroid is always located inside the triangle.

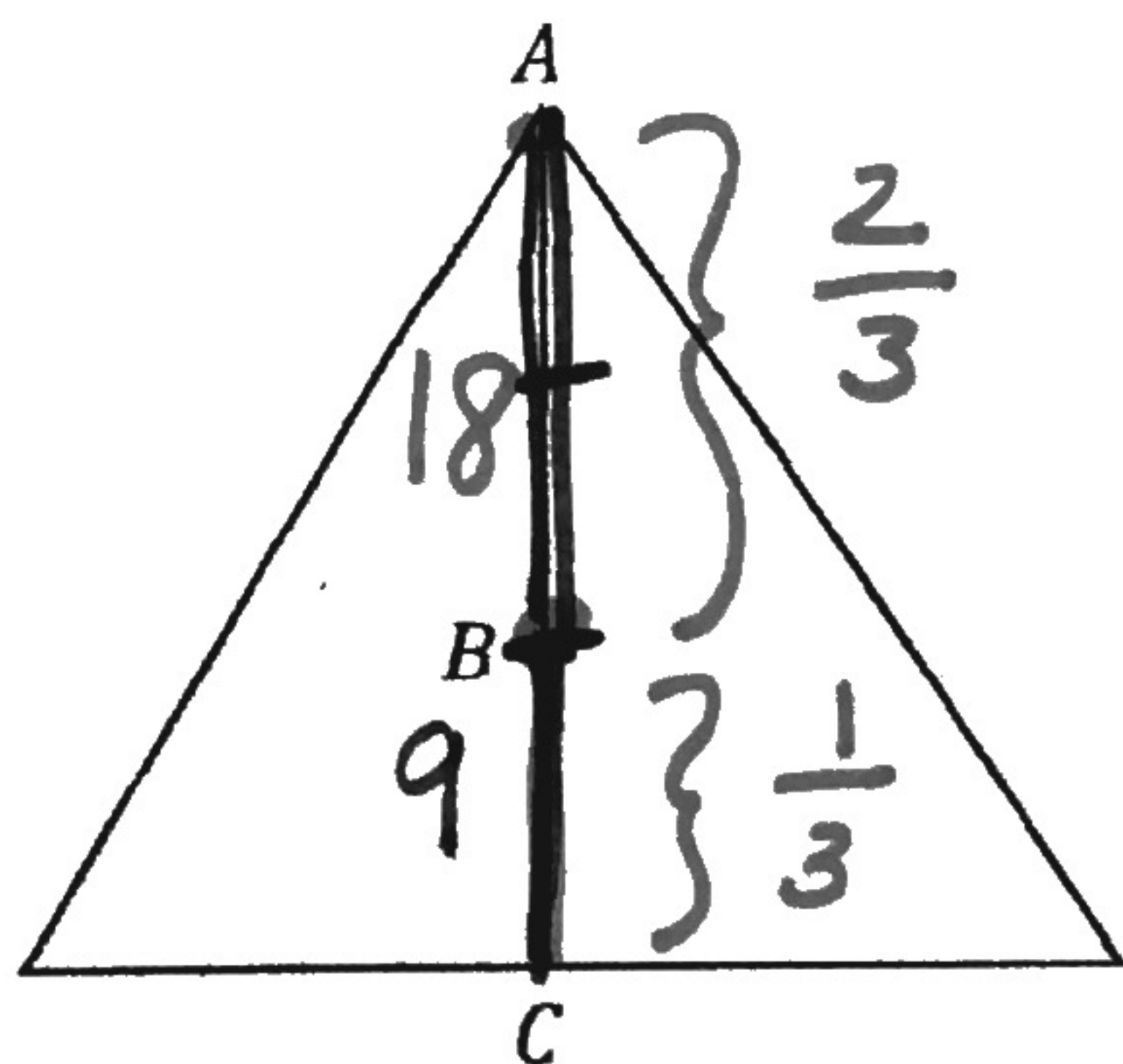
The Centroid Theorem:

The centroid of a triangle is located $\frac{2}{3}$ of the distance from each vertex to the midpoint of the opposite side. This creates a 2:1 ratio from the vertex to the opposite side inside the triangle.

B is the centroid of the given triangle.

1. If $AB = 18$, then $AC =$ 27

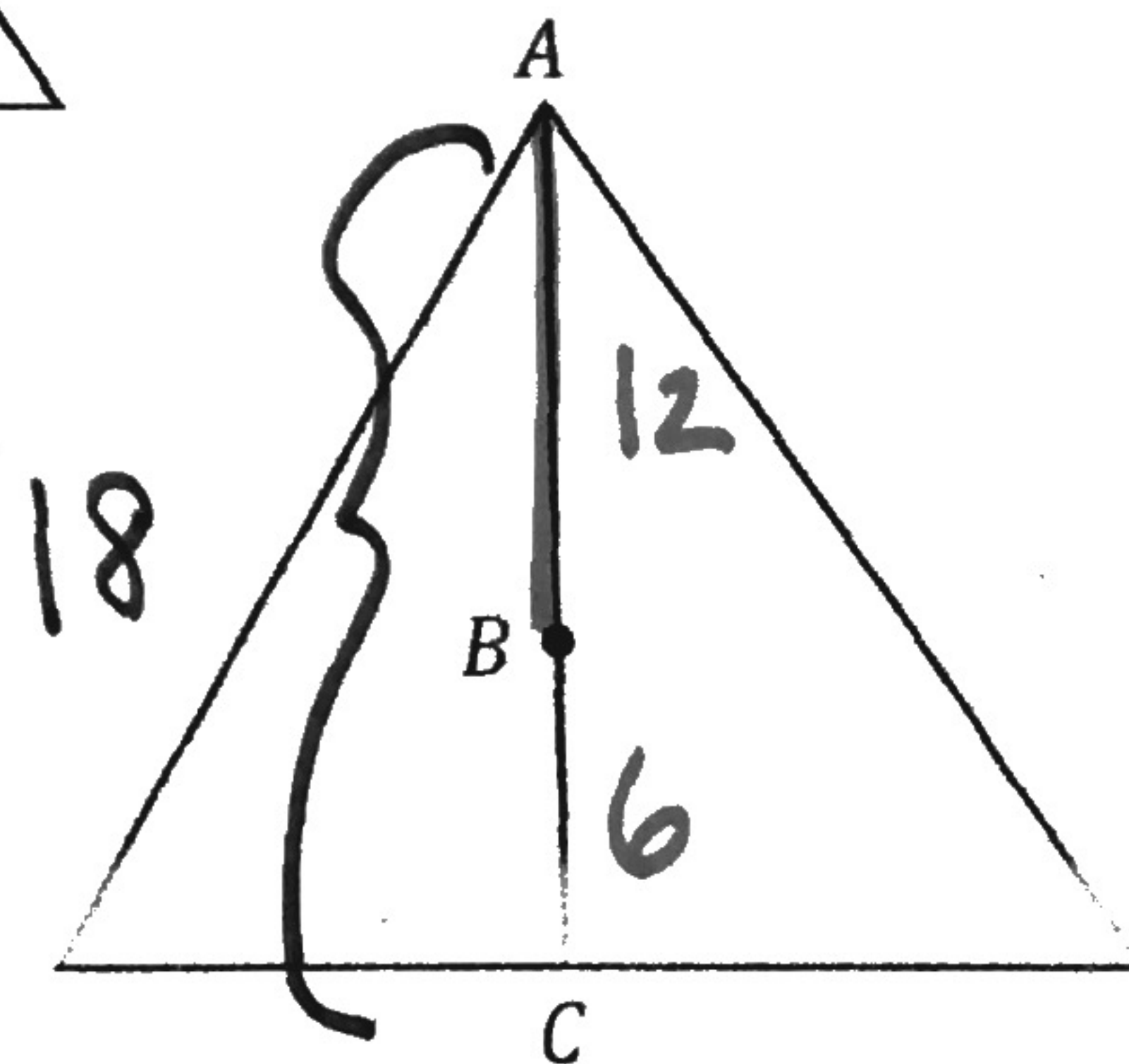
$$18 + 9$$



2. If $AC = 18$, then $AB =$ 12

$$\frac{2}{3}(18) = 12$$

$$\frac{18}{3} = 6$$



3. If $AB = 5x + 2$, and $BC = 3x - 1$, then $AC =$ 33

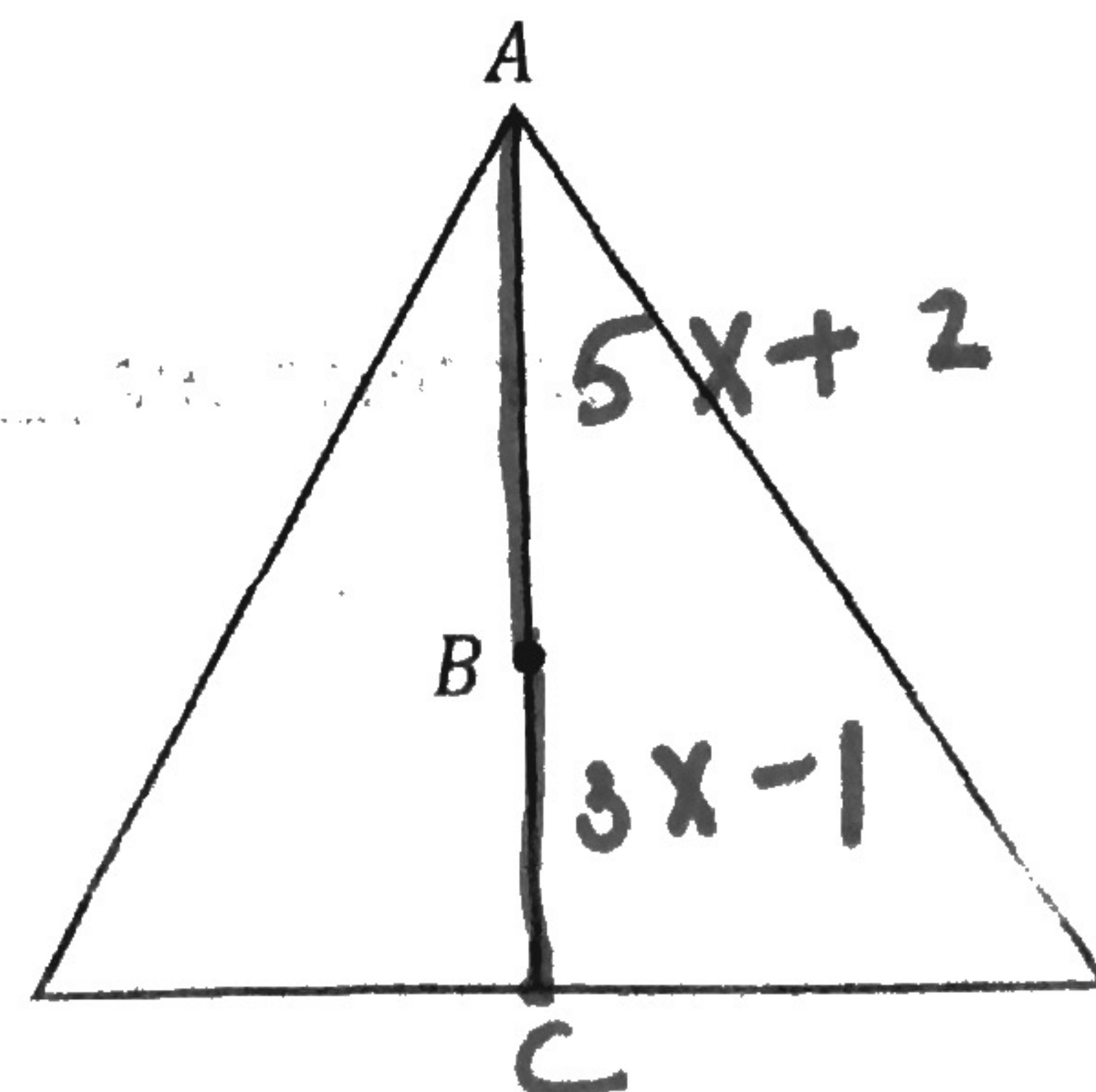
$$2(3x - 1) = 5x + 2$$

$$6x - 2 = 5x + 2$$

$$x = 4$$

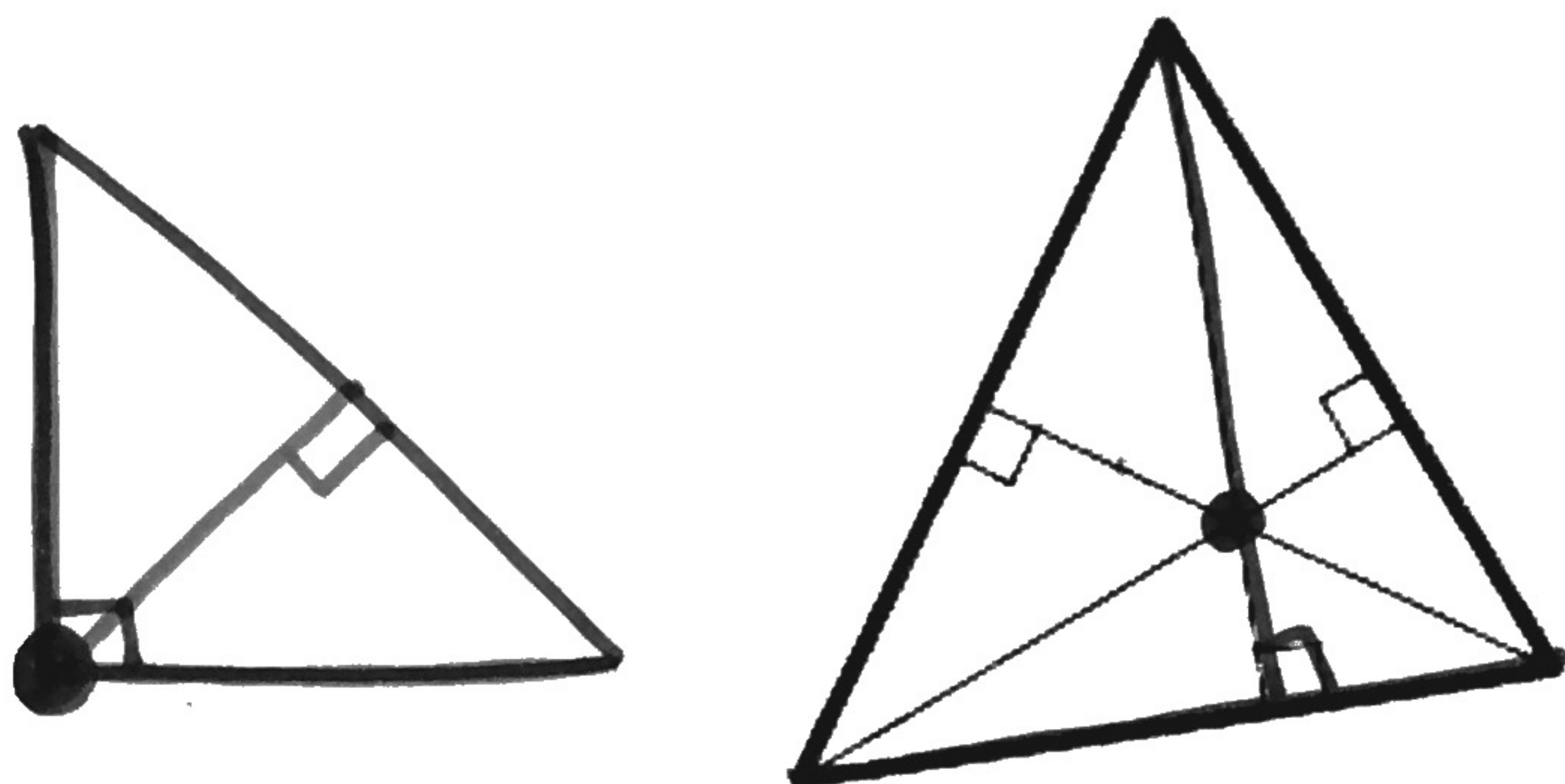
$$3(4) - 1$$

$$11$$



IV. Orthocenter

The three altitudes of a triangle intersect at the orthocenter of the triangle.



acute - inside
obtuse - outside
right Δ - at the 90° angle.

Important Facts:

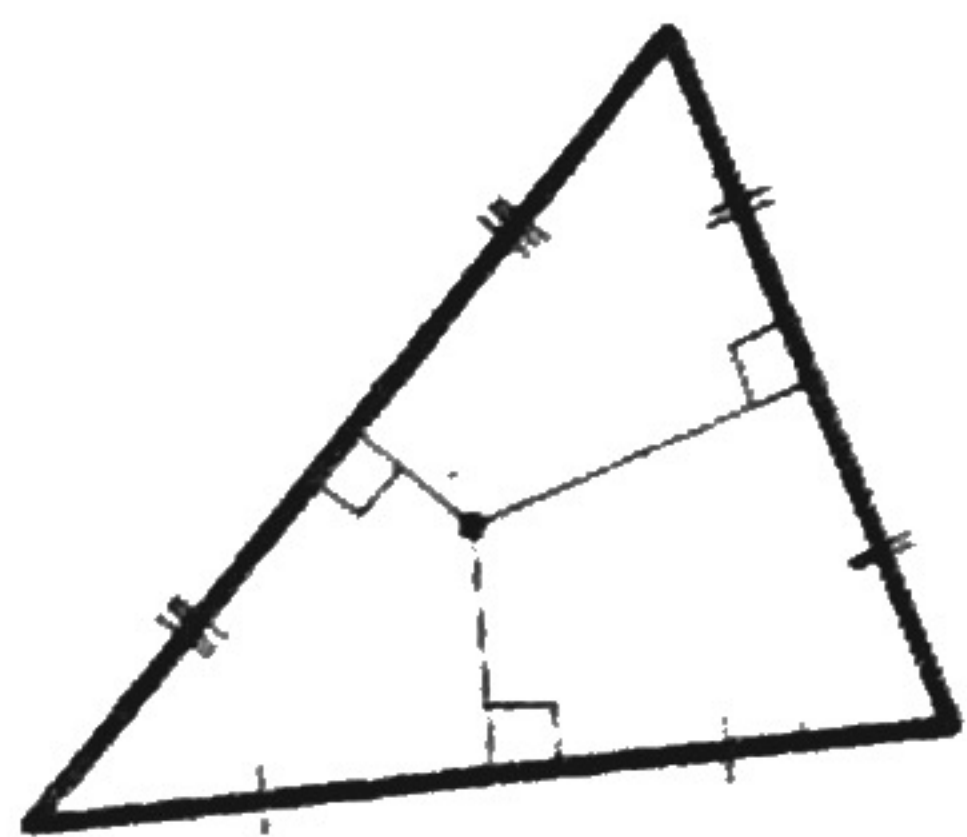
It can be located inside, outside, or on the triangle depending on the type of triangle.

For questions 1-9, fill in the blank with the appropriate term.

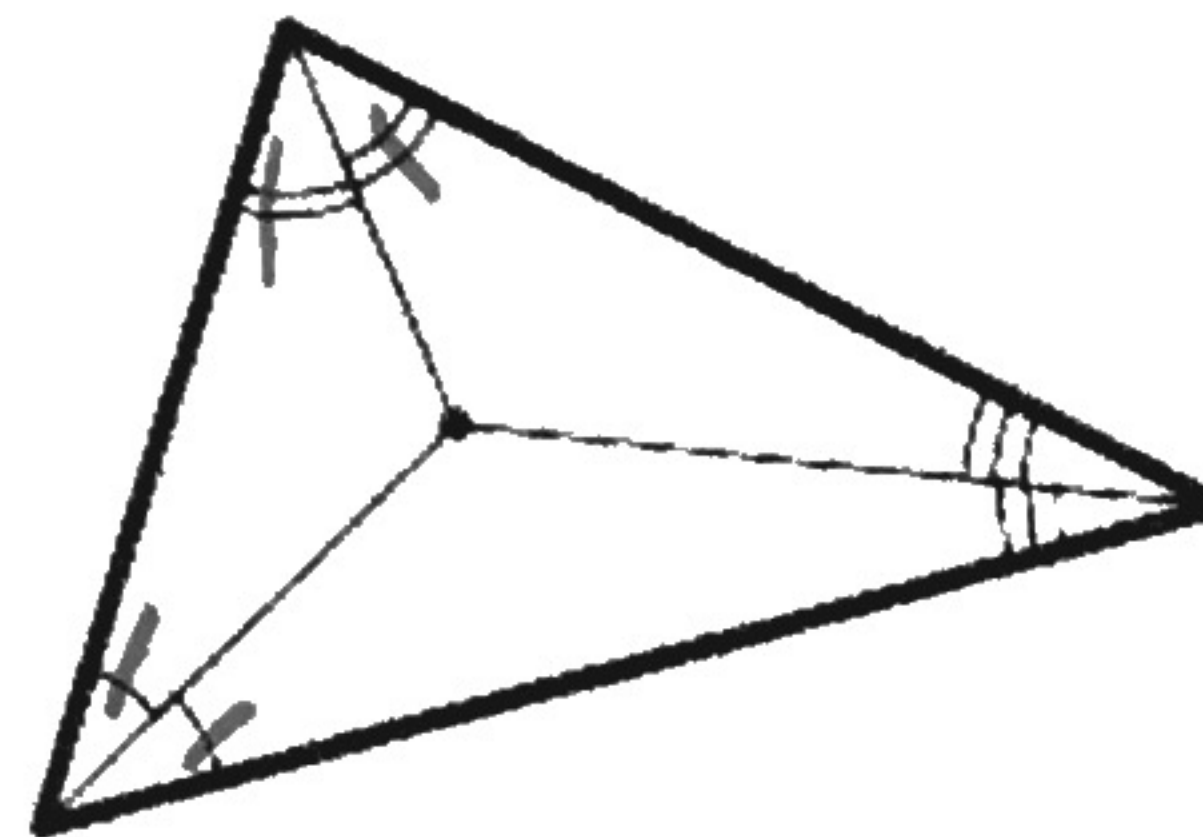
1. The three altitudes of a triangle intersect at the orthocenter.
2. The three medians of a triangle intersect at the centroid.
3. The three perpendicular bisectors of a triangle intersect at the circumcenter.
4. The three angle bisectors of a triangle intersect at the incenter.
5. The centroid of a triangle is also called the center of gravity.

For questions 10-13 identify the point of concurrency shown.

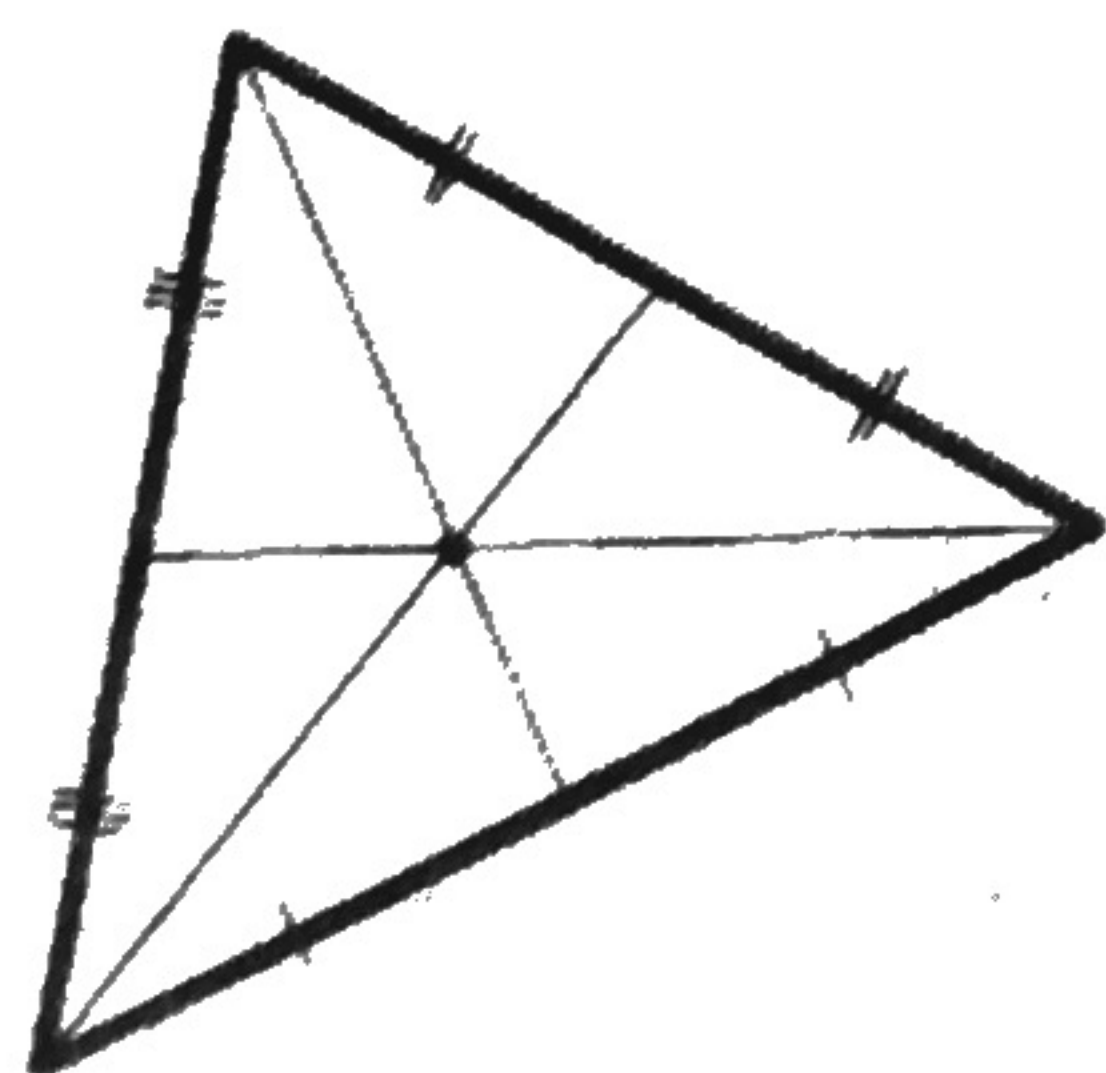
6. Circumcenter



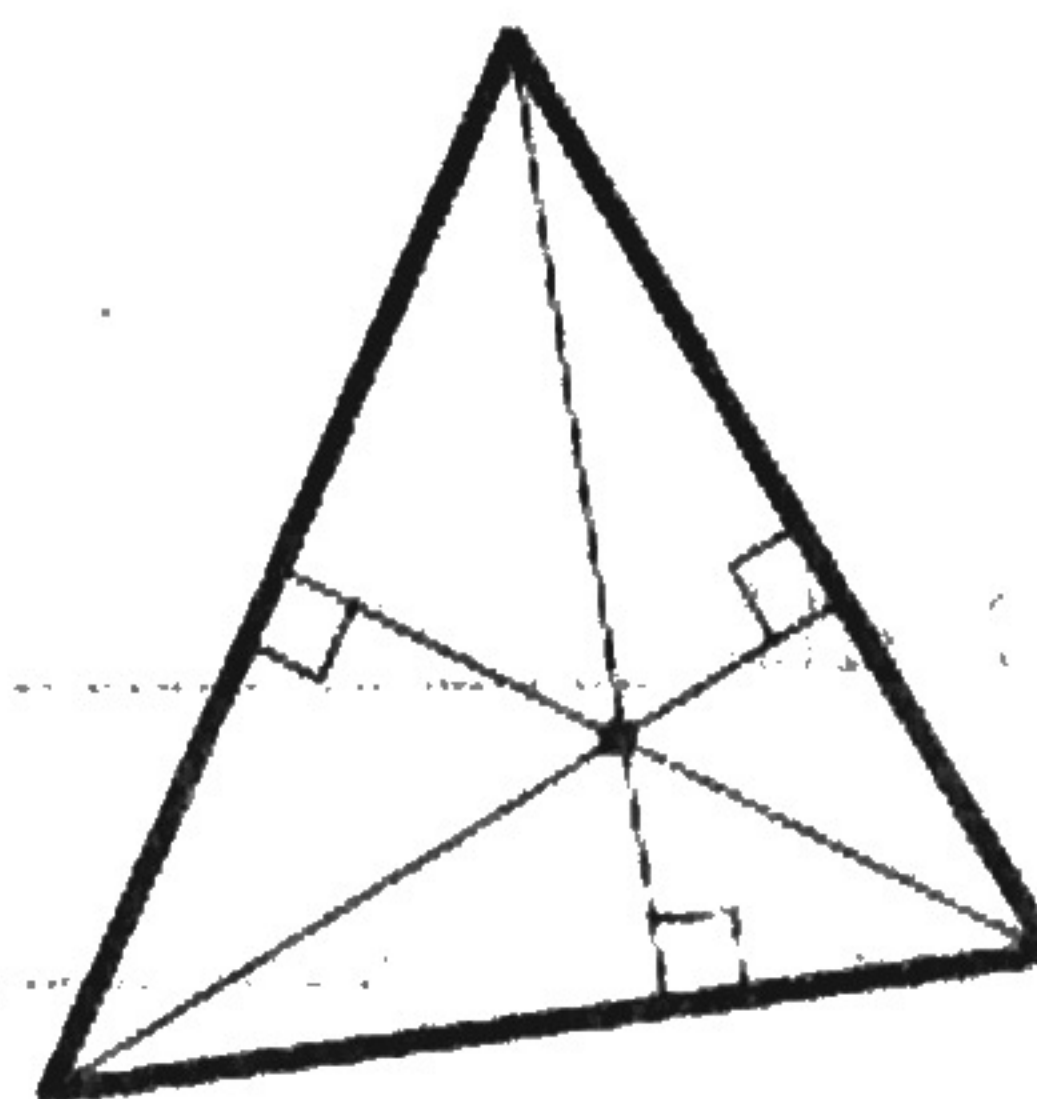
7. incenter



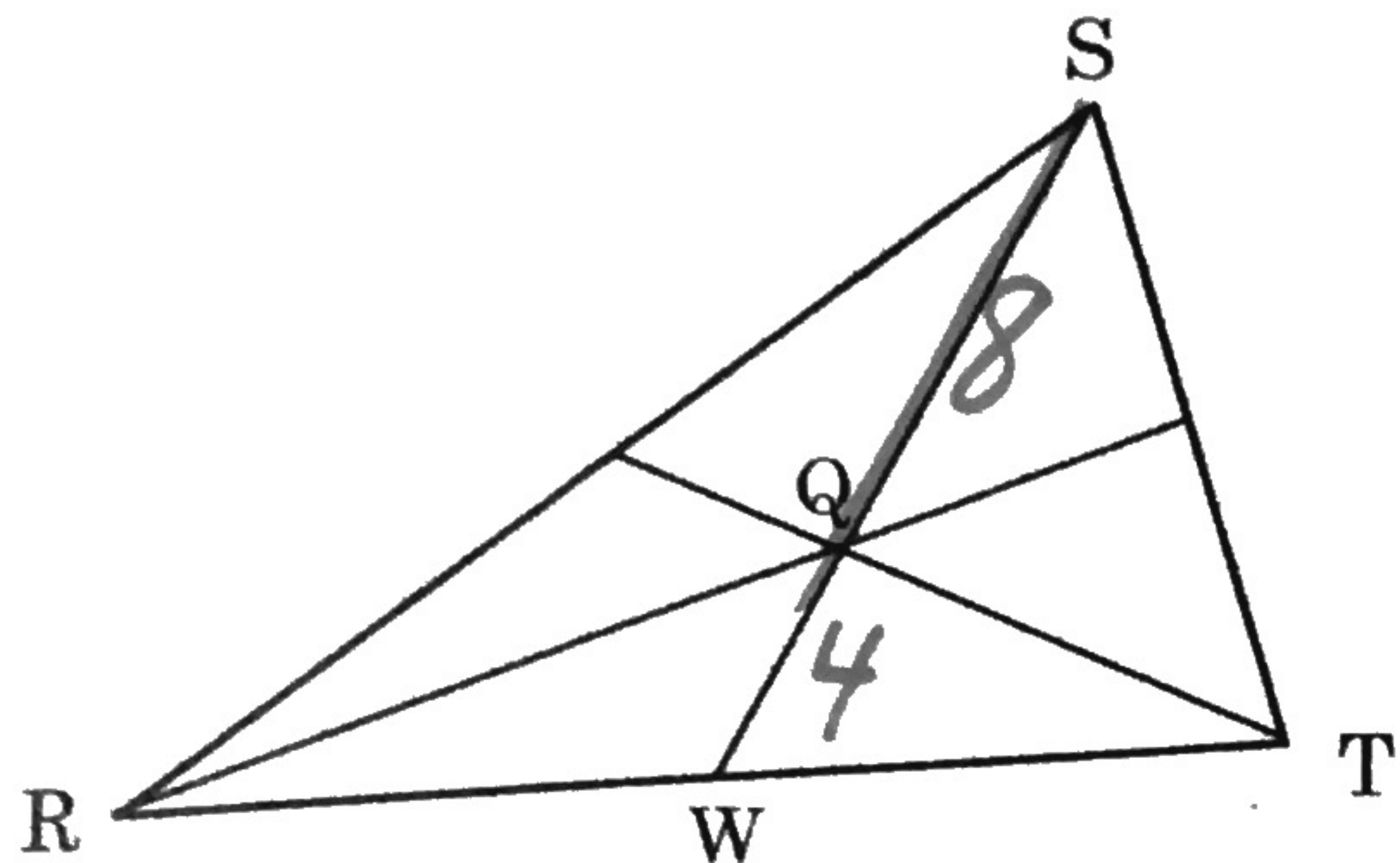
8. centroid



9. orthocenter



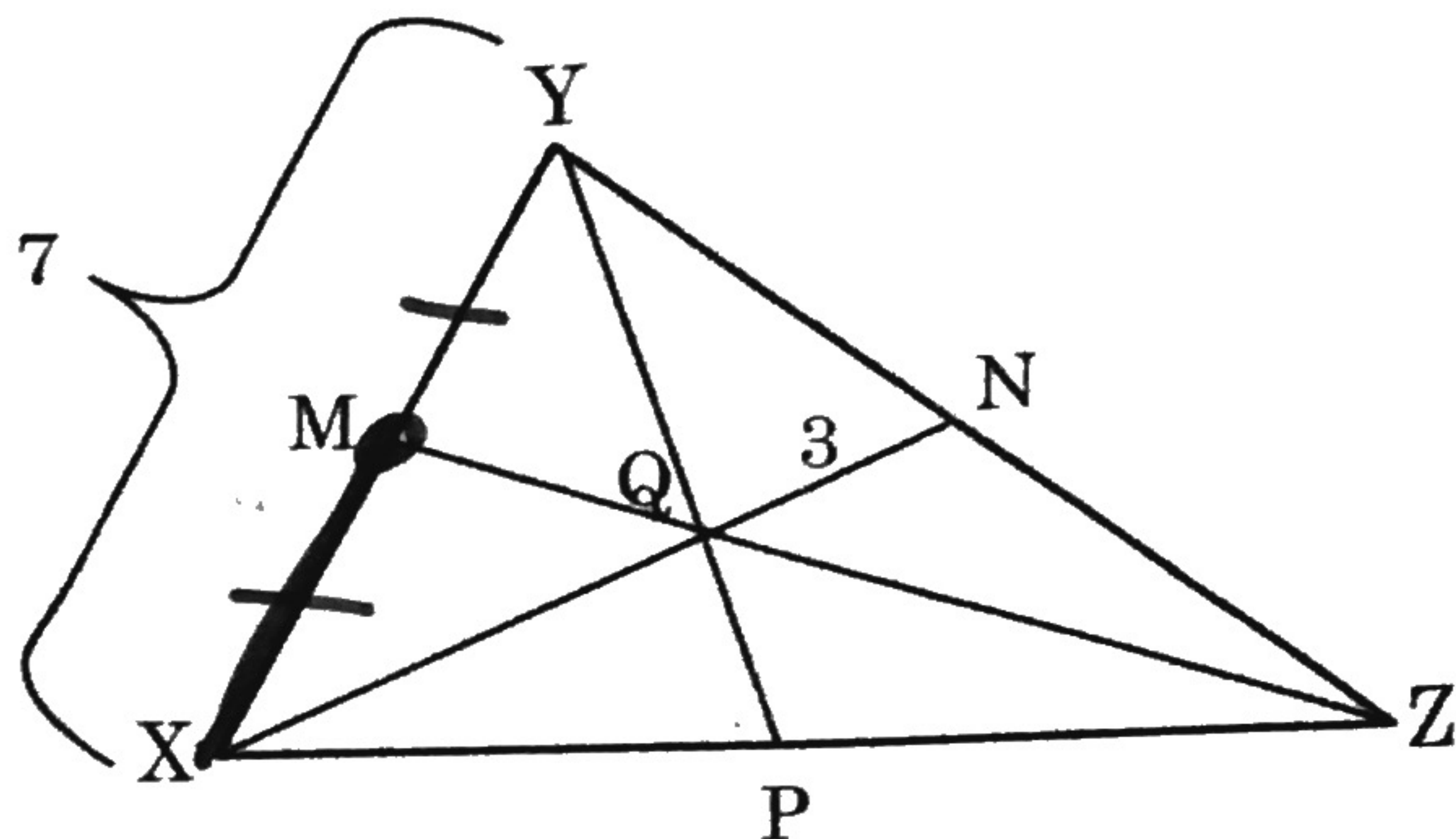
10. In $\triangle RST$, Q is the centroid and $SQ = 8$. Find QW and SW .



$$QW = 4$$

$$SW = 12$$

11. In $\triangle XYZ$, Q is the centroid. Find XQ and XM .



$$XQ = 6$$

$$XM = 3.5$$

In $\triangle QRS$, $RX = 36$ and $QW = 20$. Find each length.

12. RW

$$24$$

13. WX

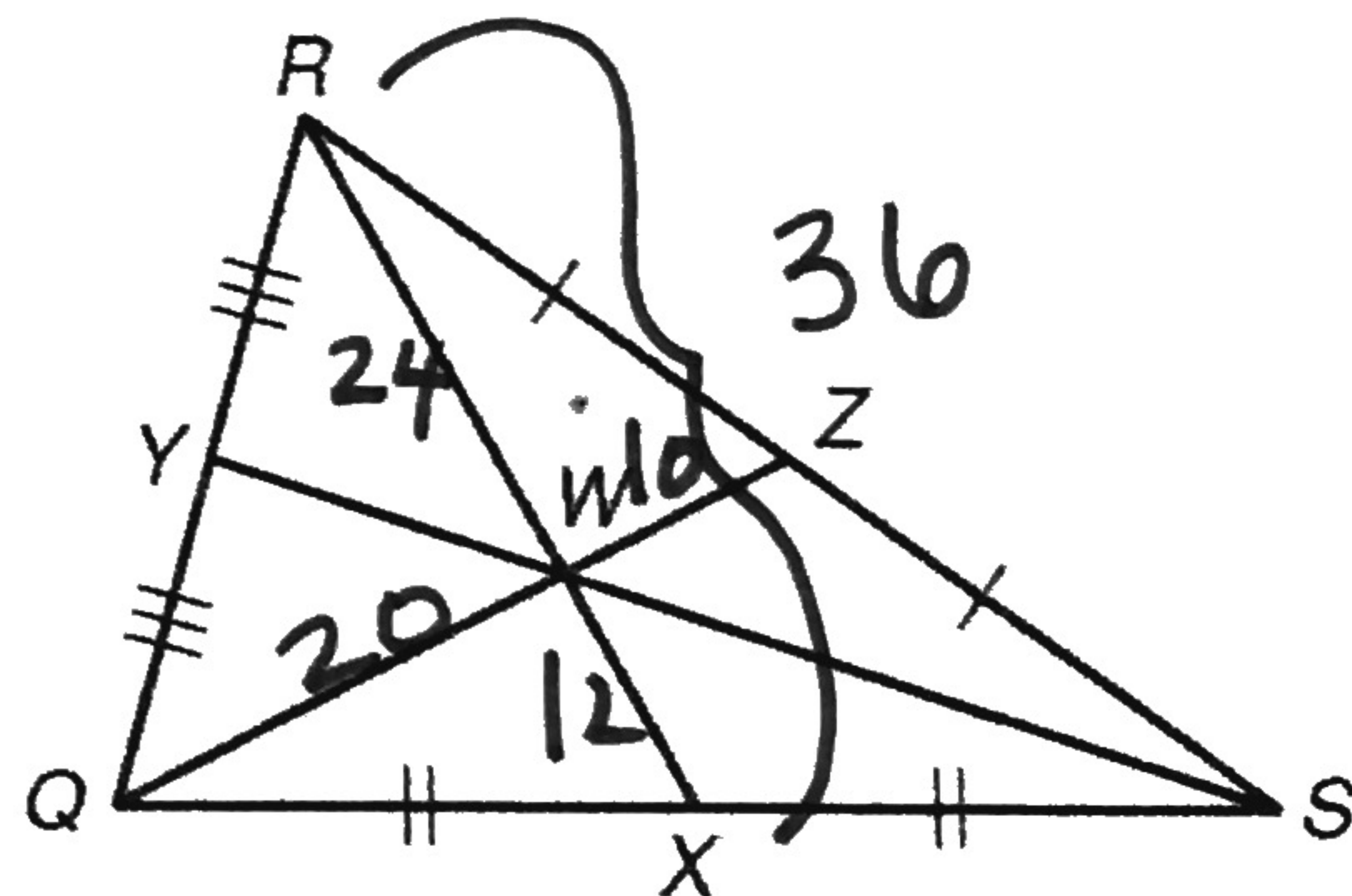
$$12$$

14. QZ

$$30$$

15. WZ

$$10$$



In $\triangle HJK$, $HD = 63$ and $BC = 11$. Find each length.

16. HB

$$42$$

17. BD

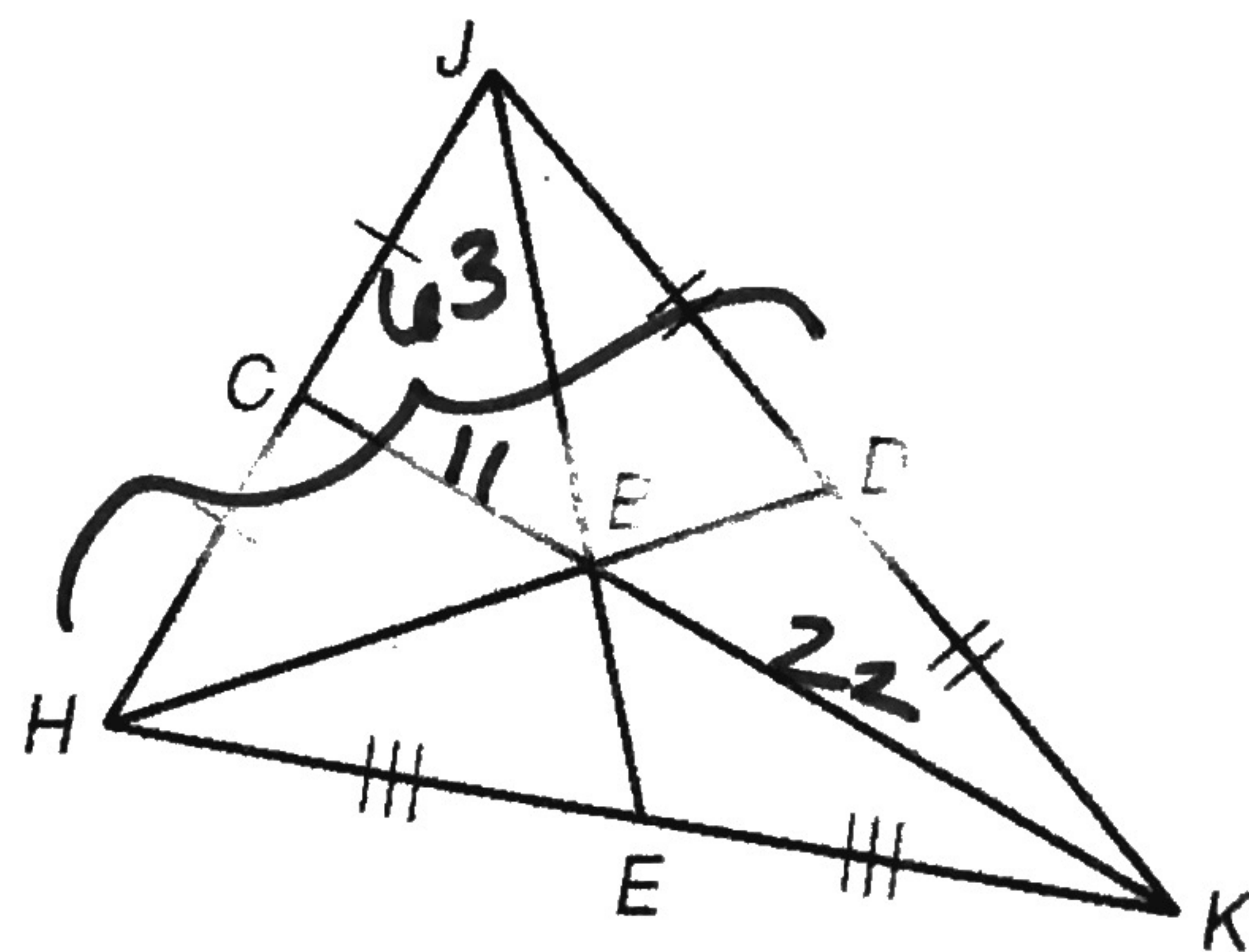
$$21$$

18. CK

$$33$$

19. KB

$$22$$



More Practice:

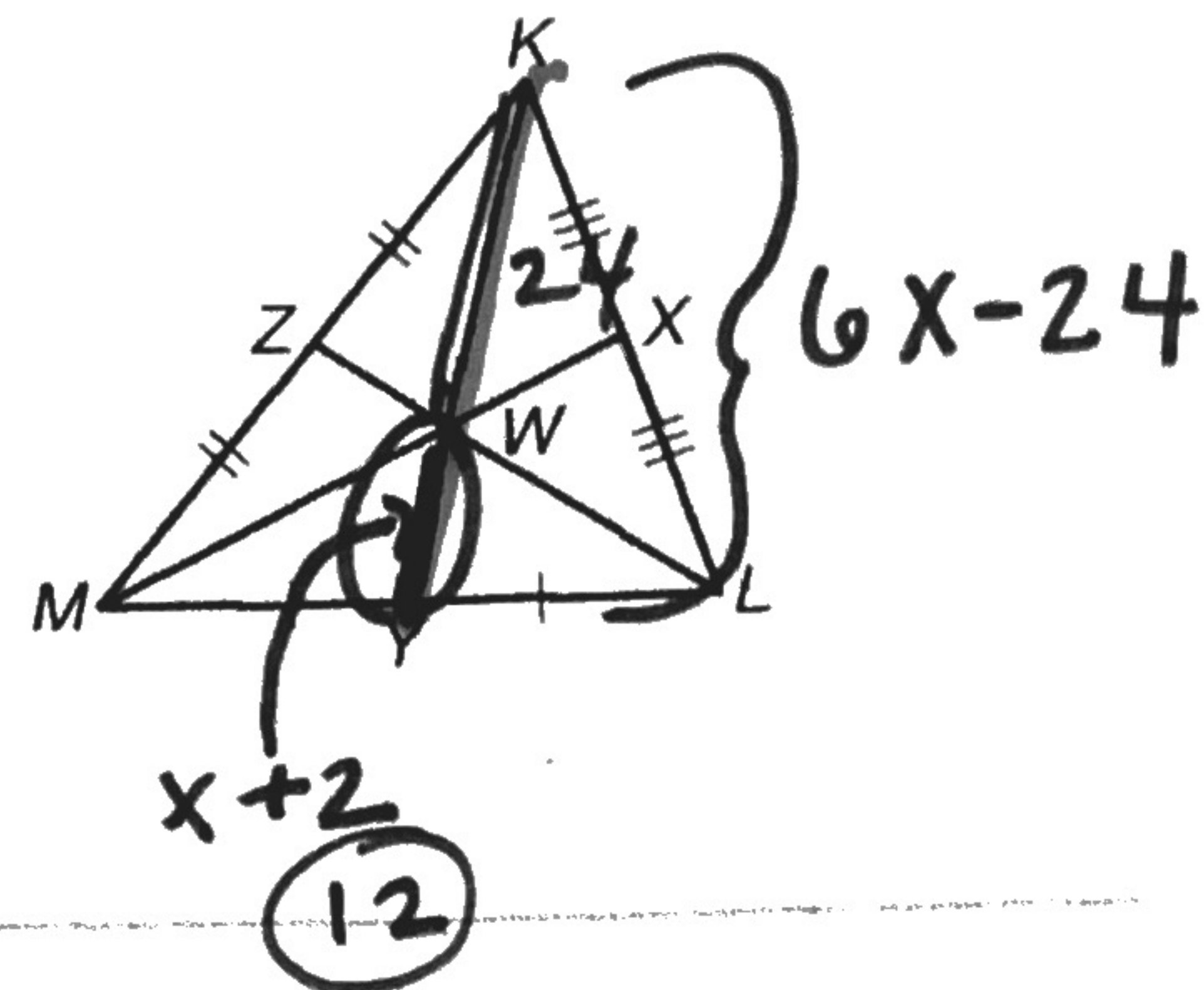
20. W is the Centroid of $\triangle KLM$. If $KY = 6x - 24$, $WY = x + 2$ Find $KW = \underline{24}$

$$3(x + 2) = 6x - 24$$

$$3x + 6 = 6x - 24$$

$$30 = 3x$$

$$x = 10$$



21. X is the incenter of $\triangle NPQ$. If $XK = 2x + 1$ and $LX = 4x - 3$, what is the value of x?

$$2x + 1 = 4x - 3$$

$$4 = 2x$$

$$x = 2$$

