

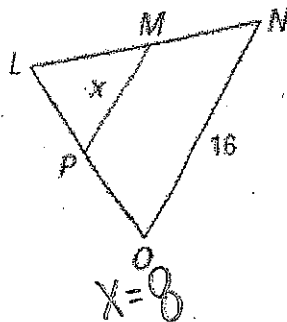
Points of Concurrency in Triangles

	Description	Point of Concurrency	Special Properties
Perpendicular Bisectors	Perpendicular to a side at its midpoint	Circumcenter (may lie outside the triangle)	Circumcenter is equidistant to the vertices of the triangle
Angle Bisectors	Cuts the angle in 2 parts	Incenter	Equidistant to the sides of the triangle
Medians	Vertex to midpoint of opposite side	Centroid (balancing point of triangle)	The length of the segment from the vertex to the centroid is twice the length of the segment from the centroid to the midpt.
Altitudes	Vertex to opposite side and perpendicular	Orthocenter (may lie outside the triangle)	

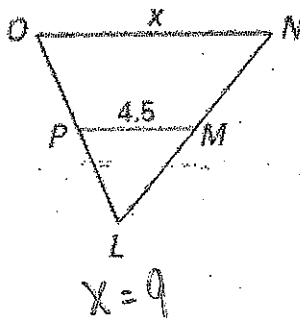
(true height of the Δ)

\overline{MP} is a midsegment of $\triangle LNO$. Find the value of x .

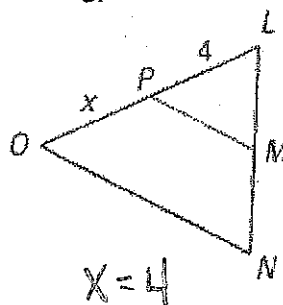
1.



2.



3.



Use the diagram of $\triangle XYZ$ where U , V , and W are the midpoints of the sides.

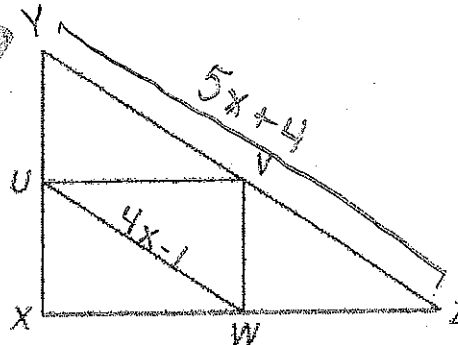
4. If $UW = 4x - 1$ and $YZ = 5x + 4$, what is UW ?

$$2(4x - 1) = 5x + 4$$

$$8x - 2 = 5x + 4$$

$$3x = 6 \quad x = 2$$

$$UW = 4(2) - 1 = 7$$



In the diagram, the perpendicular bisectors of $\triangle MNP$ meet at point O and are shown dashed. Find the indicated measure.

5. Find MO .

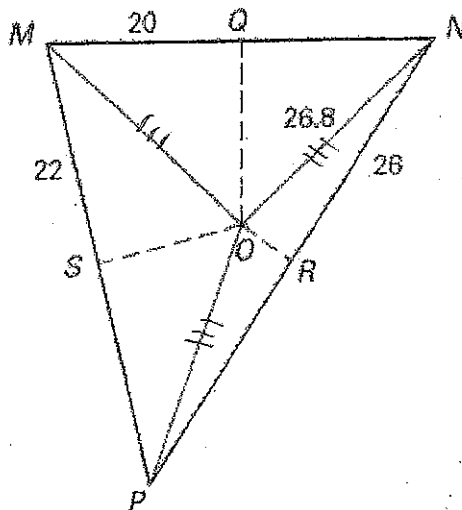
26.8

6. Find PR .

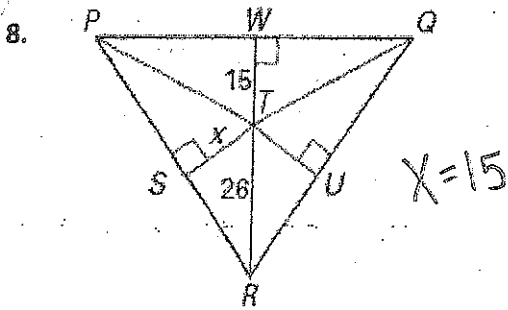
26

7. Find MN .

40



7 is the incenter of $\triangle PQR$. Find the value of x .



$x = 15$

Find $TU \rightarrow$

$$a^2 + b^2 = c^2$$

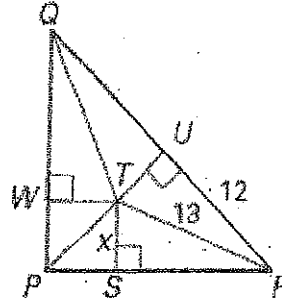
$$a^2 + 12^2 = 13^2$$

$$a^2 + 144 = 169$$

$$a^2 = 25 \quad a = 5$$

$x = 5$

9.



S is the centroid of $\triangle RTW$, $RS = 4$, $VW = 6$, and $TV = 9$. Find

10. $RV = 6$

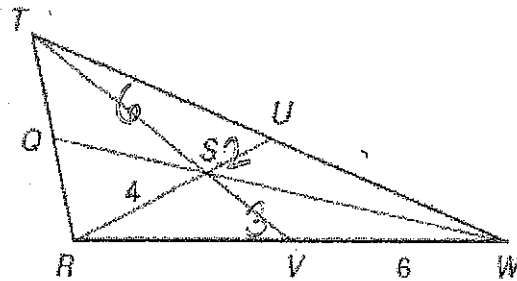
11. $SU = 2$

12. $RU = 6$

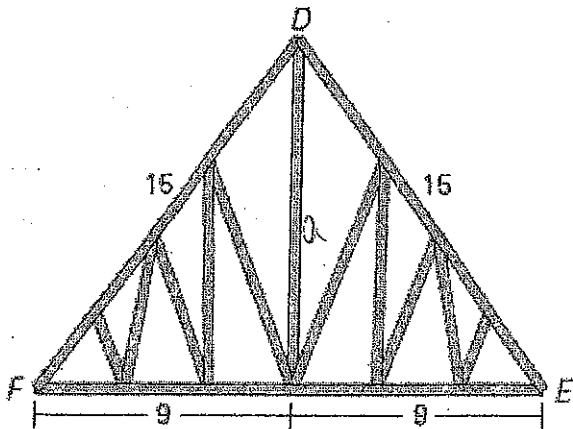
13. $RW = 12$

14. $TS = 6$

15. $SV = 3$



Roof Trusses Some roofs are built using several triangular wooden trusses.



$$a^2 + b^2 = c^2$$

$$a^2 + 9^2 = 15^2$$

$$a^2 + 81 = 225$$

$$a^2 = 144$$

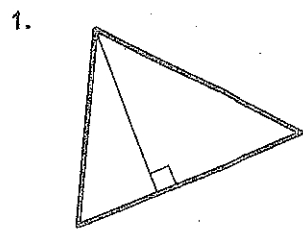
$$a = 12$$

$$\begin{array}{r} 1225 \\ - 81 \\ \hline 144 \end{array}$$

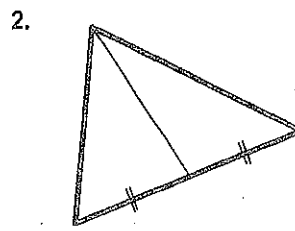
16. Find the altitude (height) of the truss. 12

17. How far down from D is the centroid of $\triangle DEF$? 8

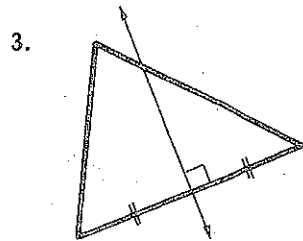
Circle the letter with the name of the segment/line/ray shown.



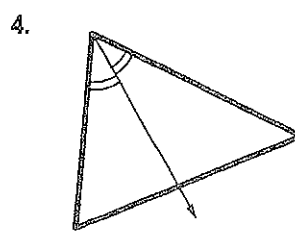
- (a) perpendicular bisector
- (b) angle bisector
- (c) median
- (d) altitude



- (a) perpendicular bisector
- (b) angle bisector
- (c) median
- (d) altitude



- (a) perpendicular bisector
- (b) angle bisector
- (c) median
- (d) altitude



- (a) perpendicular bisector
- (b) angle bisector
- (c) median
- (d) altitude

Circle the letter with the name of the correct point of concurrency.

5. The three altitudes of a triangle intersect at the _____.

- (a) circumcenter
- (b) incenter
- (c) centroid
- (d) orthocenter

6. The three medians of a triangle intersect at the _____.

- (a) circumcenter
- (b) incenter
- (c) centroid
- (d) orthocenter

7. The three perpendicular bisectors of a triangle intersect at the _____.

- (a) circumcenter
- (b) incenter
- (c) centroid
- (d) orthocenter

8. The three angle bisectors of a triangle intersect at the _____.

- (a) circumcenter
- (b) incenter
- (c) centroid
- (d) orthocenter

9. It is equidistant from the three vertices of the triangle.

- (a) circumcenter
- (b) incenter
- (c) centroid
- (d) orthocenter

10. It is equidistant from the three sides of the triangle.

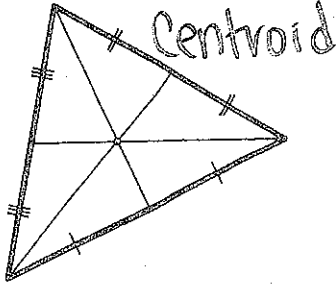
- (a) circumcenter
- (b) incenter
- (c) centroid
- (d) orthocenter

11. It divides each median into two sections at a 2:1 ratio.

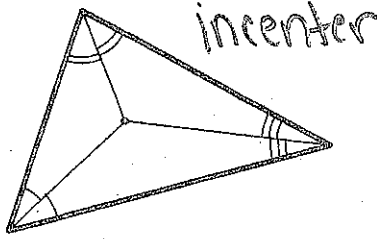
- (a) circumcenter
- (b) incenter
- (c) centroid
- (d) orthocenter

Name the point of concurrency shown.

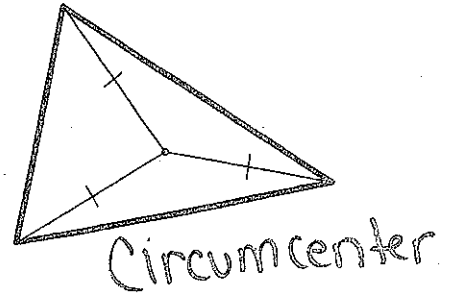
12.



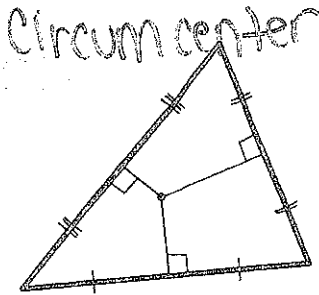
13.



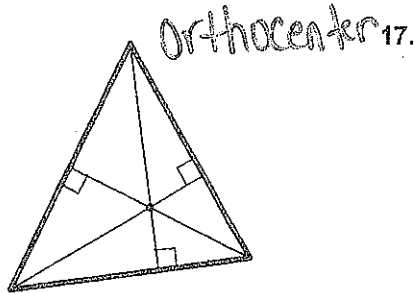
14.



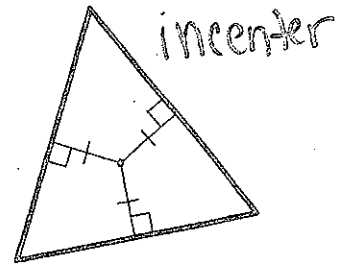
15.



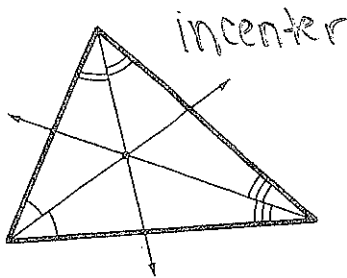
16.



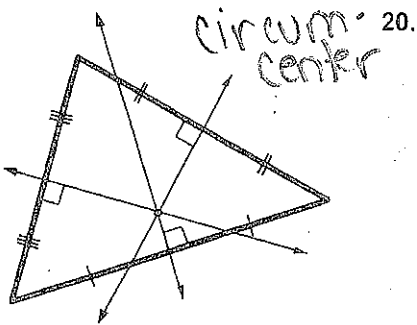
17.



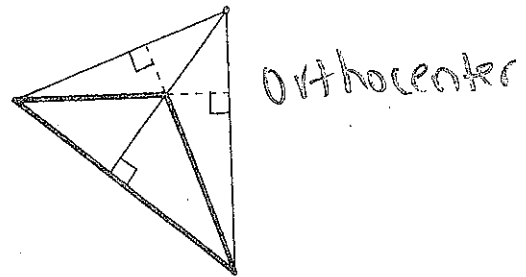
18.



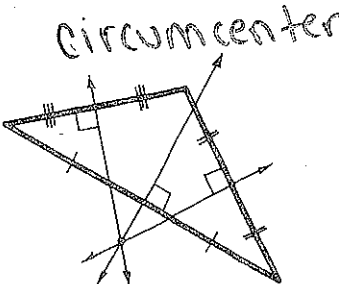
19.



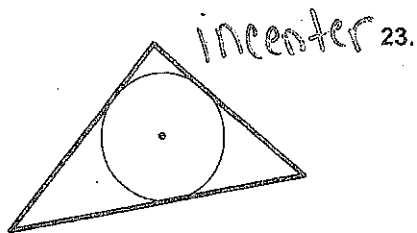
20.



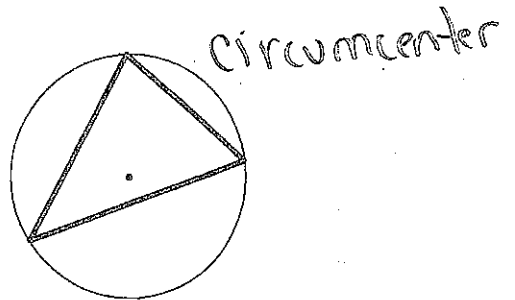
21.



22.

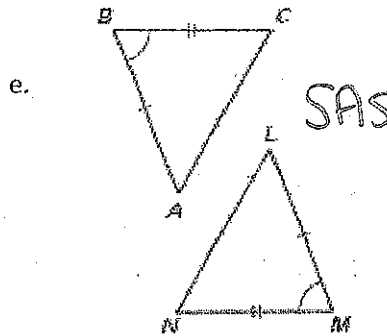
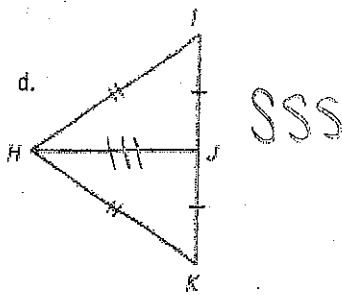
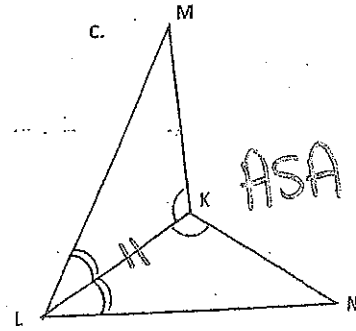
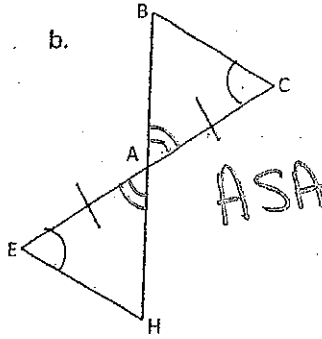
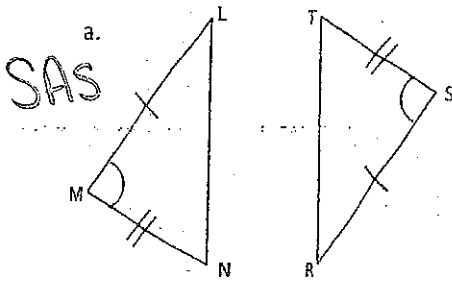


23.



Congruent Triangles

1. Name the congruent triangles shown in the diagrams and state the postulate or theorem you would use.

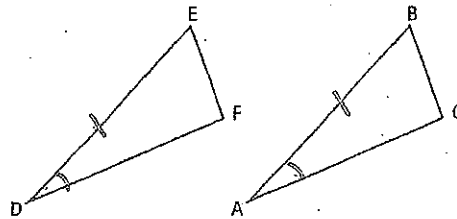


2. State the third congruence that is needed to prove that $\triangle ABC \cong \triangle DEF$.

a. GIVEN: $\overline{DE} \cong \overline{AB}$, $\angle D \cong \angle A$, $\angle F \cong \angle C$
USE: AAS Congruence

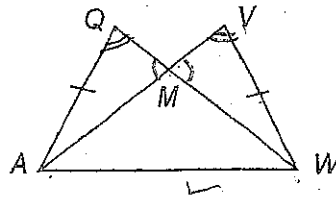
b. GIVEN: $\overline{DE} \cong \overline{AB}$, $\angle D \cong \angle A$, $\overline{DF} \cong \overline{AC}$
USE: SAS Congruence

c. GIVEN: $\overline{DE} \cong \overline{AB}$, $\angle D \cong \angle A$, $\angle E \cong \angle B$
USE: ASA Congruence



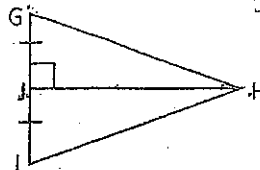
3. Given $\angle Q \cong \angle V$ and the figure shown, which statement is NOT necessarily true?

- a. $\triangle QAM \cong \triangle VWM$
- b. $\triangle QWA \cong \triangle VAW$
- c. $\triangle QAM \cong \triangle VMW$
- d. $\triangle WAM$ is isosceles



4. Complete the congruence statement $\triangle GJH \cong$ ___ by ___.

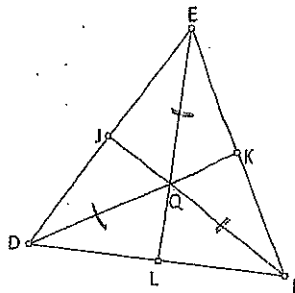
- a. $\triangle GJH \cong \triangle IJH$ by HL
- b. $\triangle GJH \cong \triangle IHJ$ by HL
- c. $\triangle GJH \cong \triangle IJH$ by SAS
- d. $\triangle GJH \cong \triangle IHJ$ by SAS



Points of Concurrency

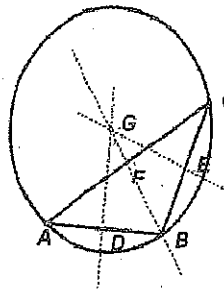
5. Define each and name the point of concurrency found by each:
- Altitudes:
 - Medians:
 - Perpendicular Bisectors
 - Angles Bisectors:
6. Which points of concurrency may lie outside the triangle? Which are always inside the triangle?

7. By the Concurrency of Perpendicular Bisectors Theorem, if \overline{QJ} , \overline{QK} , and \overline{QL} are perpendicular bisectors, then ?. (multiple choice)



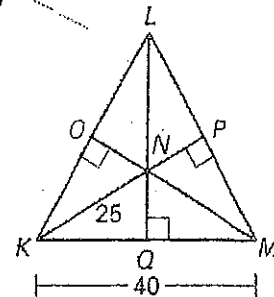
- $\angle JQK \cong \angle KQL \cong \angle LQJ$
- $DE = EF = FD$
- $QD = QE = QF$
- $\angle EQK \cong \angle FQL \cong \angle DQJ$

8. In the diagram, \overline{GE} , \overline{GD} and \overline{GF} are perpendicular bisectors of the sides of the triangle. G is the _____ of the triangle.



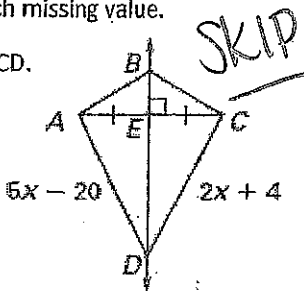
- circumcenter
- incenter
- orthocenter
- centroid
- center

9. In the diagram at the right, the angle bisectors of $\triangle KLM$ meet at point N. Q is the midpoint of \overline{KM} . Find NP .

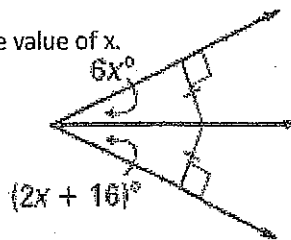


10. Find each missing value.

a. Find CD.



b. Find the value of x.



11. Explain each theorem in your own words, using diagrams.

- Midsegment Theorem
- Perpendicular Bisector Theorem
- Concurrency of Perpendicular Bisectors Theorem
- Angle Bisector Theorem
- Concurrency of Angle Bisectors Theorem
- Concurrency of Medians Theorem

Don't worry about this

6. Which triangle center did you recommend for the location of the amusement park?
7. The president of the company building the park is concerned about the cost of building roads from the towns to the park. What recommendation would you give him? Write a memo to the president explaining your recommendation.

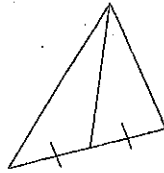
Practice:

- a 1. Which points of concurrency may lie outside the triangle?
 a. orthocenter and the circumcenter
 b. circumcenter and incenter
 c. centroid and incenter
 d. centroid and orthocenter
- c 2. Which point of concurrency is the balancing point of the triangle?
 a. incenter
 b. orthocenter
 c. centroid
 d. circumcenter
- c 3. Which point of concurrency is $\frac{2}{3}$ the distance from the vertex to the side?
 a. incenter
 b. orthocenter
 c. centroid
 d. circumcenter
- a 4. Which point of concurrency is equidistant from the sides of the triangle?
 a. incenter
 b. orthocenter
 c. centroid
 d. circumcenter
- d 5. Which point of concurrency is equidistant from the vertices of the triangle?
 a. incenter
 b. orthocenter
 c. centroid
 d. circumcenter

Matching (3 points each)

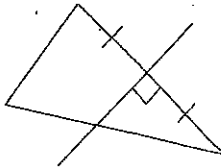
c 6. altitude

a.



d 7. angle bisector

b.



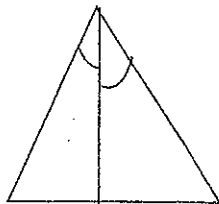
a 8. median

c.



b 9. Perpendicular bisector

d.



Matching

c 10. Centroid

a. altitude

b 11. Incenter

b. angle bisector

a 12. Orthocenter

c. median

d 13. Circumcenter

d. perpendicular bisector