

5-1

Practice

Form K

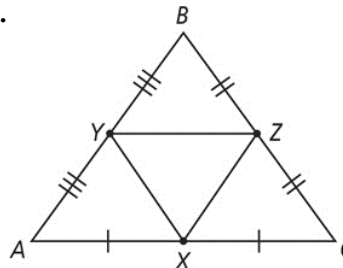
Midsegments of Triangles

Identify three pairs of parallel segments in the diagram.

1. $\overline{AB} \parallel$?

2. $\overline{BC} \parallel$?

3. $\overline{AC} \parallel$?



Name the segment that is parallel to the given segment.

4. \overline{MN}

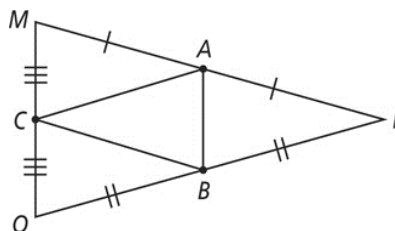
5. \overline{ON}

6. \overline{AB}

7. \overline{CB}

8. \overline{OM}

9. \overline{AC}



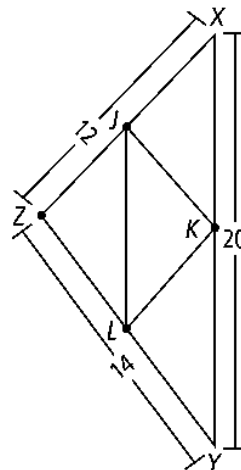
Points J , K , and L are the midpoints of the sides of $\triangle XYZ$.

10. Find LK .

To start, identify what kind of segment \overline{LK} is. Then identify which relationship in the Triangle Midsegment Theorem will help you find the length.

\overline{LK} is a midsegment of .

\overline{LK} is parallel to .



11. Find YK .

12. Find JK .

13. Find XK .

14. Find JL .

15. Find YL .

16. Find KL .

17. Draw a triangle and label it ABC . Draw all the midpoints and label them. Identify pairs of parallel segments and angles in your triangle.

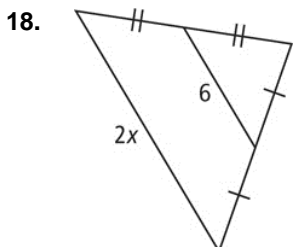
5-1

Practice (continued)

Form K

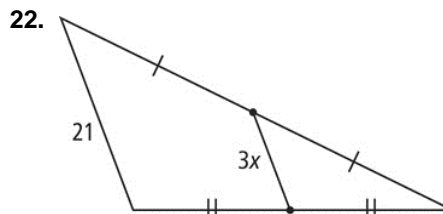
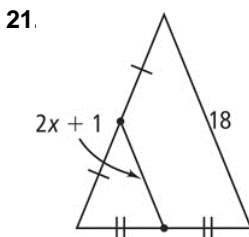
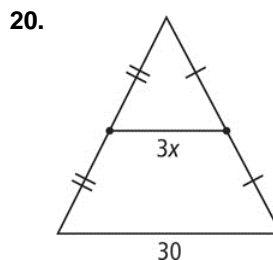
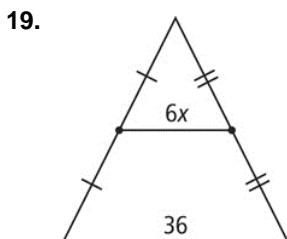
Midsegments of Triangles

Algebra Find the value of x .



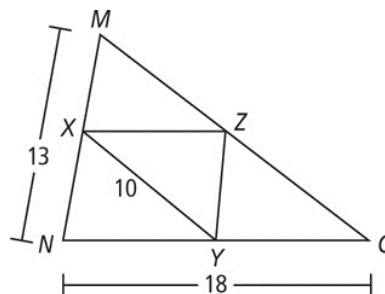
To start, identify the midsegment. Then write an equation to show that its length is half the length of its parallel segment.

The segment with length is the midsegment.
 = $\frac{1}{2}$ ·



X is the midpoint of \overline{MN} . Y is the midpoint of \overline{ON} .

23. Find XZ .



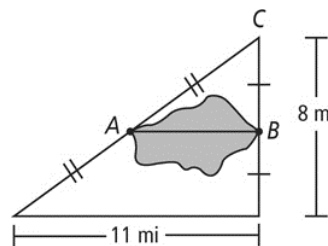
24. If $XY = 10$, find MO .

25. If $m\angle M$ is 64, find $m\angle Y$.

Use the diagram at the right for Exercises 26 and 27.

26. What is the distance across the lake?

27. Is it a shorter distance from A to B or from B to C ? Explain.



5-2

Practice

Form K

Perpendicular and Angle Bisectors

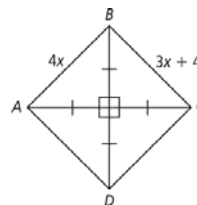
Use the figure at the right for Exercises 1–3.

1. What is the value of x ?

To start, determine the relationship between \overline{AC} and \overline{BD} .

Then write an equation to show the relationships of the sides.

\overline{BD} is the $\frac{?}{?}$ bisector of \overline{AC} . Therefore, point B is equidistant from points A and \square .

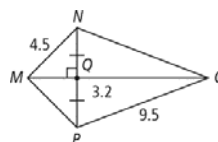


$$4x = \frac{?}{?}$$

2. Find AB .
3. Find BC .

Use the figure at the right for Exercises 4–7.

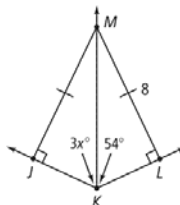
4. \overline{MO} is the perpendicular bisector of \square .



- 5 Find MP .
6 Find NO .
7 Find NP .

Use the figure at the right for Exercises 8–13.

8. How far is M from \overline{KL} ?
9. How far is M from \overline{JK} ?
10. How is \overline{KM} related to $\angle JKL$?
11 Find the value of x .
12 Find $m\angle MKL$.
13 Find $m\angle JMK$ and $m\angle LMK$.

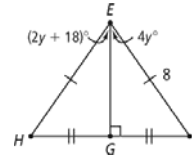


5-2 Practice (continued)

Perpendicular and Angle Bisectors

Form K

Use the figure at the right for Exercises 14–16.



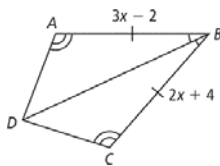
14. what are the lengths of \overline{EF} and \overline{EH} ?

15. Find the value of y .

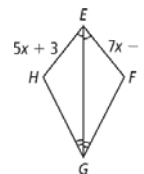
16. Find $m\angle GEH$ and $m\angle GEF$.

Algebra Find the values of the indicated variables and measures.

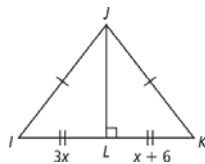
17. x , BA , BC



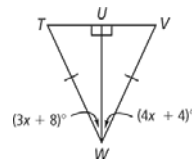
18. x , EH , EF



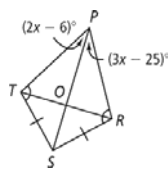
19. x , IK



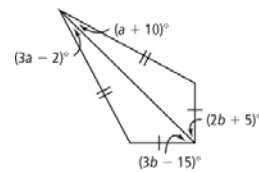
20. x , $m\angle UWV$, $m\angle UWT$



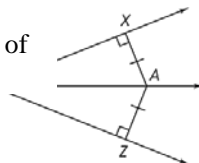
21. x , $m\angle TPS$, $m\angle RPS$



22. a , b



23. **Writing** Is A on the angle bisector of $\angle XYZ$? Explain.



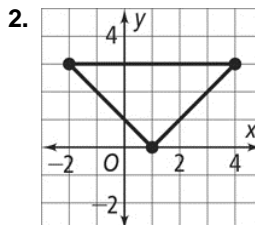
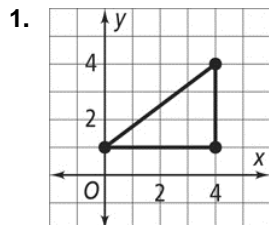
5-3

Practice

Form K

Bisectors in Triangles

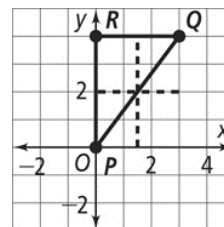
Coordinate Geometry Find the coordinates of the circumcenter of each triangle.



Coordinate Geometry Find the circumcenter of $\triangle PQR$.

3. $P(0, 0)$
 $Q(3, 4)$
 $R(0, 4)$

To start, graph the vertices and connect them on a coordinate plane. Then draw two perpendicular bisectors.



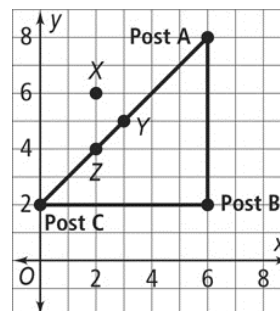
4. $P(1, -5)$
 $Q(4, -5)$
 $R(1, -2)$

5. $P(-3, -5)$
 $Q(-3, 2)$
 $R(1, -5)$

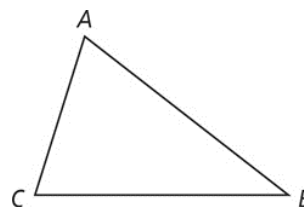
6. $P(-6, 6)$
 $Q(3, 6)$
 $R(-6, 2)$

7. $P(4, 6)$
 $Q(1, 6)$
 $R(1, -2)$

8. a. Which point is equidistant from the three posts?
 b. Where are the coordinates of this point?



9. **Construction** Construct three perpendicular bisectors for $\triangle ABC$. Then use the point of concurrency to construct the circumscribed circle.



5-3

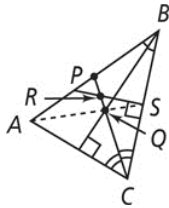
Practice (continued)

Form K

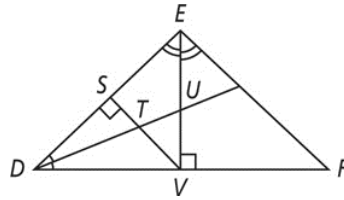
Bisectors in Triangles

Name the point of concurrency of the angle bisectors.

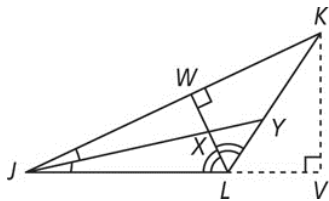
10.



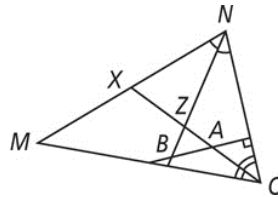
11.



12.



13.



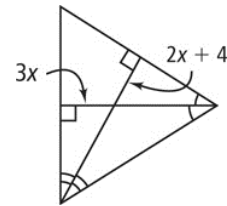
Find the value of x .

14. To start, identify the relationship between the line segments that are labeled.

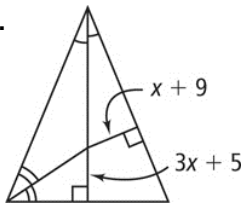
Because the segments meet at the point where the meet, the segments are .

Then write an equation to find x :

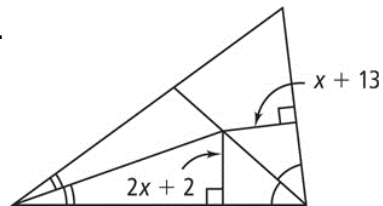
$$\boxed{} = \boxed{} + \boxed{}$$



15.

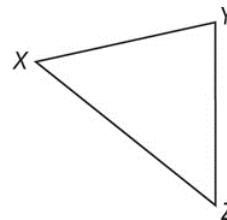


16.



17. **Construction** Construct two angle bisectors for $\triangle XYZ$.

Then use the point of concurrency to construct the inscribed circle.



5-4

Practice

Form K

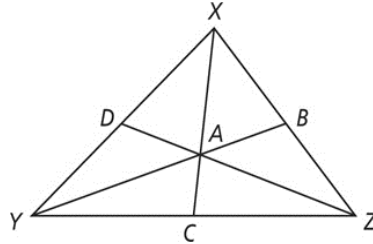
Medians and Altitudes

In $\triangle XYZ$, A is the centroid.

1. If $DZ = 12$, find ZA and AD .

To start, write an equation relating the distance between the vertex and centroid to the length of the median.

$$ZA = \square DZ$$

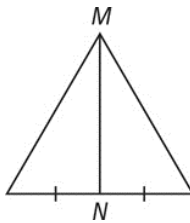


2. If $AB = 6$, find BY and AY .

3. If $AC = 3$, find CX and AX .

Is \overline{MN} a median, an altitude, or neither? Explain.

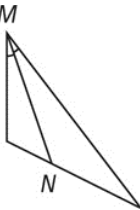
- 4.



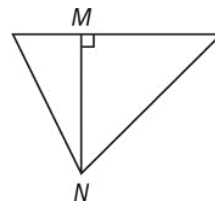
To start, identify the relationship between \overline{MN} and the side it intersects.

\overline{MN} ? the side of the triangle it intersects.

- 5.

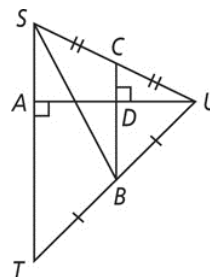


- 6.

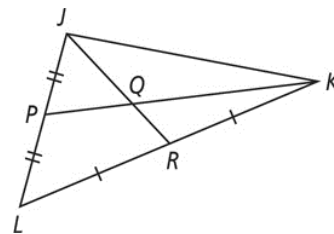


In Exercises 7–10, name each segment.

7. a median in $\triangle STU$
8. an altitude in $\triangle STU$
9. a median in $\triangle SBU$
10. an altitude in $\triangle CBU$



11. Q is the centroid of $\triangle JKL$. $PK = 9x + 21y$.
Write expressions to represent PQ and QK .



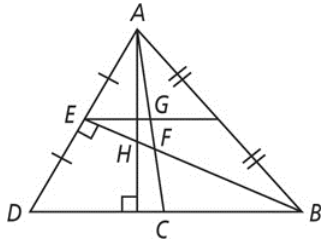
5-4 Practice (continued)

Medians and Altitudes

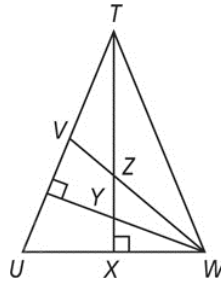
Form K

Find the orthocenter of each triangle.

12.



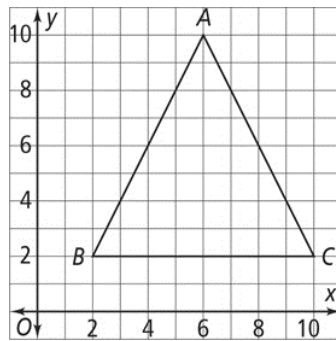
13.



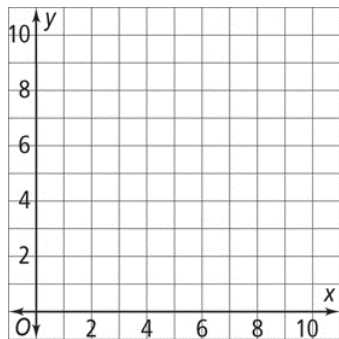
Coordinate Geometry Find the coordinates of the orthocenter of $\triangle ABC$.

14. $A(6, 10), B(2, 2), C(10, 2)$

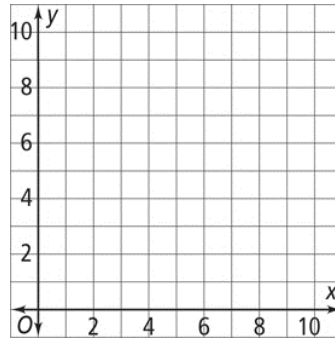
To start, graph the vertices of the triangle in a coordinate plane.



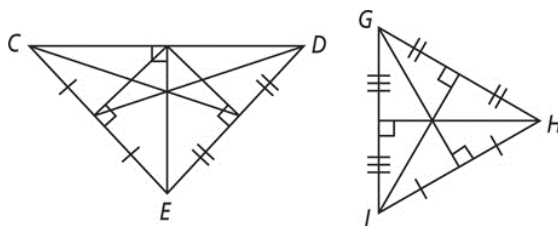
15. $P(1, 7), Q(1, 2), R(11, 2)$



16. $D(5, 11), E(2, 5), F(11, 5)$



17. Which triangle has a centroid at the same point as the orthocenter?



5-5

Practice

Form K

Indirect Proof

Complete the first step of an indirect proof of the given statement.

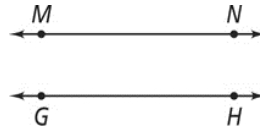
1. There are fewer than 11 pencils in the box.
Assume temporarily that there are ? pencils in the box.
2. If a number ends in 0, then it is not divisible by 3.
Assume temporarily that a number that ends in 0 ?.
3. $4x + 3 > 12$
Assume temporarily that $4x + 3$ 12.
4. $\triangle RST$ is not an isosceles triangle.
Assume temporarily that ?.

Write the first step of an indirect proof of the given statement.

5. There are more than 20 apples in a box.
6. If a number ends in x , then it is a multiple of 5.
7. $m\angle XYZ < 100$
8. $\triangle DEF$ is a right triangle.

Identify the two statements that contradict each other.

9. i. $\overleftrightarrow{MN} \parallel \overleftrightarrow{GH}$
- ii. \overleftrightarrow{MN} and \overleftrightarrow{GH} do not intersect.
- iii. \overleftrightarrow{MN} and \overleftrightarrow{GH} are skew.



To start, identify two conditions that cannot be true at the same time.

? lines must be in the same plane.
? lines must not be in the same plane.
 Therefore, two lines cannot be both ? and ?.

5-5 Practice (continued)

Indirect Proof

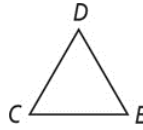
Form K

Identify the two statements that contradict each other.

10. I. $\triangle CDE$ is equilateral.

II. $m\angle C$ and $m\angle E$ have the same measure.

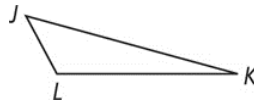
III. $m\angle C > 60$



11. I. $\triangle JKL$ is scalene.

II. $\triangle JKL$ is obtuse.

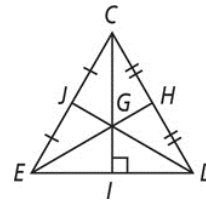
III. $\triangle JKL$ is isosceles.



12. I. The orthocenter of $\triangle CDE$ is point G .

II. The centroid and orthocenter of $\triangle CDE$ are both point G .

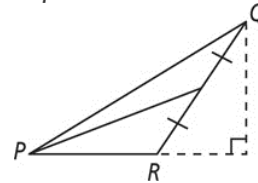
III. $\triangle CDE$ is scalene.



13. I. The altitude of $\triangle PQR$ is outside the triangle.

II. $\triangle PQR$ is acute.

III. The median of $\triangle PQR$ is inside the triangle.



Complete the indirect proof.

14. Given: $\angle S \cong \angle W$

$\angle T \cong \angle V$

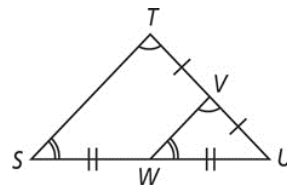
Prove: $\overrightarrow{TS} \parallel \overrightarrow{VW}$

Assume temporarily that ?.

Then by the Converse of the ?, $\angle S$ and $\angle W$ cannot be ?.

This contradicts the given information that ?.

Therefore, \overrightarrow{TS} must be ? \overrightarrow{VW} .



5-6

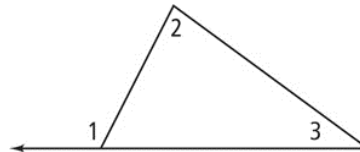
Practice

Form K

Inequalities in One Triangle

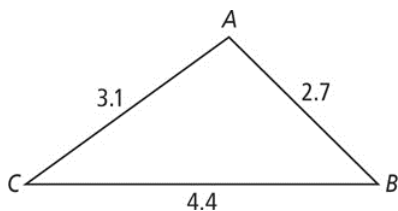
1. Explain the relationship of $m\angle 1$, $m\angle 2$, and $m\angle 3$.

The measure of an exterior angle of a triangle is ? than the measure of each of its remote ? angles. $\angle 1$ is an ? angle of the triangle, so $m\angle 1 > ?$ and $m\angle 1 > ?$.



For Exercises 2–5, list the angles of each triangle in order from smallest to largest.

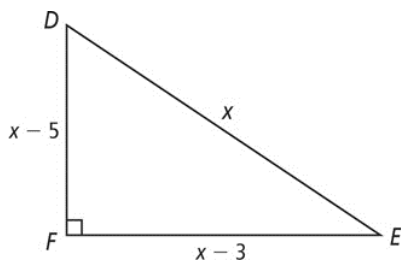
- 2.



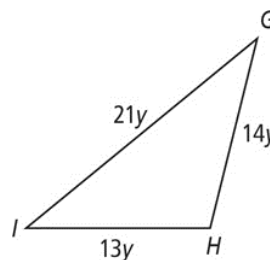
To start, order the side lengths from least to greatest.

$$\square < \square < \square$$

- 3.



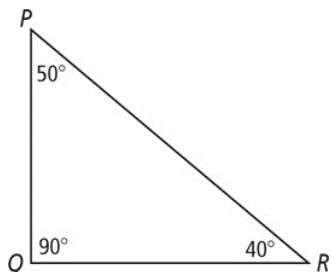
- 4.



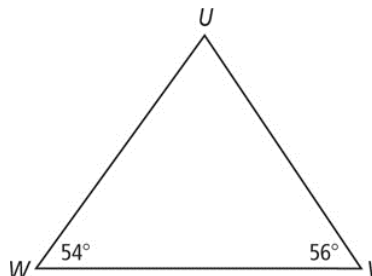
5. $\triangle XYZ$, where $XY = 25$, $YZ = 11$, and $XZ = 15$

For Exercises 6–8, list the sides of each triangle in order from shortest to longest.

- 6.



- 7.



8. $\triangle MNO$, where $m\angle M = 56$, $m\angle N = 108$, and $m\angle O = 16$

9. **Algebra** List the sides in order from shortest to longest in $\triangle XYZ$, with $m\angle X = 50$, $m\angle Y = 5x + 10$, and $m\angle Z = 5x$.

5-6

Practice (continued)

Form K

Inequalities in One Triangle**Can a triangle have sides with the given lengths? Explain.**

10. 10 in., 13 in., 18 in.

To start, choose two sides and see if their sum exceeds the third side.

 $10 + 13$ [$\overset{?}{>}$] 18 yes / no (Circle the correct answer.)

Check the other two sums.

11. 6 m, 5 m, 12 m

12. 11 ft, 8 ft, 18 ft

Algebra The lengths of two sides of a triangle are given. Find the range of possible lengths for the third side.

13. 4, 8

To start, write the inequalities relating the known side lengths and the unknown side length.

$x + 4 > 8$

$x + 8 > \square$

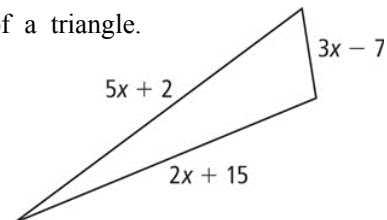
$8 + 4 > \square$

14. 13, 8

15. 10, 15

- 16.
- Error Analysis**
- A student draws a triangle with a perimeter of 12 in. The student says that the longest side measures 7 in. How do you know that the student is incorrect? Explain.

- 17.
- Algebra**
- $\triangle XYZ$
- has the side lengths shown at the right. What values of
- x
- result in side lengths that could be the sides of a triangle. (Hint: Write and solve three inequalities.)



5-7

Practice

Form K

Inequalities in Two Triangles

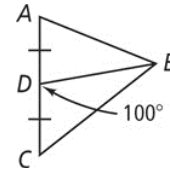
Write an inequality relating the given side lengths. If there is not enough information to reach a conclusion, write *no conclusion*.

1. AB and CB

To start, determine whether the triangles have two pairs of congruent sides.

$$\overline{AD} \cong \overline{CD}$$

$$\overline{DB} \cong \underline{\hspace{1cm}}$$

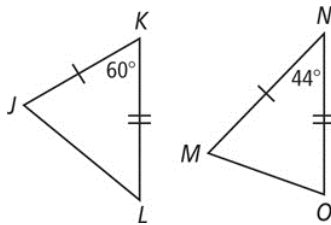


Then compare the hinge angles.

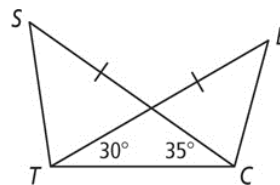
$$m\angle CDB = \square$$

$$m\angle \square = \square$$

2. JL and MO

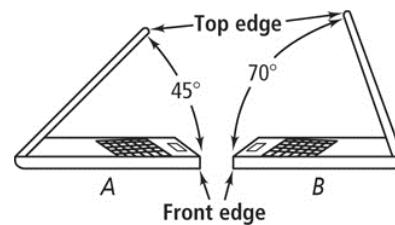


3. ST and BT



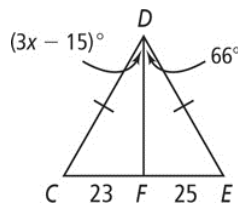
4. Two identical laptops are shown at the right.

In which laptop is the distance from the top edge of the screen to the front edge of the keyboard greater? Explain.



Algebra Find the range of possible values for each variable.

- 5.



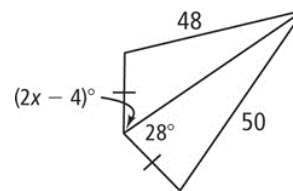
$$m\angle CDF < m\angle EDF$$

$$x < \square$$

$$m\angle CDE > 0$$

$$x > \square$$

- 6.



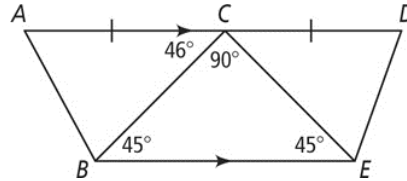
$$\square < x < \square$$

5-7 Practice (continued)

Inequalities in Two Triangles

Form K

Use the diagram at the right for Exercises 7–9. Complete each comparison with $<$ or $>$. Then complete the explanation.



7. $m\angle ACB$ $m\angle DCE$

forms a straight angle with and .

The measure of $\angle DCE$ is .

8. AB DE

Because $\triangle BCE$ is an isosceles triangle, = .

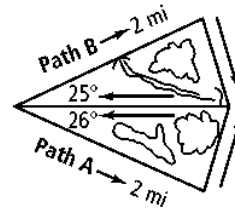
and have two pairs of congruent sides.

So, by the ? Theorem, AB DE .

9. BE CE

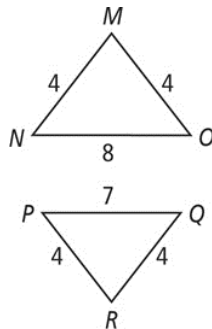
The longest side of a \triangle is opposite the angle with the ? measure.

10. The diagram shows two paths that lead through a park. Would a jogger run a greater distance on Path A or Path B? Explain.



Write an inequality relating the given angle measures.

11. $m\angle M$ and $m\angle R$



\overline{MN} , \overline{MO} , \overline{PR} , and \overline{QR} are ?.

NO PQ

12. $m\angle U$ and $m\angle X$

