Module 1 Properties of Quadrilaterals

What this module is about

This module is about the properties of trapezoids and parallelograms. In this module, you will learn to compute problems involving the median of a trapezoid, the base angles and diagonals of an isosceles trapezoid, as well as problems involving the diagonals, angles and sides of parallelograms



This module is designed for you to

- 1. apply inductive/deductive skills to derive certain properties of a trapezoid.
 - median of a trapezoid
 - base angles of an isosceles trapezoid
 - diagonals of an isosceles trapezoid
- 2. apply inductive and deductive skills to derive the properties of a parallelogram
 - each diagonal divides a parallelogram into two congruent triangles
 - opposite angles are congruent
 - non-opposite angles are supplementary
 - opposite sides are congruent
 - diagonals bisect each other.

How much do you know

True or False

- 1. The median of a trapezoid is twice the sum of the lengths of its bases.
- 2. The base angles of an isosceles trapezoid are congruent.
- 3. The diagonals of any trapezoid are congruent.
- 4. Non-opposite angles of a parallelogram are complementary.

ABCD is a trapezoid with median EF.



- 5. If DC = 12 cm and AB = 23 cm, what is EF?
- 6. If EF = 2x + 3, DC = x + 5 and AB = 2(x + 3), what is AB?

Quadrilateral BEST is a parallelogram.



7. If BE = 3(x - 1) and TS = 2x + 3, what is BE + TS?

Quadrilateral ABCD is a rhombus.



8. If m $\angle A$ = 5x and m $\angle C$ = 4x + 10, what is m $\angle ADC$ in degrees?

Quadrilateral ABCD is a parallelogram. Diagonals DB and AC intersect at E.



9. Find AC if AE = x + 2 and CE = 3x - 6

Quadrilateral TEAM is a parallelogram.



10. If $m \angle T = x$ and $m \angle E = 3x + 20$. find $m \angle A$?

What you will do

Lesson 1

The Median of a Trapezoid

A trapezoid is a quadrilateral with exactly one pair of parallel sides. The median of a trapezoid is the segment joining the midpoints of the non-parallel sides. In the trapezoid ABCD below, EF is the median. It joins the midpoints E and F of side AD and BC respectively.



Illustration

If the length of the upper base of a trapezoid is 4 cm, and the lower base is 6 cm, what do you think is the length of the median?

Do the following:

- 1. Using a ruler draw a segment 4 cm long. Name the segment HT.
- 2. Draw another segment 6 cm long parallel to segment $\overline{\text{HT}}$. Name the segment $\overline{\text{MA}}$.

- 3. Connect points H and M.
- 4. Connect points T and A.
- 5. Using a ruler, carefully determine the midpoints of HM and TA. Name the midpoints of HM and TA, G and E respectively.
- 6. Connect points G and E. Carefully measure the length of \overline{GE} .

What did you discover? Did you discover the following?

1. GE is parallel to $\overline{\text{HT}}$ and $\overline{\text{MA}}$.

2. GE =
$$\frac{1}{2}$$
 (HT + MA)

Example 1

ABCD is a trapezoid with median \overline{EF} . If DC = 8 cm and AB = 14 cm, find EF.



Solution:

Step 1. Write the formula.

$$\mathsf{EF} = \frac{1}{2}(\mathsf{AB} + \mathsf{DC})$$

Step 2. Substitute the values of DC and AB into the formula. Solve for EF.

$$EF = \frac{1}{2}(14 + 8)$$
$$EF = \frac{1}{2}(22)$$
$$EF = 11$$

Therefore EF is 11 cm.

Example 2

EFGH is a trapezoid with median \overline{IJ} . If HG = 12 cm and IJ =15 cm, what is EF?



Step 1. Write the formula.

$$IJ = \frac{1}{2}(EF + HG)$$

Step 2. Substitute the values of HG and IJ into the formula. Solve for EF.

$$15 = \frac{1}{2}(EF + 12)$$

$$15 = \frac{EF + 12}{2}$$

$$EF + 12 = 15(2)$$

$$EF = 30 - 12$$

$$EF = 18$$

Therefore EF is 18 cm.

Example 3

ABCD is a trapezoid with median \overline{EF} . If DC = x + 5, EF = 2x + 1 and AB =4x - 10, find EF.



Solution:

Step 1. Write the formula.

$$\mathsf{EF} = \frac{1}{2} (\mathsf{AB} + \mathsf{DC})$$

Step 2. Substitute the values of EF, AB and DC into the formula. Solve for x.

$$2x + 1 = \frac{1}{2}(4x - 10 + x + 5)$$

$$2x + 1 = \frac{1}{2}(5x - 5)$$

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

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

$$4x - 5x = -5 - 2$$

$$-x = -7$$

$$x = 7$$

Step 3. Substitute 7 for x. Solve for EF EF = 2x + 1 = 2(7) + 1 = 14 + 1= 15

Therefore EF = 15 cm.

Try this out

Set A





- 5. IF DC = 10 and EF = 12, what is AB?
- 6. If DC = 14 and EF = 16, what is AB?
- 7. If AB = 14.6 and EF = 10.4, what is DC?

8. IF AB = 22.8 and EF = 16.2, what is DC?
9. If DE = 14 what is AE?
10. If BF = 24, what is CF?

Set B

EFGH is a trapezoid with median IJ.





KLMN is a trapezoid with median OP.



- 1. If OP = 20, NM = x + 3 and KL = x + 6, what is x?
- 2. If NM = x − 2, KL = x + 4 and OP = 24, what is x?
- 3. If OP = 22, NM = x + 4, and KL = x + 8, what is NM?
- 4. If OP = 24, NM = x 3 and KL = x + 7, what is KL?
- 5. If NM = 12, OP = x +3, and KL = x + 10, what is x?
- 6. If NM = 18, OP = x 2 and KL = x + 3, what is x?
- 7. If KL = 30, OP = x + 1 and NM = x 6, what is OP?

Lesson 2

Isosceles Trapezoid

An isosceles trapezoid is a trapezoid with congruent non-parallel sides. Trapezoid DAVE below is an isosceles trapezoid. The nonparallel sides ED and VA are congruent.



Do the following:

1. Using a ruler, draw isosceles trapezoid ABCD with base angles, $\angle A$ and $\angle B$, on a graphing paper.



- 2. Using a protractor, find the measures of $\angle A$ and $\angle B$. What do you notice?
- 3. Using the same protractor find the measures of ∠ D and ∠ C. What do you notice?
- 4. Draw the diagonals \overline{AC} and \overline{BD} . Using a ruler, find their lengths. Are the lengths equal?

Perhaps you discovered the following properties of an isosceles trapezoid.

- 1. The base angles of an isosceles trapezoid are congruent.
- 2. The diagonals of an isosceles trapezoid are congruent.

If you know the properties of an isosceles trapezoid, you will find the next set of exercises easy to solve.

Example 1

In isosceles trapezoid ABCD, with base angles, $\angle A$ and $\angle B$. If m $\angle B$ = 40, what is m $\angle A$?



Solution:

Step 1. Base angles of an isosceles trapezoid are congruent.

∠ A ≅∠ B

 $m \angle A = m \angle B$ (The measures of congruent angles are equal)

Step 2. Substitute 40 for $m \angle B$ $m \angle A = 40$

Example 2

In isosceles trapezoid ABCD with $\angle A$ and $\angle B$ as base angles. If $m \angle A = x + 20$ and $m \angle B = 2x$. Find $m \angle A$.



Solution:

Step 1. Base angles of an isosceles trapezoid are congruent.

 $\label{eq:A} \begin{array}{l} \ensuremath{\simeq} \ensuremath{{\sc A}} \\ \ensuremath{\cong} \ensuremath{{\sc A}} \\ \ensuremath{{\sc B}} \\ \ensuremath{{\sc A}} \\ \ensuremath{{\sc B}} \\ \ensuremath{{\sc A}} \\ \ensuremath{{\sc B}} \ensuremath{{\sc B}} \\ \ensuremath{{\sc B}} \ensuremath{\sc B} \e$

Step 2. Substitute x + 20 for $m \angle A$ and 2x for $m \angle B$.

$$x+20 = 2x$$

 $x - 2x = -20$
 $x = 20$

Step 3. Substitute 20 for x in $m \angle A = x + 20$. Then solve for $m \angle A$.

$$m \angle A = x + 20$$

= 20 + 20
= 40

Example 3

In isosceles trapezoid ABCD, AD = 10. What is BC?



Solution:

Step 1. Non-parallel sides of an isosceles trapezoid are congruent.

 $\frac{\overline{BC}}{\overline{BC}} \cong \overline{AD}$ (Congruent segments have equal lengths)

Step 2. Replace BC with 10 BC = 10

Example 4.

In isosceles trapezoid ABCD, AC = 4x + 4 and BD = 2x + 10. What is x?



Solution:

Step 1 The diagonals of an isosceles trapezoid are congruent. $AC \cong BD$ AC = BD (Congruent segments have equal lengths) Step 2. Substitute 4x + 4 for AC and 2x + 10 for BD. 4x + 4 = 2x + 10 4x - 2x = 10 - 4 2x = 6x = 3

Try this out

Set A

PQRS is an isosceles trapezoid



- 1. Name the two pairs of base angles.
- 2. Name the nonparallel sides.
- 3. Name the parallel sides.
- 4. If $m \angle A = 30$, what is the $m \angle B$?
- 5. If m \angle B = 60, what is m \angle A?
- 6. If $m \angle C = 110$, what is $m \angle D$?
- 7. If m \angle D = 105, what is m \angle C?
- 8. If $m \angle A = 35$, what is $m \angle D$?
- 9. If m \angle C = 120, what is m \angle B?
- 10. If $m \angle A = 35$ what is $m \angle C$?

Set B.

EFGH is an isosceles trapezoid.



- 1. If $m \angle E = x + 10$ and $m \angle F = 50$, what is x?
- 2. If $m \angle F = x 15$ and $m \angle E = 70$ what is x?
- 3. If $m \angle H = x + 20$ and $m \angle G = 100$ what is x?
- 4. If $m \angle G = x 10$ and $m \angle H = 135$ what is x?
- 5. If $m \angle E = 2x$ and $m \angle F = 46$ what is x?
- 6. If $m \angle F = 3x$ and $m \angle E = 39$ what is x?
- 7. If $m \angle E = 2x + 5$ and $m \angle F = 44$ what is x?
- 8. If $m \angle F = 2x 6$ and $m \angle E = 56$ what is x?
- 9. If $m \angle H = 2(x + 4)$ and $m \angle G = 116$ what is x?
- 10. If $m \angle G = 2(x 5)$ and $m \angle H = 120$ what is x?

Set C.

ABCD is an isosceles trapezoid.



- 1. If $m \angle A = 2x + 10$ and $m \angle B = 3x 20$ what is $m \angle A$?
- 2. If $m \angle A = 2x + 15$ and $m \angle B = 4x 11$ what is $m \angle B$?
- 3. If $m \angle D = x + 15m$ and $m \angle C = 2x 85$ what is $m \angle D$?
- 4. If $m \angle C = 3y + 12$ and $m \angle D = 2y + 50$, what is $m \angle C$?
- 5. If $m \angle C = 4x + 70$ and $m \angle D = 2x + 90$, what is x?
- 6. If $m \angle D = 4x 20$ and $m \angle C = 5x 50$, what is x?
- 7. If AC = 60 cm, what is BD?
- 8. If BD = 70 cm, what is AC?
- 9. If AC = 4x 6 and BD = 2x + 10, what is AC?
- 10. If AC = 3y + 7 and BD = 6y 8, what is BD?

Lesson 3

Properties of a Parallelogram

A parallelogram is a quadrilateral in which both pairs of opposite sides are parallel.

Do the following:

1. On a graphing paper, draw a parallelogram similar to the one below. Name your parallelogram ABCD.



- 2. Draw diagonal AC. What do you notice?
- 3. Using a protractor, find the measures of the opposite angles of parallelogram ABCD. Are the angles congruent?
- 4. Using a protractor, find the measures of each pair of non-opposite angles. Add their measures. Are the angles supplementary?
- 5. Using a ruler, find the lengths of each pair of opposite sides. Are their lengths equal?
- 6. Draw diagonal BD. What do you notice?

Were you careful in doing the above activity? You actually proved inductively the following properties of a parallelogram.

- 1. Each diagonal divides a parallelogram into two congruent triangles.
- 2. The opposite angles of a parallelogram are congruent.
- 3. The non-opposite angles of a parallelogram are supplementary.
- 4. The opposite sides of a parallelogram are congruent.
- 5. The diagonals of a parallelogram bisect each other.

These properties of a parallelogram can also be proven deductively.

1. Each diagonal divides a parallelogram into two congruent triangles.

М



Proof:

Statements	Reasons
 Parallelogram MATH with diagonal MT 	1. Given
2. MH // TA	 A parallelogram is a quadrilateral in which both pairs of opposite sides are parallel.
3. ∠HMT ≅ ∠ATM (A)	 If two parallel lines are cut by a transversal, then any pair of alternate interior angles are congruent.
4. $\overline{\text{MT}} \cong \overline{\text{MT}}$ (S)	4. Reflexive Property of Congruence
5. HT // MA	 A parallelogram is a quadrilateral in which both pairs of opposite sides are parallel.(Same as reason # 2)
6. ∠HTM ≅ ∠AMT (A)	 If two parallel lines are cut by a transversal, then any pair of alternate interior angles are congruent. (Same as reason #3)
7. \triangle HTM $\cong \triangle$ AMT	7. ASA Congruence

2. The opposite angles of a parallelogram are congruent H_____

 Given: Parallelogram MATH
 H
 T

 Prove: $\angle H \cong \angle A$ A

Statements	Reasons	
1. Parallelogram MATH	1. Given	
2. Draw MT	2. Two points determine a line.	
3. $\triangle MHT \cong \triangle TAM$	 Each diagonal divides a parallelogram into two congruent triangles. (First property) 	
4. ∠H ≅ ∠A	 Corresponding parts of congruent triangles are congruent. (CPCTC) 	

If you want to prove that $\angle M \cong \angle T$, draw diagonal HA. Then follow the above steps.

3. The non-opposite angles of a parallelogram are supplementary



Prove: $\angle H$ and $\angle M$ are supplementary



Т

Proof:

Statements	Reasons
1. <u>Pa</u> rallelogram MATH	1. Given
2. $\overline{\text{HT}} // \overline{\text{MA}}$ 3. ∠H and ∠ M are supplementary	 A parallelogram is a quadrilateral in which both pairs of opposite sides are parallel If two parallel lines are cut by a transversal, then the interior angles on the same side of the transversal are supplementary.

4. The opposite sides of a parallelogram are congruent



Proof:

Statements	Reasons
1. Parallelogram MATH	1. Given
Draw diagonal MT	2. Two points determine a line
 ΔΜΗΤ ≅ ΔΤΑΜ 	 Each diagonal divides a parallelogram into two congruent triangles.
4. $\overline{HT} \cong \overline{MA}$ $\overline{HM} \cong \overline{TA}$	 Corresponding parts of congruent triangles are congruent.

5. The diagonals of a parallelogram bisect each other.

Given: Parallelogram LOVE

Prove: EO and LV bisect each other



1 1001.

Statements	Reasons
 Parallelogram LOVE with diagonals EO and LV 	1. Given
2. $\overline{LE} \cong \overline{VO}$ (S)	 Opposite sides of a parallelogram are congruent
3. LE // VO	 A parallelogram is a quadrilateral in which both pairs of opposite sides are parallel
4. ∠1 ≅ ∠2 (A)	 If two parallel lines are cut by a transversal, then the alternate interior angles are congruent.
5. ∠3 ≅ ∠4 (A)	5. Vertical angles re congruent
6. ΔLEA ≅ ΔVOA	6. SAA Congruence
7 $\overline{FA} \simeq \overline{OA}$	Corresponding parts of
$\frac{1}{1} \frac{1}{A} \simeq \frac{1}{1} \frac{1}{A}$	congruent triangles are
	congruent
8 EO and IV bisect each other	8. The bisector of a segment is a
	point, line, segment, or plane
	that divides the segment into
	two segments (Definition of
	bisector of a segment)

Example 1



Solution:

Step 1. Opposite angles of a parallelogram are congruent $\angle A \cong \angle K$

 $m \angle A = m \angle K$ (Congruent angles have equal measures)

Step 2. Replace $m \angle K$ with 110 $m \angle A = 110$

Example 2 \square ABCD is a parallelogram. If $m \angle A = x + 15$ and $m \angle C = 40$, what is x?



Solution:

Step 1 Opposite angles of a parallelogram are congruent $\angle A \cong \angle C$ $m \angle A = m \angle C$ (Congruent angles have equal measures)

Step 2. Replace $m \angle A$ with x + 15 and $m \angle C$ with 40 and solve for x. x + 15 = 40 x = 40 - 15 x = 25

Example 3

The figure below is a parallelogram. If $m \angle O = 2x + 10$ and $m \angle E = x + 30$, what is $m \angle O$?



Solution:

Step 1. Opposite angles of a parallelogram are congruent.

 $\angle O \cong \angle E$ m $\angle O$ = m $\angle E$ (Congruent angles have equal measures)

Step 2. Substitute 2x + 10 for $m \angle O$ and x + 30 for $m \angle E$. Then solve for x. 2x + 10 = x + 30 2x - x = 30 - 10x = 20

Step 3. Substitute 20 for x in $m \angle O = 2x + 10$ to solve for $m \angle O$. $m \angle O = 2(20) + 10$ $m \angle O = 40 + 10$ $m \angle O = 50$

Example 4

Quadrilateral ABCD is a parallelogram. If $m \angle A = 60$, what is $m \angle B$?



Solution:

Step 1. Non-opposite angles of a parallelogram are supplementary $\angle A$ and $\angle B$ are supplementary $m\angle A + m\angle B = 180$

Step 2. Substitute 60 for m \angle A and solve for m \angle B 60 + m \angle B = 180 m \angle B = 180 - 60 m \angle B = 120

Example 5



Solution:

Step 1. Non-opposite angles of a parallelogram are supplementary. $\angle E$ and $\angle A$ are supplementary $m\angle E + m\angle A = 180$

Step 2. Substitute x – 60 for m \angle E, and 2x for m \angle A. x –60 + 2x = 180 x + 2x = 180 + 60 3x = 240 x = 80

Step 3. Substitute 80 for x in $m \angle E = x - 60$. Then solve for $m \angle E$. $m \angle E = x - 60$ $m \angle E = 80 - 60$ $m \angle E = 20$

Example 6

In the parallelogram below, m $\angle A$ = 2x and m $\angle C$ = 4x – 80. What is m $\angle B$?



Solution:

Step 1. Opposite angles of a parallelogram are congruent. $\angle A \cong \angle C$ $m \angle A = m \angle C$ (Congruent angles have equal measures)

Step 2. Substitute 2x for m \angle A and 4x – 80 for m \angle C. Then solve for x. 2x = 4x – 80 2x – 4x = – 80 -2x = -80x = 40

Step 3. Substitute 40 for x $m \angle A = 2x$ $m \angle A = 2(40)$ = 80

Step 4. Non-opposite angles of a parallelogram are supplementary $\angle A$ and $\angle B$ are supplementary $m\angle A + m\angle B = 180$

Step 5. Substitute 80 for $m \angle A$ and solve for $m \angle B$. $80 + m \angle B = 180$ $m \angle B = 180 - 80$ $m \angle B = 100$

Example 7

<u>Q</u>uadrilateral EFGH is a parallelogram. If EH = 14 cm long, how long is side FG?



Solution:

Step 1. Opposite sides of a parallelogram are congruent $\frac{FG}{FG} \cong \frac{EH}{EH}$ FG = EH (Congruent segments have equal lengths)

Step 2. Substitute 14 for EH in the equation FG = EH FG = 14

Therefore FG is 14 cm long.

Example 8

Quadrilateral GEOM is a parallelogram. If MO = 2x + 3 and GE = 4x - 15. What is MO?



Solution:

Step 1. Opposite sides of a parallelogram are congruent $\overline{MO} \cong \overline{GE}$ $\overline{MO} = \overline{GE}$ (Congruent segments have equal lengths) Step 2. Substitute 2x + 3 for MO and 4x – 15 for GE. Solve for x 2x + 3 = 4x - 152x - 4x = -15 - 3

$$-2x = -18$$

x = 9

Step 3. Substitute 9 for x in MO = 2x + 3 MO = 2(9) + 3 = 18 +3 = 21

Example 9

 \Box CDEF is a parallelogram. If FD = 12 cm, what is the length of \overline{FG} ?



Solution:

The diagonals of a parallelogram bisect each other.

$$\overline{CE}$$
 bisects FD
Therefore: FG = $\frac{1}{2}$ FD
= $\frac{1}{2}$ (12)
= 6 cm

Example 10

 \Box CDEF is a parallelogram with diagonals \overline{CE} and \overline{DF} intersecting at G. If FG = 3x –7 and DG = x +21, find FG.

Solution:

Step 1. Draw the figure.



Step 2. The diagonals of a parallelogram bisect each other. FG = DG

Step 3. Substitute 3x - 7 for FG and x + 21 for DG in the equation FG DG. 3x - 7 = x + 21 3x - x = 21 + 7 2x = 28x = 14 Step 4. Substitute 14 for x in the equation FG = 3x - 7. (See given data) FG = 3x – 7 =3(14) - 7=42 - 7 = 35

Try this out

Set A

Fill in the blanks

Quadrilateral ABCD is a parallelogram..



- 1. m∠A = ____
- 2. m∠ABC =____
- 3. m∠A + m∠ABC =
- 4. m∠ABC + m∠C = _____
- 5. m∠C + m∠ADC = _____
- 6. $\triangle ABD \cong$ _____

Quadrilateral EFGH is a parallelogram.



- 8. El =
- 9. If EG is 16 cm, then EI = _____
- 10. If HI is 7 cm, then FI = _____

7. If $m \angle A = 50$, what is $m \angle D$?

8. If $m \angle D = 130$, what is $m \angle C$?

1. If m \angle A is 50, what is m \angle C? 2. If m \angle B is 125, what is m \angle D?

If m∠A = x and m∠C = 30, what is x?
 If m∠B = y and m∠D = 115, what is y?
 If m∠A = x + 30, and m∠C = 60, what is x?
 If m∠D = 100 and m∠B = y - 40, what is y?

- 9. If $m \angle B = 2x 20$ and $m \angle D = x + 40$, what is $m \angle B$?
- 10. If $m \angle A = 2x 50$ and $m \angle C = x + 10$ what is $m \angle A$?

Set C

Use the figure below for exercises 1-10

Quadrilateral ABCD is a parallelogram.



- 1. If AB = 17 cm, then CD = _____
- 2. If AD = 25 cm, then BC = _____
- If AE = 5 dm, then CE = _____
- 4. If BD = 36 cm, then BE =
- 5. If AB = 2x + 10 and CD = 15, then AB =
- 6. If AD = 4x + 15 and BC = 2x + 21 then AD =
- 7. If AB = x + 6 and CD = 14, what is x?
- 8. If AD = 20 and BC = x 5, what is x?
- 9. If AE = 15 and CE = x + 4, what is x?
- 10. If BE = 2x and DE = 6, what is x?

Quadrilateral ABCD is a parallelogram





- 1. A trapezoid is a guadrilateral with exactly one pair of parallel sides.
- 2. The median of a trapezoid is a segment joining the midpoints of the nonparallel sides of a trapezoid.
- 3. The median of a trapezoid is parallel to its bases and half the sum of the lengths of the bases.
- 4. An isosceles trapezoid is a trapezoid with congruent non-parallel sides.
- 5. The base angles of an isosceles trapezoid are congruent.
- 6. The diagonals of an isosceles trapezoid are congruent.
- 7. A parallelogram is a guadrilateral in which both pairs of opposite sides are parallel.
- 8. Each diagonal divides a parallelogram into two congruent triangles.
- 9. Opposite angles of a parallelogram are congruent.
- 10. Non-opposite angles of a parallelogram are supplementary.
- 11. The diagonals of a parallelogram bisect each other.



Multiple Choice. Choose the letter of the correct answer.

- 1. Non-opposite angles of a parallelogram are
 - A. Complementary

- C. Adjacent
- B. Supplementary
- D. Congruent

- C.
- 2. A guadrilateral with exactly one pair of parallel sides
 - A. Square
 - B. Rectangle

- C. Trapezoid D. Rhombus
- 3. In the figure at the right, DC = 20 cm And AB = 36 cm. What is EF?
 - A. 16 cm
 - B. 56 cm
 - C. 28 cm
 - D. 46 cm



4. The figure below is a parallelogram. If AD = 2x - 10and BC = x + 30, then BC =



- 5. The figure below is a rhombus. If m $\angle I = 4x$ and m $\angle E = 2x + 60$, what is m $\angle I$ in degrees?
 - A. 100
 - E. 110
 - F. 120
 - G. 130



- 6. Quadrilateral BEST is a parallelogram. If $m \angle B = x + 40$ and $m \angle E = 2x + 20$, what is $m \angle B$ in degrees?
- 7. The figure below is a parallelogram. The diagonals AC and BD intersect at E. If AE = 2x and EC = 12, what is x?
 - A. 5
 - B. 6
 - C. 7
 - D. 9



- 8. Quadrilateral CDEF is a parallelogram. If m \angle C = y and m \angle E = 2y 40, then m \angle D is
 - A. 80 B. 110 C. 140





9. Into how many congruent triangles is a parallelogram divided by one of its diagonals?

A. 1	C. 3
B. 2	D. 4

10. Base angles of an isosceles trapezoid are

A. Complementary	C. Congruent
B Supplementary	D. Adjacent



How much do you know

- 2. True
- 3. False
- 4. False
- 5. 17.5
- 6. AB = 16
- 7. BE + TS = 30
- 8. m∠ADC = 130
- 9. AC = 12
- 10. m∠C = 40

Try this out

Lesson 1

Set A	Set B	Set C
1. 7	1. x = 10	1. x = 15.5
2. 9.5	2. y = 17	2. x = 23
3. 11.5	3. x = 10	3. NM = 20
4. 8.5	4. y = 13	4. KL = 29
5. 14	5. x = 10	5. x = 16
6. 18	6. y = 18	6. x = 25
7. 6.2	7 x = 9	7. OP = 23
8. 9.6	8. y = 11	8. NM = 22
9. 14	9. x = 2	9. OP = 15
10.24	10.x = 14	10.NM = 10

Lesson 2

Set A	Set B	Set C
1. $\angle P$ and $\angle Q$; $\angle R$ and $\angle S$	1. $x = 40$	1. m∠A = 70
2. AD and BC	2. x = 85	2. m∠B = 41
3. DC and AB	3. x = 80	3. m∠D = 115
4. m∠B = 30	4. x = 145	4. m∠C = 126
5. m∠A = 60	5. x = 23	5. x = 10
6. m∠D = 110	6. x = 13	6. x = 30
7. m∠C = 105	7. $x = 19.5$	7. BD = 60
8. m∠D = 145	8. $X = 31$	8. AC = 70
9. m∠B = 60	9. $X = 04$	9. AC = 26
10.m∠C = 145	10.2 - 33	10.BD = 22

Lesson 3

Set A	Set B	Set C
1. 50	1. m∠C = 50	1. CD = 17 cm
2. 130	2. m∠D = 125	2. BC = 25 cm
3. 180	3. x = 30	3. CE = 5 dm
4. 180	4. y = 115	4. BE = 18 cm
5. 180	5. $\dot{x} = 30$	5. AB = 15
6. 42	6. y = 140	6. AD = 27
7. FI	7. m∠D = 130	7. x = 8
8. GI	8. m∠C = 50	8. x = 25
9. 8 cm	9 m/B = 100	9. x =11
10.7 cm	10.m∠A = 70	10.x = 3

What have you learned 1. B 2. C

- 3. C
- 4. C 5. C
- 6. D
- 7. B
- 8. C
- 9. B 10.C