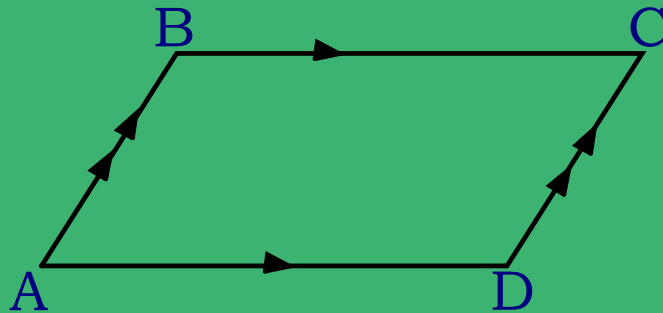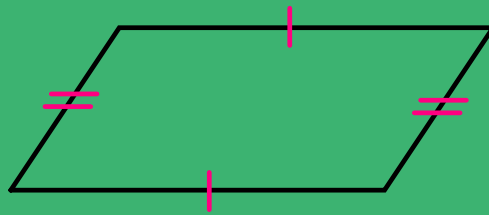# 8.2 Properties of Parallelograms

Chapter 8 deals with exploring quadrilaterals.

parallelogram - a quadrilateral with both pairs of opposite sides parallel

The parallelogram above is called parallelogram ABCD, or can be written as ▱ABCD.

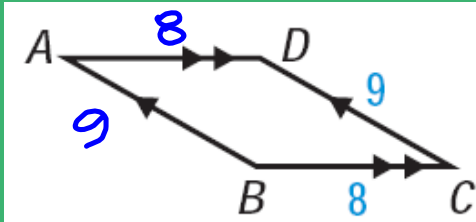## Theorem 6.2
Opposite sides of a parallelogram are congruent.

Theorem 6.3
Opposite angles of a parallelogram are congruent.

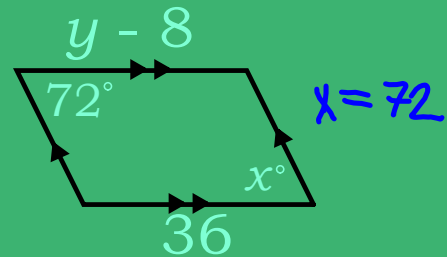## Example 1

a) Find the measures of the missing sides.

A ← 8 → D

9

9

B   8   C

b) Find the values of x and y.

$y - 8$

72°

$x = 72$

$x°$

36

$y - 8 = 36$
$y = 44$

Theorem 6.4

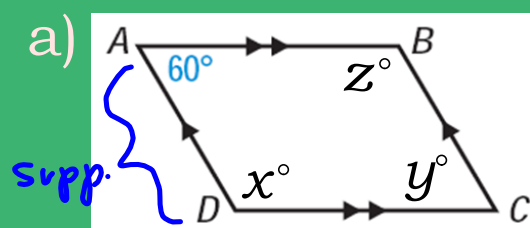Consecutive angles in a parallelogram are supplementary.

B ————→ C

A ————→ D
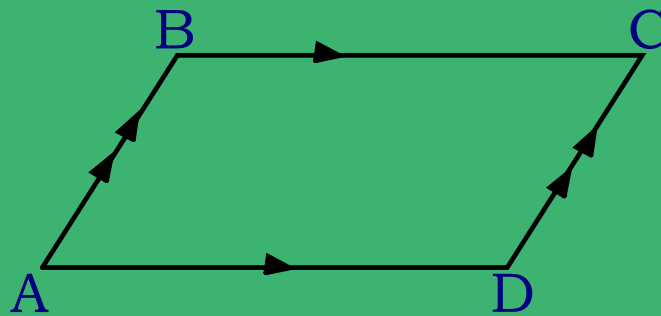
$m \angle A + m \angle B = 180$

$m \angle B + m \angle C = 180$

$m \angle C + m \angle D = 180$

$m \angle D + m \angle A = 180$

Example 2
Find the values of $x, y,$ and $z.$

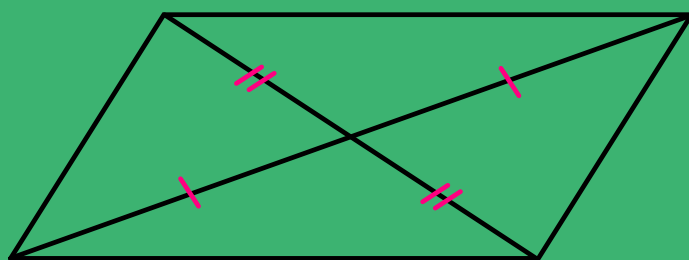a)

A — 60° — B
$z°$
D — $x°$ — $y°$ — C

supp.

$$X = 120°$$
$$Y = 60°$$
$$Z = 120°$$

b)

$x°$
$y°$
supp.
$104°$
$z°$

$$X = 76°$$
$$Y = 104°$$
$$Z = 76°$$
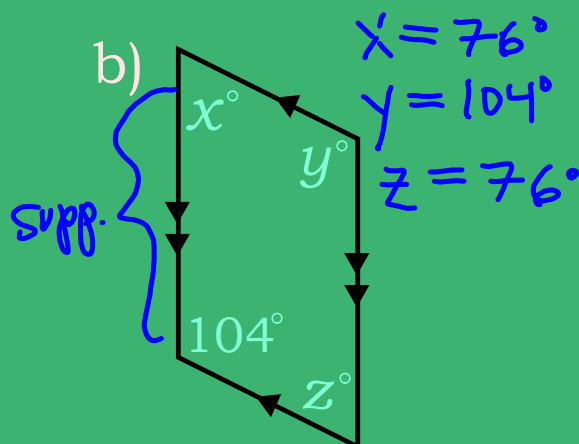
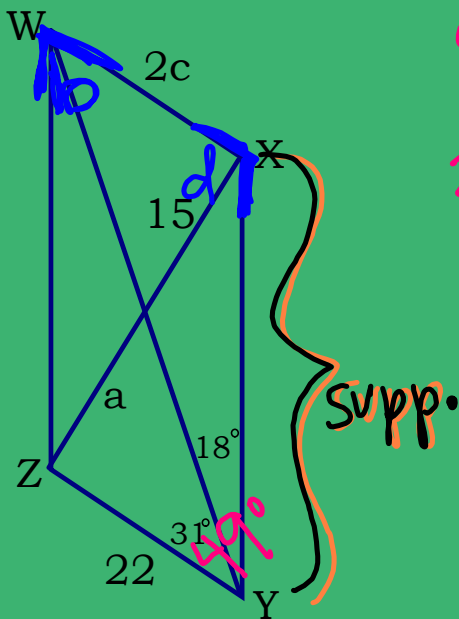## Theorem 6.5
The diagonals of a parallelogram bisect each other.

Example 3

WXYZ is a parallelogram, m∠ZWX = b, and m∠WXY = d. Find the values of a, b, c, & d.

W

2c

X

15

d

a

18°

Z

31° 40°

22

Y

Supp.

$a = 15$ $b = 49°$

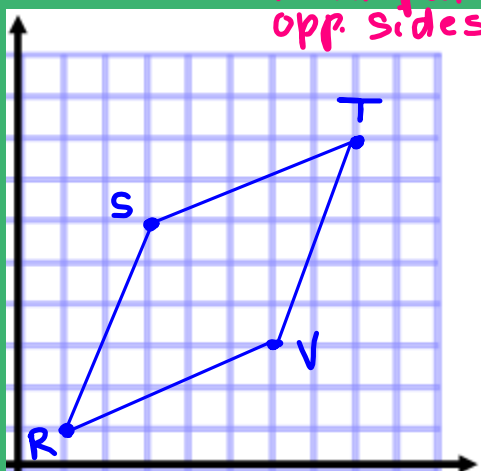$2c = 22$ $d = 131°$

$c = 11$

Example 4

The coordinates of the vertices of RSTV are R(1, 1), S(3, 6), T(8, 8), & V(6, 3). Determine if RSTV is a parallelogram.   yes

both pairs of
opp. sides //

T

S

V

R

$\overline{RS}$ & $\overline{VT}$

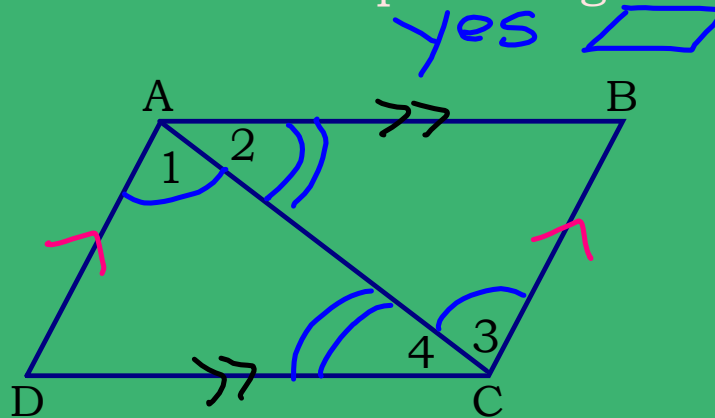$m = \dfrac{5}{2}$ $m = \dfrac{5}{2}$ //

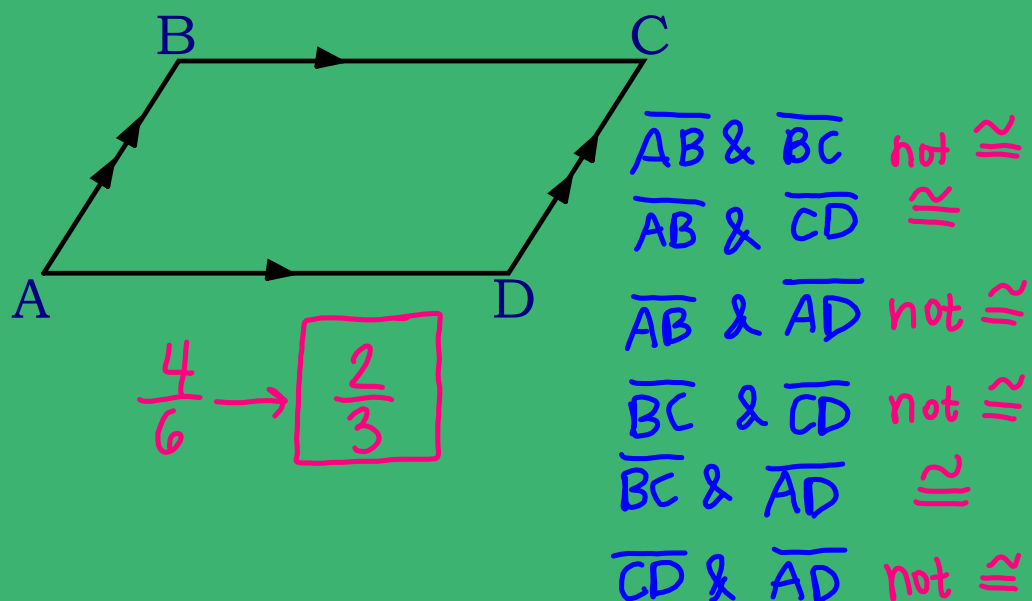$\overline{ST}$ & $\overline{RV}$

$m = \dfrac{2}{5}$ $m = \dfrac{2}{5}$ //

Example 5 $\overline{AD} \parallel \overline{BC}$ $\overline{AB} \parallel \overline{DC}$

Given $\angle 1 \cong \angle 3$ and $\angle 2 \cong \angle 4$, determine if quadrilateral ABCD is a parallelogram.

yes ▱

A   B

1   2

4   3

D   C

Example 6

Two sides of ▱ABCD are chosen at random.
If $\overline{AB} \neq \overline{BC}$, what is the probability
that the two sides chosen are <u>not</u> congruent?

B   C

A   D

$\dfrac{4}{6} \rightarrow \boxed{\dfrac{2}{3}}$

$\overline{AB}$ & $\overline{BC}$ not $\cong$

$\overline{AB}$ & $\overline{CD}$ $\cong$

$\overline{AB}$ & $\overline{AD}$ not $\cong$

$\overline{BC}$ & $\overline{CD}$ not $\cong$

$\overline{BC}$ & $\overline{AD}$ $\cong$

$\overline{CD}$ & $\overline{AD}$ not $\cong$

Example 7

For ▱ABCD, what is the probability that two randomly chosen angles are congruent? List the possible pairs of angles and determine which are congruent.

$$\frac{2}{6} \rightarrow \boxed{\frac{1}{3}}$$

∠A & ∠B no
∠A & ∠C ≅
∠A & ∠D no
∠B & ∠C no
∠B & ∠D ≅
∠C & ∠D no
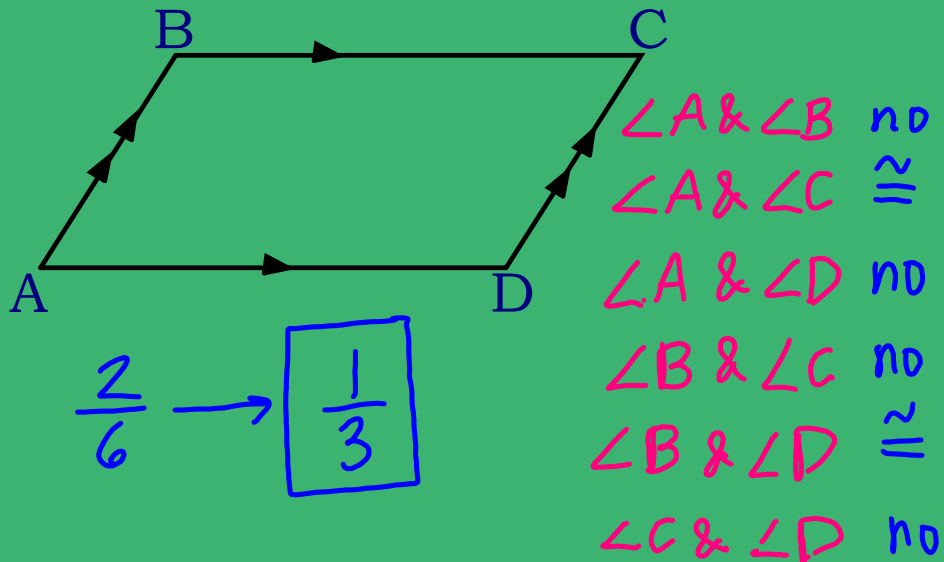
Example 8

For ▱JKLM, find the indicated measures.

supp.

$$110 + 30 + ? = 180$$

a) Find NM. 2

b) Find KM. 4

c) Find m∠ JML. 70°

d) Find m∠ KML. 40°