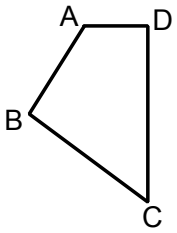
QUADRILATERALS

A quadrilateral is any polygon with four sides.

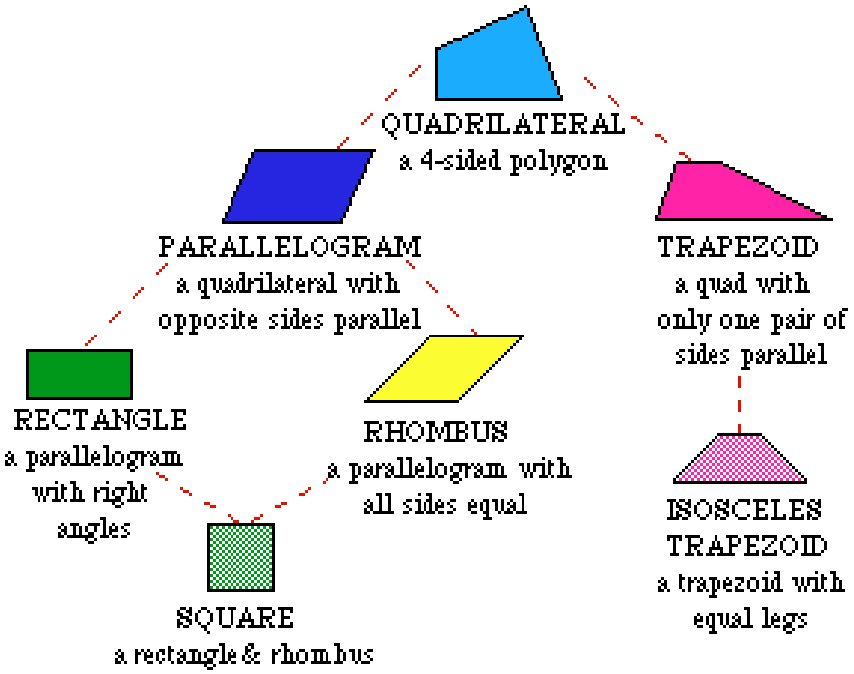


Parts of a Quadrilateral:

- Opposite sides are sides that do not share a common endpoint.
- Consecutive (or adjacent) sides are sides that share a common endpoint.

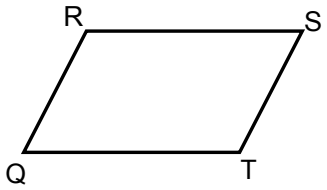
- Opposite vertices are two corners of the quadrilateral that are not connected by a side.
- Opposite angles are angles whose vertices are opposite vertices. They do not share a side.
- Consecutive angles are angles that are next to each other, either clockwise or counter-clockwise.
- The diagonals of a quadrilateral are line segments that connect two opposite vertices.

The Quadrilateral Family Tree



Parallelograms

A parallelogram is a special type of quadrilateral in which the pairs of opposite sides are both parallel and equal in length.



Properties of parallelograms:

- Each diagonal divides a parallelogram into two congruent triangles.
- Opposite sides of a parallelogram are congruent.
- Opposite angles of a parallelogram are congruent.
- Consecutive angles of a parallelogram are supplementary.
- Diagonals of a parallelogram bisect each other.

Parallelogram Word Problems

1) In parallelogram MATH, the measure of ∠T exceeds two times the measure of ∠H by 30. What is the measure of the largest angle of the parallelogram?

For quadrilateral word problems:

- Draw the picture!
- Determine which property you will use.
- Write and solve the equation.
- Answer the question!!

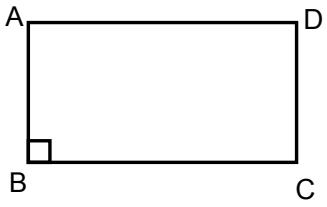
2) In parallelogram ABCD, $m\angle B = 5x$ and $m\angle C = 2x + 12$. Find the measure of ∠D.

3) In parallelogram RSTW, diagonals RT and SW intersect at point A. If SA = x - 5 and AW = 2x - 37, what is the length of SW?

4) In parallelogram TRIG, $m\angle R = 2x + 19$ and $m\angle G = 4x - 17$. What is $m\angle T$?

Rectangles

A rectangle is a parallelogram one of whose angles is a right angle.



Properties of Rectangles:

- A rectangle is a parallelogram in which all four angles are right angles.
- The diagonals of a rectangle are congruent.
- A rectangle is equiangular.

** Note: Since a rectangle is a type of parallelogram, it also has all of the properties of a parallelogram!

1) ABCD is a rectangle. Diagonal AC measures 2x + 3 and diagonal BD measures 4x - 21. Find the value of x and the measures of AC and BD.

2) In rectangle ABCD, the diagonals AC and BD intersect at point E. If the measure of AE = 5, find the length of EC, AC, and BD.

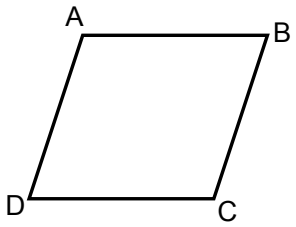
3) In rectangle ABCD, diagonals AC and BD meet at point E. If CB = 6, AB = 8, and AC = 10, find the lengths of AD, CD, EC, AE, DE, EB, and DB.

4) In rectangle QRST, diagonals QS and RT meet at point U. If the measure of QU = 3x + 4 and US = x + 20, what are the value of x and the lengths of QU, QS, and RT?

5) In rectangle PQRS, diagonal PR = 4x + 3 and diagonal QS = 6x - 7. What is the length of diagonal QS?

Rhombuses

A rhombus is a parallelogram with two congruent consecutive sides.



Properties of Rhombuses:

- All sides of a rhombus are congruent.
- The diagonals of a rhombus are perpendicular.
- The diagonals bisect the angles of a rhombus.

** A rhombus is a type of parallelogram, so it also has all of the properties of a parallelogram. However, a rhombus does NOT necessarily have the properties of a rectangle!!

1) PQRS is a rhombus. The shorter diagonal PR measures 12 units, and the measure of ∠PQR = 60º. Find the length of a side of the rhombus.

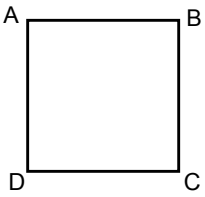
2) In rhombus ABCD, the measure of ∠ABC = 120º. If AB = 10 find the length of the shorter diagonal BD.

3) In rhombus PINK, the diagonals measure 6 units and 8 units. What is the length of a side?

4) If ABCD is a parallelogram with AB = 2x + 1, CD = 3x - 10, and AD = x + 12, show that ABCD is a rhombus.

Squares

A square is a rectangle with two congruent consecutive sides.



Properties of Squares:

- A square is a rectangle in which all sides are congruent.
- A square is a rectangle in which all angles are right angles.
- Diagonals of a square are equal and perpendicular.
- Diagonals of a square bisect the angles of a square.

** A square has all the properties of the parallelogram, the rectangle, AND the rhombus!

1) TOMA is a square. If the measure of ∠TOM = 3x - 9, find the value of x.

2) ABCD is a square. If the measure of diagonal AC = 52, what is the length of a side?

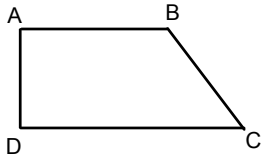
3) The perimeter of a square is 80. What is the area of the square?

4) If one side of a square is 32 and the side opposite it is 5x -8, what is the value of x?

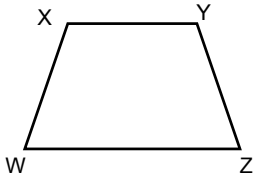
5) The perimeter of a square is 24. In simplest radical form, what is the length of a diagonal of the square?

Trapezoids

A trapezoid is a quadrilateral with two, and only two, sides parallel.



An isosceles trapezoid is a trapezoid in which the nonparallel sides are congruent.



Properties of **Isosceles** Trapezoids:

- The legs of the isosceles trapezoid are congruent.
- The diagonals of the isosceles trapezoid are congruent.
- The base angles (two angles connected by the same base) are congruent.

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1) Given: Isosceles trapezoid ABCD with BC ||AD. If m<A = 4(x+5) and m<D = 2(x+15) + 8, find m<A, m<B, m<C, and m<D.

2) In isosceles trapezoid MIKE, <K and <E are the base angles. If IK = 11 and ME = 3x - 1, what is the value of x?

3) In isosceles trapezoid ABCD, BC||AD. The measure of <ADC=4x+20 and the measure of <DAB = 8x - 20. Find the value of x, <ADC, <DAB, <BCD, and <ABC.

4) In trapezoid ABCD, m<ABD = 30, m<BDC = 30, m<ADB = 40, m<BCD = 70, AD = x + 5, and BC = 3x - 21. What are the lengths of sides AD and BC?

5) The bases of an isosceles trapezoid ABCD measure 10 cm and 20 cm. The height (altitude) is 12 cm. How long are the legs AB and CD?