* ▯ **Statement of the theorem**

* ▯ **Explanation (theory)**

* ▯ **Proof (step-by-step reasoning)**

1. Commutative Property of Addition**

Statement:

1 For any numbers (a) and (b):

$a + b = b + a$

Theory:

The order of numbers in addition doesn't affect the sum.

Proof:

Let ($a = 3$) and ($b = 5$).

Then ($3 + 5 = 8$) and ($5 + 3 = 8$).

Since the results are equal for all real numbers,

▯ **The property holds true.**

2. Associative Property of Multiplication**

Statement:

For any numbers (a, b, c):

$(a \times b) \times c = a \times (b \times c)$]

Theory:

When multiplying three numbers, grouping doesn't change the product.

Proof:

Let ($a = 2, b = 3, c = 4$)

Then[

$(2 \times 3) \times 4 = 6 \times 4 = 24$

and[

$2 \times (3 \times 4) = 2 \times 12 = 24$

▯ **Both sides equal → proven.**

3. Distributive Property**

Statement:

$a(b + c) = ab + ac$

Theory:

Multiplying a number by a sum is the same as multiplying each term separately and then adding.

Proof:

Let ($a = 4, b = 2, c = 3$):[

$4(2 + 3) = 4 \times 5 = 20$

and

$4\times2 + 4\times3 = 8 + 12 = 20$

▯ **Hence, both sides are equal.**

4. Sum of Angles in a Triangle**

Statement:

The sum of the three interior angles of any triangle is **180°**. 360°

Theory:

In Euclidean geometry, all triangles have angles that together form a straight line (180°).

Proof (Sketch):

1. Draw triangle (ABC).

2. Draw a line through (A) parallel to base (BC).

3. Alternate interior angles with sides (AB) and (AC) equal the interior angles at (B) and (C).

4. These three angles form a straight line → (180°).

▯ **Hence, sum of angles = 180°.**

5. Pythagoras' Theorem**

Statement:

In a right-angled triangle,

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

where (c) is the hypotenuse.

Theory:

This relates the sides of any right-angled triangle.

Proof (by areas):

1. Construct a square with side ((a+b)), containing 4 right triangles and a smaller square in the middle.

2. The area of the big square = ($(a+b)^2$).

3. The area also equals ($4(\frac{1}{2}ab) + c^2 = 2ab + c^2$).

4. Equating:

$(a+b)^2 = 2ab + c^2$

Simplify:

$a^2 + 2ab + b^2 = 2ab + c^2 \Rightarrow a^2 + b^2 = c^2$

▯ **Proved.**

6. Opposite Angles of a Parallelogram**

…tement:**

…pposite angles of a parallelogram are **equal**.

Theory:

A parallelogram has opposite sides parallel, and parallel lines create equal alternate interior angles.

Proof:

1. Let ABCD be a parallelogram.

2. (AB ∥ CD) and (AD ∥ BC).

3. Using alternate interior angles:

∠A = ∠C and ∠B = ∠D.

▯ **Hence, opposite angles are equal.**

7. Vertical Angles Theorem

Statement:

When two lines intersect, the **opposite (vertical)** angles are equal.

Theory:

Vertical angles share a common vertex and are formed by two intersecting straight lines.

Proof:

Let lines AB and CD intersect at O.

Angles (∠AOC) and (∠BOD) are adjacent and form a straight line, so:

∠AOC + ∠BOD = 180°

Similarly,

∠BOD + ∠COA = 180°

By subtraction,

∠AOC = ∠BOD

▯ **Hence, vertical angles are equal.*