

Basic Geometry Rules

Triangle

Definition: Triangles are closed geometrical figures that have three straight sides. Every triangle will, as a result, have three angles as well.

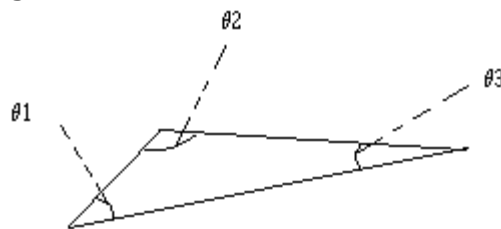


Figure 1: a triangle

$$\theta_1 + \theta_2 + \theta_3 = 180 \text{ degrees}$$

The sum of the three angles in a triangle is always equal to 180 degrees (for definition of degree see subsection below on *angles*)

Special Triangles:

A. The Right Triangle: *The right triangle* is a triangle that has one 90° angle. Since the sum of the angles in a triangle must be 180° , this implies that the other two angles in a right triangle must add up to 90° . One of these relations is the so called *Pythagorean Theorem*. For the right triangle shown in figure 2, the relation is:

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

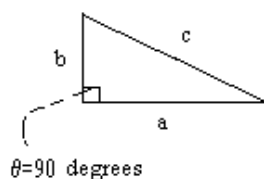


Figure 2: The Right Triangle

B. Isosceles Triangle: In this special type of triangle, *two* sides are equal to each other. One can prove that the angles *opposite* to these two equal sides are also equal to each other. Thus, let us say that we have a triangle in which two sides are 5.0 cm in length and the other side is - let's say - 2.0 cm in length, as in the figure below. This means that the two angles indicated with an arrow in the figure are equal.



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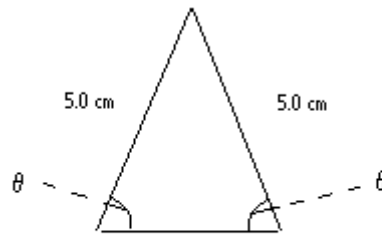


Figure 4: Isosceles Triangle, two sides equal.

B. Equilateral Triangle: This is a special type of isosceles triangle in which not just two, but all three sides, and as a result all three angles are equal. Since the sum of the angles in a triangle must be 180° , this means that for an equilateral triangle each angle is 60° .

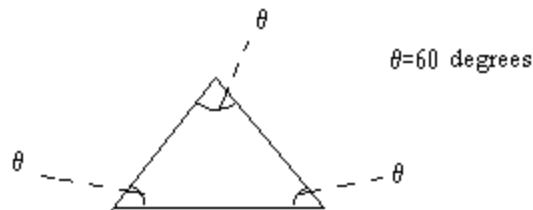


Figure 3: Equilateral Triangle, all sides equal

Perimeter: The *perimeter of a triangle* is equal to the sum of the length of its three sides.

Area: The *area of a triangle* is equal to half its base times its height.

The *height of a triangle* is each of the perpendicular lines drawn from one vertex to the opposite side (or its extension).

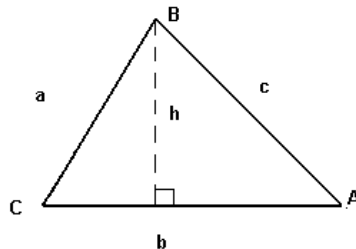


Figure 5: Sample Triangle

Perimeter for Figure 5: $P = a + b + c$

where: P = Perimeter, a , b , c = (length of) sides

Area for Figure 5: $A = \frac{1}{2} (h * b)$

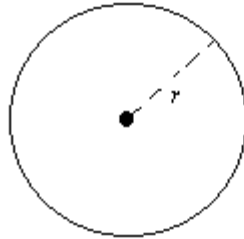
where: A = Area, b = (length of) base, h = (length of) height



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Circle

Definition: A circle is a closed geometric figure as shown in the following figure:



$r = \text{radius, a constant value}$

Figure 7: A Circle

It is defined such that all the points on the circle are at a constant distance from a *center*. This distance is called the *radius* of the circle, as indicated in the diagram above.

Circumference: The *circumference of a circle* depends very simply on the radius of the circle.

$$C = 2 \times \pi \times r$$

where: C = Circumference, r = radius, and $\pi = 3.1415 \dots$

Area: The *area of the circle* also depends on the radius of the circle. It is given by:

$$A = \pi \times r^2$$

where: A = Area, r = radius, and $\pi = 3.1415 \dots$

Parallelogram

Definition: a parallelogram is a quadrilateral with two pairs of parallel sides.

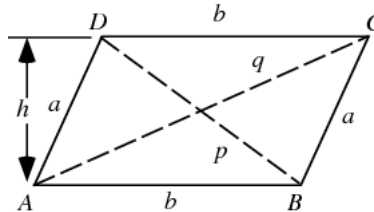


Figure 8: A Parallelogram

The opposite or facing sides of a parallelogram are of equal length and the opposite angles of a parallelogram are of equal measure.

Perimeter: The *perimeter of a triangle* equals the sum of the length of its four sides. In Figure 8,

$$P = a + b + a + b = 2a + 2b$$

where: a, b = length of sides

Area: The *area of a triangle* is equal its base times its height. The *height of a triangle* is each of the perpendicular lines drawn from one vertex to the opposite side (or its extension). In Figure 8,

$$A = b \cdot h$$

where: A = area, b = base, h = height



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Trapezoid

Definition: A trapezoid is a 4-sided flat shape with straight sides that has a pair of opposite sides parallel.

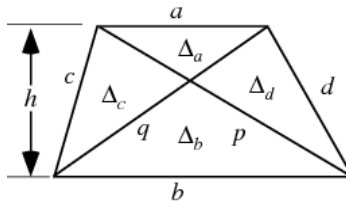


Figure 9: A Trapezoid

Isosceles trapezoid is a trapezoid when the sides that aren't parallel are equal in length and both angles coming from a parallel side are equal.

Perimeter: The *perimeter of a trapezoid* equals the sum of the length of all its four sides. In Figure 9,

$$P = a + b + c + d$$

where: a, b, c, d = length of sides

Area: The *area of a trapezoid* is equal half the sum of its base (or parallel sides) times height. In Figure 9,

$$A = \frac{1}{2} * (a + b) * h$$

where: a, b = bases, h = height

Rectangle

Definition: A rectangle is a special parallelogram with straight sides where all interior angles are right angles (90°).

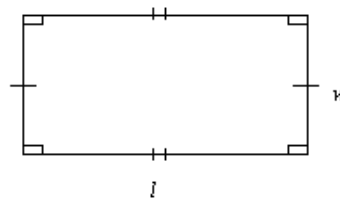


Figure 10: A Rectangle

The opposite sides of a rectangle are parallel and of equal length. The longer sides are called length and the shorter sides are called width.

Perimeter: The *perimeter of a rectangle* equals the sum of the length of all its four sides. In Figure 10,

$$P = l + w + l + w = 2l + 2w$$

where: l, w = length and width (four sides)

Area: The *area of a rectangle* equals its length times its width. In Figure 10,

$$A = l * w$$

where: l = length, w = width



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Square

Definition: A square is a special rectangular that all its four sides equal.

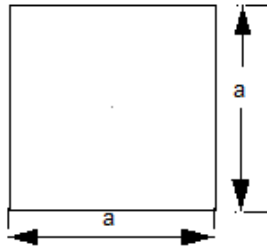


Figure 11: A Square

Perimeter: The *perimeter of a square* equals the sum of the length of all its four sides. In Figure 11,

$$P = a + a + a + a = 4a$$

where: a = side

Area: The *area of a square* equals the length of the sides squared. In Figure 11,

$$A = a^2$$

where: a = side

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References - The following work was referenced to during the creation of this handout: [The University of Colorado Atlas Project](#), [Analyze Math](#), [Wolfram](#), [Paul Bourke](#), and [Trans4mind](#).



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