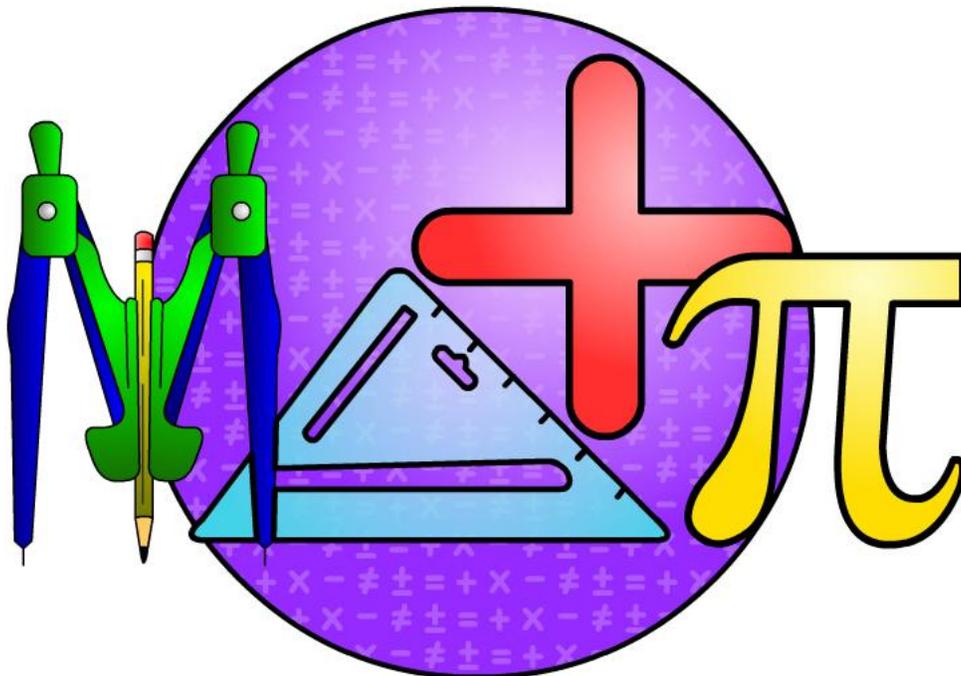




Mathematics tips for parents

(Sixth Grade and Up)



:INTRODUCTION:

This booklet contains math facts and concepts that should be well-known by every student in grade 6 and up. These facts and concepts form the fabric of knowledge—the foundation necessary for success in the middle school and high school math classroom.

BASIC MATHEMATICS SYMBOLS

=	EQUALITY
≠	INEQUALITY
≈	APPROX. EQUAL
<	LESS THAN
>	GREATER THAN
≤	LESS THAN OR EQUAL
≥	MORE THAN OR EQUAL
+	ADDITION
-	SUBTRACTION
÷	DIVISION
x	MULTIPLICATION

PLACE VALUES

9,	BILLIONS
8	HUNDRED MILLIONS
7	TEN MILLIONS
6,	MILLIONS
5	HUNDRED THOUSANDS
4	TEN THOUSANDS
3,	THOUSANDS
2	HUNDREADS
1	TENS
0	ONES
.	DECIMALS
1	TENTHS
2	HUNDREATHS
3	THOUSANDTHS
4	TEN THOUSDANTHS
5	HUNDREAD THOUSANDTHS
6	MILLIONTHS

THEORIES OF MATHEMATICS:

ASSOCIATIVE LAW: Associativity is a valid rule of replacement for expressions in logical proofs. Within an expression containing two or more occurrences in a row of the same associative operator, the order in which the operations are performed does not matter as long as the sequence of the operands is not changed.

For example:

- when addition takes place

$$(a + b) + c = a + (b + c) \longrightarrow (13 + 99) + 111 = 13 + (99 + 111)$$

So, 243=243.

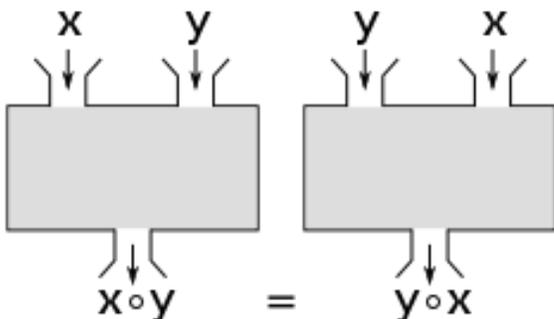
- when multiplication takes place

$$(a \times b) \times c = a \times (b \times c) \longrightarrow (13 \times 99) \times 111 = 13 \times (99 \times 111)$$

So, 142,857=142,857.

So the associative law confirms that it doesn't matter how we group numbers in equation as the end result will be the same.

COMMUTATIVE LAW:



An operation is commutative, if $x \times y = y \times x$ & $x + y = y + x$. This image illustrates this property with the concept of an operation as a "calculation machine".

And this is applicable for only addition and multiplication.

For example: $3 - 5 \neq 5 - 3$ or

$$3 \div 5 \neq 5 \div 3$$

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DISTRIBUTIVE LAW: The distributive property tells us how to solve equations in the form of $a(b + c)$. The distributive property is sometimes called the distributive law of multiplication and division.

Normally when we see an equation like this: $4(13+27)$, we add the numbers in brackets first and then multiply that value with 4.

So, $4(13+27)=4 \times 40=160$

But distributive law states that the same equation can be solved in a little different way:
 $4(13+27)= (4 \times 13)+(4 \times 27)=52+108=160$

Why did we do it differently when we could have easily worked out what was in the brackets first?

This is preparation for when we have variables instead of numbers inside the parentheses.

So remember this:

Commutative Laws: $a + b = b + a$

$a \times b = b \times a$

Associative Laws: $(a + b) + c = a + (b + c)$

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

Distributive Law: $a \times (b + c) = a \times b + a \times c$

Identity law: $a+0=a$ & $a*1=a$

RATIOS AND PROPORTIONS: A ratio is a comparison of two numbers. For example, if 25 students -- 10 boys and 15 girls -- are in your class, then the *ratio* of boys to girls is 10 to 15. A ratio can be expressed in three ways. The ratio of boys to girls in your class might be expressed as

- 10 to 15
- 10:15
- $\frac{10}{15}$

We can use an *equation* to show that two ratios are *equivalent*s of each other. The proportion can be expressed in two ways:

- $10:15 = 2:3$
- $\frac{10}{15} = \frac{2}{3}$

Worksheet:

Are these statements true or false?	True	False
1) 3:5 and 12:20 are equal ratios.	<input type="checkbox"/>	<input type="checkbox"/>
2) $\frac{4}{5} = \frac{16}{18}$	<input type="checkbox"/>	<input type="checkbox"/>
3) 6 for \$0.85 is better than 8 for \$1.00	<input type="checkbox"/>	<input type="checkbox"/>
4) 7 miles in 10 minutes = 3.5 miles in 5 minutes.	<input type="checkbox"/>	<input type="checkbox"/>
5) If two triangles are similar, their sides are the same length.	<input type="checkbox"/>	<input type="checkbox"/>
6) If $\frac{x}{15} = \frac{12}{36}$, then $x = 3$.	<input type="checkbox"/>	<input type="checkbox"/>
7) If cross products are equal, the ratios are equal.	<input type="checkbox"/>	<input type="checkbox"/>
8) $\frac{3}{5} = \frac{6}{10}$, so $3 \times 6 = 5 \times 10$.	<input type="checkbox"/>	<input type="checkbox"/>

- And when **two ratios are equivalent**, they can be written as a **proportion**. A **proportion** is **two equal ratios**. That doesn't always mean they have the same numbers in them.

EQUATIONS AND INEQUALITIES:

To start with, we will execute the four basic operations such as addition, subtraction, multiplication and division. Algebra uses variables, constant, coefficients, exponents, terms and expressions. The fundamental concept of the algebra is balancing the algebraic equations on both sides.

- **Variables:**

Algebraic variables are the alphabetical characters which are used for assigning the value. Most commonly used are x,y,z.

- **Constant:**

Algebraic constants are the value whose value never changes while solving the algebraic equation. In $5y+7$, the value 7 is the constant.

- **Coefficient:**

A numerical or constant quantity placed before and multiplying the variable in an algebraic expression. From the following example,

$51n^2 + 31n$ the coefficients are 51 for n^2 and 31 for n .

- **Expressions:**

An algebraic Expression is the combination of variables, constant, coefficients, exponents, terms which are combined together by the following arithmetic operations, Addition, subtraction, multiplication and division. For example: $9x+25y+30$

For example: Solve the equation $4x + 6 = -10$

Sol: $4x + 6 = -10$

$$4x + 6 - 6 = -10 - 6 \text{ (Add -6 on both sides, so we get)}$$

$$4x = -16$$

$$\frac{4x}{4} = \frac{-16}{4} \text{ (Divided both sides by 4, so we get)}$$

$$-1x = 4 \text{ are equal to } x = -4$$

Example 2 : $4(a-2)+2b-4(a-b-4)+10$

Solution: $4(a-2)+2b-4(a-b-4)+ 10$

$$= 4a-8+2b-4a-4b-16+10 \text{ (distribute 4 and -4)}$$

$$= 4a-4a+2b-4b-8-16+10$$

$$= -2b-14$$

- Equations:

An algebraic equation is an equation that includes one or more variables.

Some basic formulas:

- Difference of squares
- Difference of cubes
- Sum of cubes
- Formula for
- Formula for

$$\begin{aligned} a^2-b^2 &= (a-b)(a+b) \\ a^3-b^3 &= (a-b)(a^2+ab+b^2) \\ a^3+b^3 &= (a+b)(a^2-ab+b^2) \\ (a+b)^2 &= a^2+2ab+b^2 \text{ \& } (a-b)^2 = a^2-2ab+b^2 \\ (a+b)^3 &= a^3+3a^2b+3ab^2+b^3 \text{ \& } (a-b)^3 = a^3-3a^2b+3ab^2-b^3 \end{aligned}$$

WORKSHEET:

SOLVE

$$1) 3 = t - 10 ; \quad 2) 9 + 12 = 12s ; \quad 3) 5p - 2p = 8 ; \quad 4) 12 \cdot 4 = S/2$$

$$5) 12 = -8(-8 - p); \quad 6) -10 = -8(-11 - z); \quad 7) \frac{s - (-3)}{-1} = 9$$

Find:

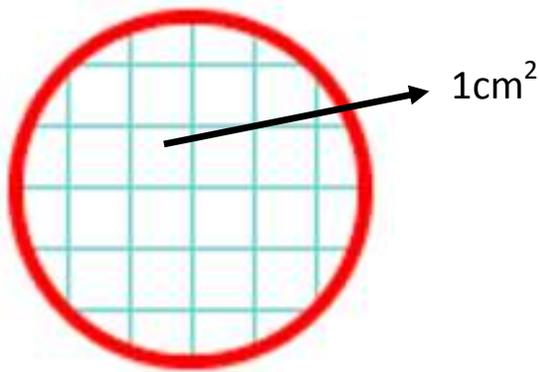
- $(14+21)^2$
- $X^3 - Y^3$ when $X=15$ and $Y=11$
- $(X + Y)^3$ when $X=7$ and $Y=4$

AREA AND VOLUME:

- **CIRCLE:** The distance around a circle is called its **circumference (formulae - $2\pi r$, where r is radius and $\pi = 3.14$ approx.)**. The distance across a circle through its center is called its **diameter** and is denoted by **D** or **d**. We use the Greek letter π (pronounced Pi) to represent the ratio of the circumference of a circle to the diameter. And radius **$r = D/2$ or $D = 2r$** .

The area of a circle is the number of square units inside that circle.

- If each square in the circle to the left has an area of 1 cm^2 , you could count the total number of squares to get the area of this circle. Thus, if there were a total of 41.25 squares, the area of this circle would be 41.25 cm^2 . However, it is easier to use this formula: **$A = \pi r^2$ or $\pi \cdot r \cdot r$**



Where A is the area of the circle.

- **VOLUME OF A SPHERE:**

The volume of sphere: $V = \frac{4}{3} \pi r^3$

HOW ?

Well, the total surface area and the volume of a pyramid play the role.

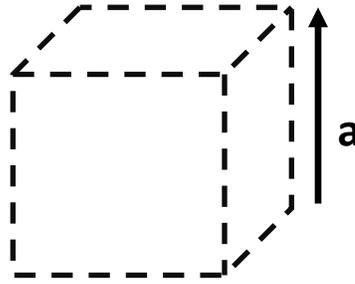
So, combining $4\pi r^2$ (total surface area of sphere) and $Bh/3$ (volume of pyramid, where B is side of the base and h is the height of the pyramid and in this case it is the radius of the sphere)

Volume of a pyramid = $1/3$ multiplied by Surface Area of sphere by radius of the sphere.

- **CUBE AND CUBOID:** A **cube** is a 6 faced 3D structure who have same area of surface and are squares.

Volume of cube: $V=a^3$

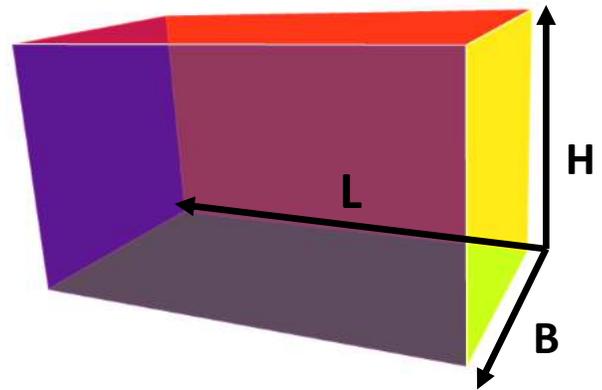
Where a is a side of the Cube.



A **cuboid** is a six faced 3D structure which has 4 equal rectangle sides and two opposite and equal square sides or rectangle. But the basic formulae for the **Volume of cuboid: $V=L \times B \times H$**

Where, L is the length of the cuboid , B is breadth of the cuboid & H height of the cuboid.

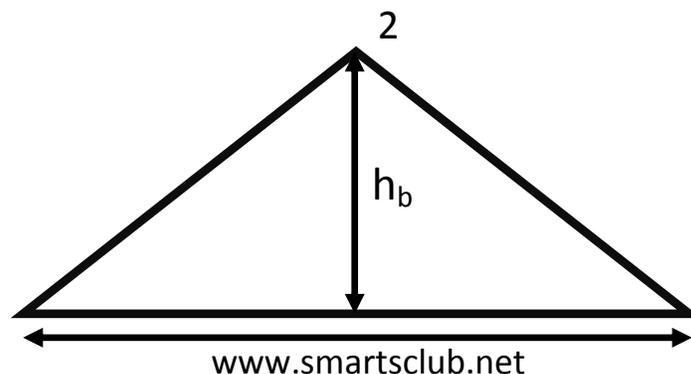
These can be notified variably there is nothing to it as such which is lengthier. But we basically should consider that the vertical side is the height, the lengthier side of the base is generally called length and the shorter side as breadth.



- **TRIANGLE , CONE AND PYRAMID:**

TRIANGLE - A plane figure with three straight sides and three angles.

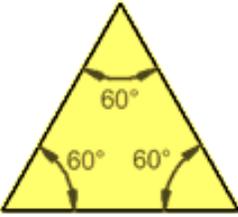
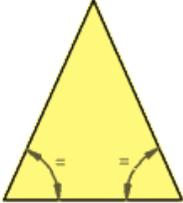
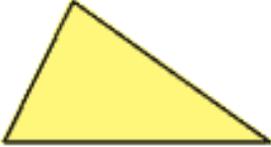
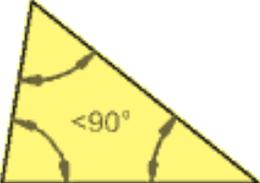
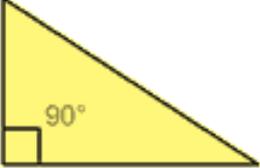
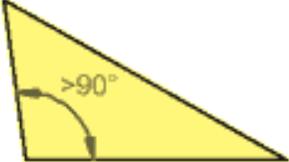
Area of a triangle : $A= \frac{h_b \times b}{2}$



b

The three angles always add to 180°

There are different kinds of triangles:

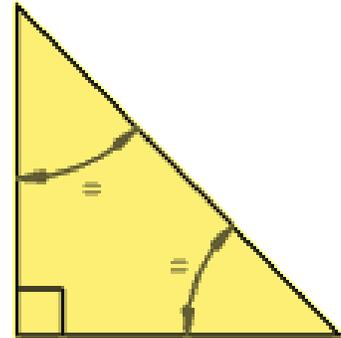
TYPE	ABOUT
	<p>EQUILATERAL TRIANGLE Three equal sides Three equal angles, always 60°</p>
	<p>ISOSCELES TRIANGLE Two equal sides Two equal angles</p>
	<p>SCALENE TRIANGLE No equal sides No equal angles</p>
BASED ON TYPES OF ANGLES	ABOUT
	<p>ACUTE TRIANGLE All angles are less than 90°</p>
	<p>RIGHT TRIANGLE Has a right angle (90°)</p>
	<p>OBTUSE TRIANGLE Has an angle more than 90°</p>

WHAT IS THE PERIMETER OF A TRIANGLE?

The perimeter is the distance around the edge of the triangle. So, to find one we need to add the three sides together.

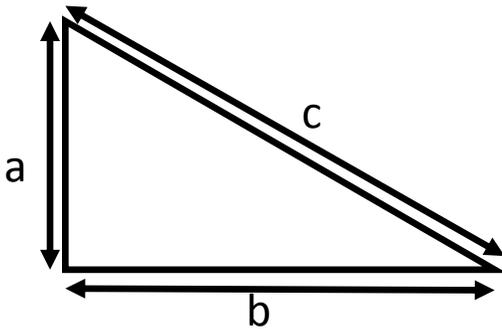
For example: the perimeter of triangle with sides 14cm, 21cm, 12cm is equal to $14+21+12=47$

There is a possibility that a triangle may be called **RIGHT ISOSCELES TRIANGLE**, when it has right angle and two equal sides.



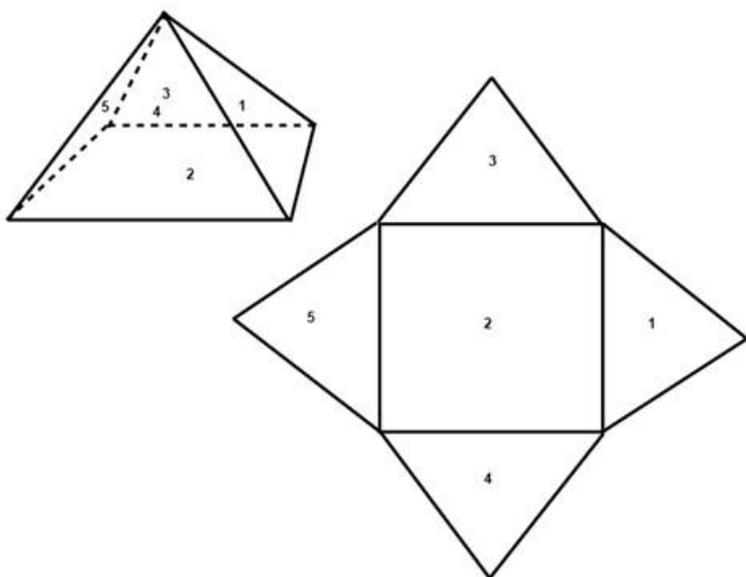
PYTHAGORAS THEOREM:

In a right angled triangle: the square of the hypotenuse is equal to the sum of the squares of the other two sides. So, lets take a triangle with sides a, b & c.



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

PYRAMID: A pyramid consists of three or four triangular lateral surfaces and a three or four sided surface, respectively, at its base. When we calculate the surface area of the pyramid below we take the sum of the areas of the 4 triangles area and the base square. The height of a triangle within a pyramid is called the slant height.



The **volume** of a pyramid is one third of the volume of a prism:

$$V = \frac{1}{3} \times B \times h$$

• The surface area of a pyramid:

$$[\text{Base Area}] + \frac{1}{2} \times \text{Perimeter} \times [\text{Slant Length}]$$

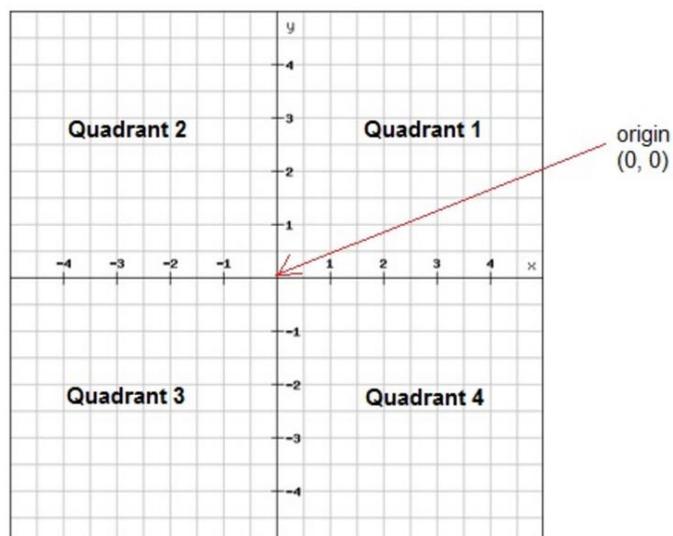
And if the surface of the faces is not the same then the total

surface area : $A = \text{base area} \times (\text{lateral area}_1 + \text{lateral area}_2 \times \dots)$

And the base area can be in the shape of a triangle, a square, a pentagon etc. So the surface area and the volume of the pyramid completely depend upon the type of base as it tells you the number of lateral surfaces too.

COORDINATE PLANES:

A coordinate plane is a two-dimensional number line where the vertical line is called the y-axis and the horizontal is called the x-axis. These lines are perpendicular and intersect at their zero points. This point is called the origin. The



axes divide the plane into four quadrants.

MEAN, MEDIAN, MODE & RANGE:

Mean, median, and mode are three kinds of "averages". There are many "averages" in statistics but these are the most commonly used.

- **MEAN:** it is the average of the number list. And it found out but first adding all the numbers together and then dividing the total with the number of elements in the list.
For ex: 21 23 25 27 29 31 33 , the mean for this list is –
 $(21+23+25+27+29+31+33)/7 = 27$
- **MEDIAN:** It is simply the middle most number in the number list.
For ex: 11 13 15 17 19 21 23 , the median of the given list is '17' as it stands in the middle of the list.
- **MODE:** It is the number that is most commonly repeated in the list of numbers.
For ex: for 13 15 15 16 18 19 21, the mode is '15' as it repeats twice.
- **RANGE:** It is the difference between the highest value and lowest value of the list.
For ex: For 12 15 18 21 24 27 30, the range is $27-12=15$ as they both are the highest and lowest values in the given list respectively.

QUICK MATH TIPS:

COMMON FRACTION—DECIMAL EQUIVALENCES

$$1/2 = 0.5$$

$$5/8 = 0.625 = 0.62\frac{1}{2}$$

$$1/3 = 0.333... = 0.33\frac{1}{3}$$

$$7/8 = 0.875 = 0.87\frac{1}{2}$$

$$2/3 = 0.666... = 0.66\frac{2}{3}$$

$$1/9 = 0.111... = 0.11\frac{1}{9}$$

$$1/4 = 0.25$$

$$1/10 = 0.1$$

$$3/4 = 0.75$$

$$1/16 = 0.0625 = 0.06\frac{1}{4}$$

$$1/5 = 0.2$$

$$1/20 = 0.05$$

$$1/6 = 0.1666... = 0.16\frac{2}{3}$$

$$1/25 = 0.04$$

$$5/6 = 0.8333... = 0.83\frac{1}{3}$$

$$1/40 = 0.025 = 0.02\frac{1}{2}$$

$$1/7 = 0.142857... = 0.14\frac{2}{7}$$

$$1/50 = 0.02$$

$$2/7 = 0.285714... = 0.28\frac{4}{7}$$

$$1/100 = 0.01$$

$$1/8 = 0.125 = 0.12\frac{1}{2}$$

$$1/1,000 = 0.001$$

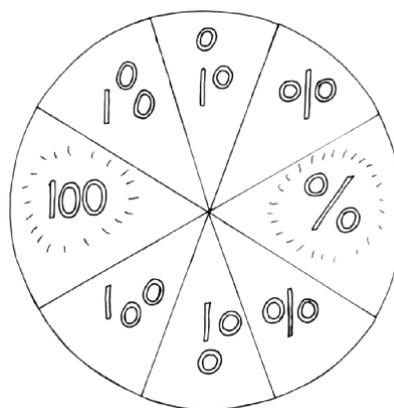
$$3/8 = 0.375 = 0.37\frac{1}{2}$$

$$1/1,000,000 = 0.000001$$

PERCENTS

“Percent” means *for each hundred*.

- 0% means “none of it.”
- 10% means “a tenth (1/10) of it.”
- 25% means “a quarter (1/4) of it.”
- 33⅓% means “a third (1/3) of it.”



50%	means “half ($1/2$) of it.”
$66\frac{2}{3}\%$	means “two-thirds ($2/3$) of it.”
75%	means “three-quarters ($3/4$) of it.”
100%	means “all of it.”
200%	means “all of it, twice.”
$\frac{1}{2}\%$	is less than 1%, and is not the same as 50%.

GEOMETRY

- A right angle contains 90° .
- A straight angle contains 180° .
- A full circle contains 360° .
- Two right angles make a straight line.
- Four right angles make a full circle.
- A **point** occupies no space and is zero-dimensional (0D).
- A **line** has length (1D) and no width.
- A **plane** is a flat surface that in theory extends infinitely in two directions. A plane has no thickness.
- **Area** is the amount of space inside a two-dimensional figure (2D), measured in square units.
- **Space** is the infinite extension of the three dimensions of length, width, and depth.
- **Volume** is the amount of space inside a three-dimensional figure (3D), measured in cubic units.
- **Time** is often considered to be the fourth dimension.
- **Parallel lines** are always the same distance apart. Parallel lines do not intersect, except in the case of coincident lines.
- **Perpendicular lines** meet to form four right angles.
- **Distance** is the amount of space between two points, measured in linear units, along a given path. Distance is one-dimensional (1D).

- Distance is always a *positive* quantity.
- The **absolute value** of a number is its *distance* from zero (0).
- Because the absolute value is a distance, it is always a positive number or zero, and is *never* negative.
- The *sum of the angles* of a triangle is 180° .