Física General

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Semana 1:

Conceptos Fundamentales

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Universidad Antonio Nariño

Ecuaciones, formulas,… ¿son lo mismo?

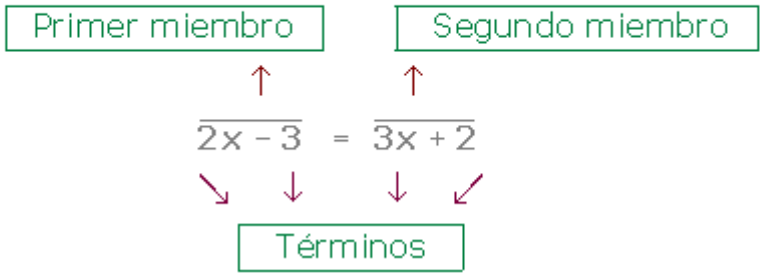
Tipos de ecuaciones

Ecuación

Una ecuación es una igualdad que se cumple para algunos valores de las letras.

$x + 1 = 2$ $\qquad$ $x = 1$

- Los **miembros** de una ecuación son **cada una de las expresiones que aparecen a ambos lados del signo igual.**
- Los **términos son los sumandos que forman los miembros.**



Tipos de ecuaciones

- $X + 8 = 12$

$X = 12 - 8$

$X = 4$

- $4x+9=12x$

- $2x^2 - 34 = 6$
- $12x^2 + 8x = 19$

$$ax^2 + bx + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Fórmulas y variables

Podemos definir una fórmula como un conjunto de caracteres (variables) cuyos símbolos obedecen a un lenguaje formal, tal que la expresión tiene sentido y admite una interpretación respecto al comportamiento de las variables involucradas.

$$P = \frac{W}{t}$$

Fórmulas y variables

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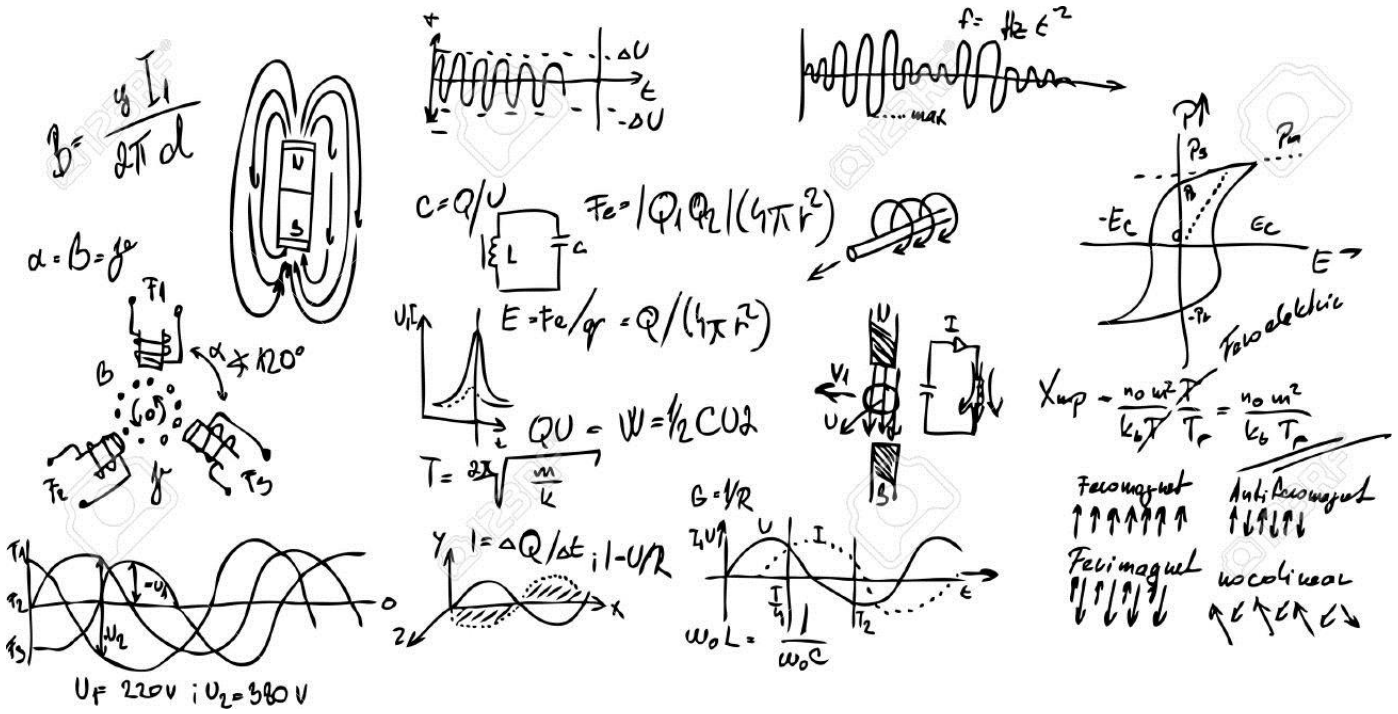


Fórmulas y variables

Expressing relations by formulas

1. How many days (d) are there in w weeks? (answer: d=7w)
2. How many hours (h) are there in d days?
3. How many cents (c) are d dollars?
4. How many dollars (d) are c cents?
5. How many ounces (O) are p pounds?
6. How many cents (c) are d dimes and q quarters?
7. How many days (d) are w weeks and m months?
8. How many yards (y) are f feet and i inches?
9. What is the average score (S) of a student who got x points in the first test, 75 in the second, y in the third, and 98 in the fourth?
10. How many feet (F) have c cows, p pigs, and d ducks?

Fórmulas y variables

Manipulating formulas

39. Given $S = v \cdot t$, solve for t; solve for v.

40. Given $S = \frac{1}{2} a t^2$, solve for a; solve for t.

41. Given $S = v_0 + \frac{1}{2} a t^2$, solve for a; solve for v_0.

42. Given $E = mc^2$, solve for m.

43. Given $H = \frac{kA(t_2 - t_1)}{L}$, solve for k; solve for t_2.

44. Given $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$, solve for V_1; solve for T_2.

45. Given $f_1 = \frac{1}{2L}\sqrt{\frac{S}{\mu}}$, solve for S; solve for μ.

46. Given $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$, solve for R.

Fórmulas y variables

Understanding formulas

In the following formulas, you can figure out relationships between variables, even though you may not know (yet) the meaning of these variables.

59. The voltage across a resistor V is given by the formula $V = I \cdot R$, where I is the current through the resistor, and R is the resistance of the resistor.
True or False?
The voltage is proportional to the current.
The voltage is inversely proportional to the resistance.

Fórmulas y variables

Understanding formulas

In the following formulas, you can figure out relationships between variables, even though you may not know (yet) the meaning of these variables.

60. The heat flow Q through a wall is given by the formula: $Q = \frac{k \cdot A \cdot T \cdot t}{d}$, where k is the heat conductivity constant of the wall, A is the area of the wall, T is the temperature difference across the wall, t is the duration of the heat flow, and d is the thickness of the wall.

True or False?
The heat flow is proportional to the area of the wall.
The heat flow is inversely proportional to the duration of the heat flow.
The heat flow is inversely proportional to the thickness of the wall.
The heat flow is inversely proportional to d/k.

Fórmulas y variables

Understanding formulas

In the following formulas, you can figure out relationships between variables, even though you may not know (yet) the meaning of these variables.

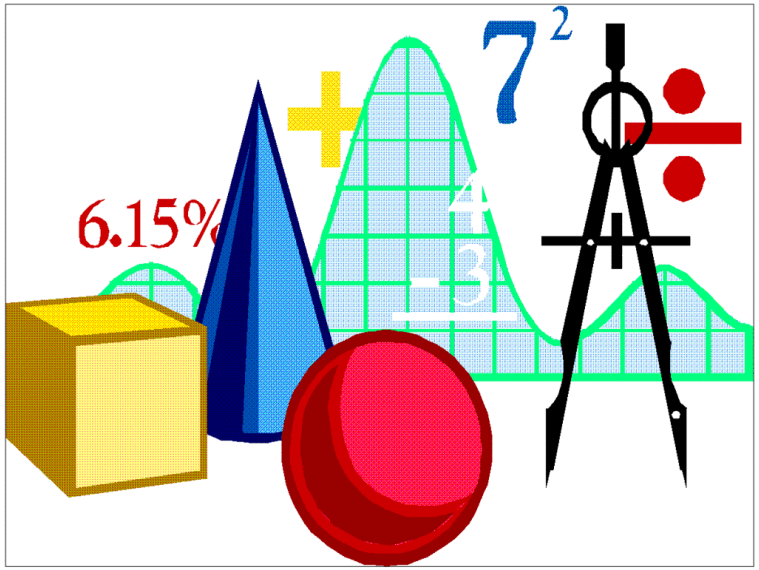
61. The distance S covered by a car accelerating from rest in time t is given by $S = 0.5 \cdot a \cdot t^2$, where a is the acceleration of the car. If the time is tripled, what would be the relative change in the distance covered by that car?

62. The electric potential V created at a distance of r from a point source is given by $V = \frac{C}{r}$, and the electric field E is given by $E = \frac{C}{r^2}$, where C is a constant that depends on the source. What would be the relative change in V and in E if the distance r is quadrupled?

Conceptos geométricos

La Geometría estudia las formas de los objetos y sus propiedades. Podemos clasificarla en:

- Geometría Plana (Líneas, rectas, círculos, triángulos, ...)
- Geometría Sólida (cubos, pirámides, ...)

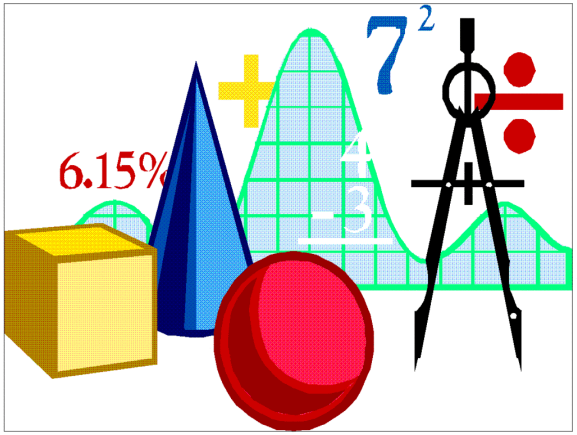


Euclides
(325 a.C.-265 a.C.)

Conceptos geométricos

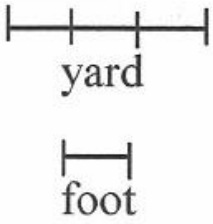
Some geometric objects have formulas for their sizes:

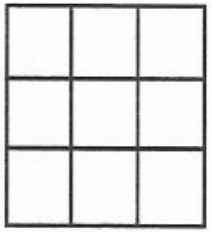
The circumference (length) of a polygon is the sum of the lengths of its sides.
The circumference L of a circle of radius r is $L=2\pi r$.
The area A of a rectangle of length a and width b is $A=a \cdot b$.
The area A of a triangle of base a and height h is $A=1/2\ a \cdot h$
The area A of a circle of radius r is $A=\pi r^2$.
The area A of the surface of a sphere of radius r is $A=4\pi r^2$.
The volume V of a prism or a cylinder of base area B and height h is $V= B \cdot h$
The volume V of a sphere of radius r is $V=4/3\pi r^3$.



Conceptos geométricos

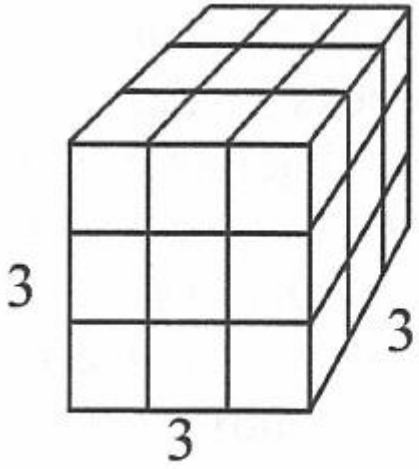
1 yard= 3 feet.
1m=100cm=3.28ft=39.4in
1ft=30.5cm=12in
1mi=1.61km=5280ft
It should be remembered that these conversion-relations are only for length.





square yard

square foot



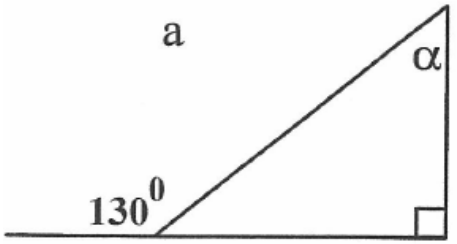
cubic yard

cubic foot

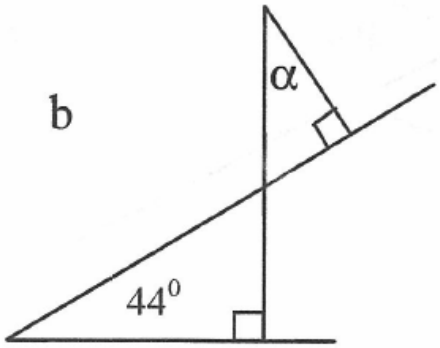
Conceptos geométricos

3. Find the size of the angle α in each of the drawings.  indicates right angle.

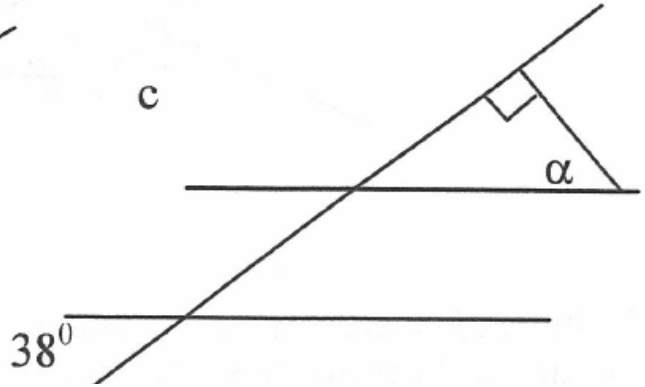
a



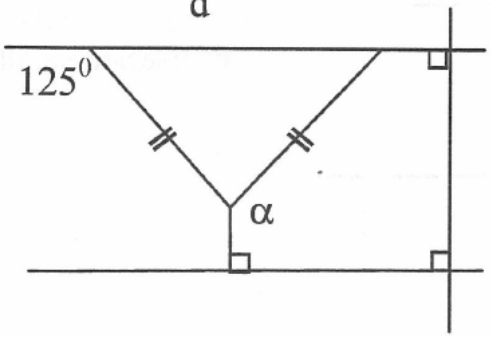
b



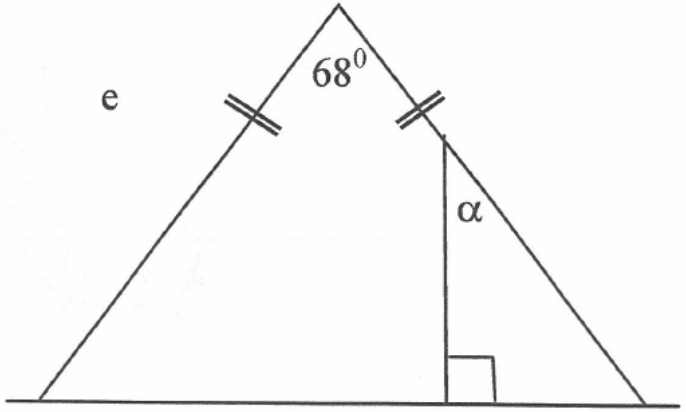
c



d

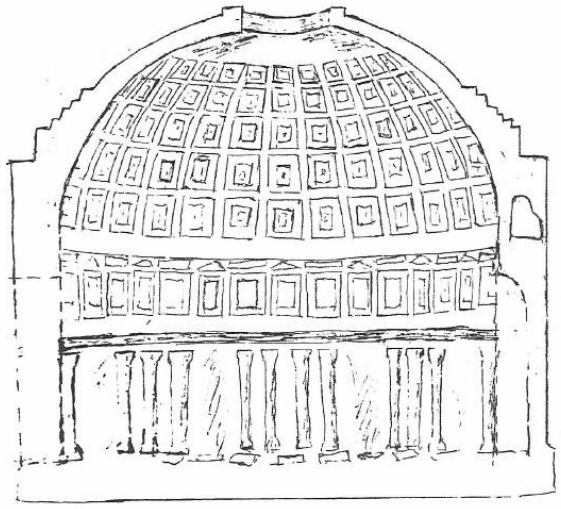


e

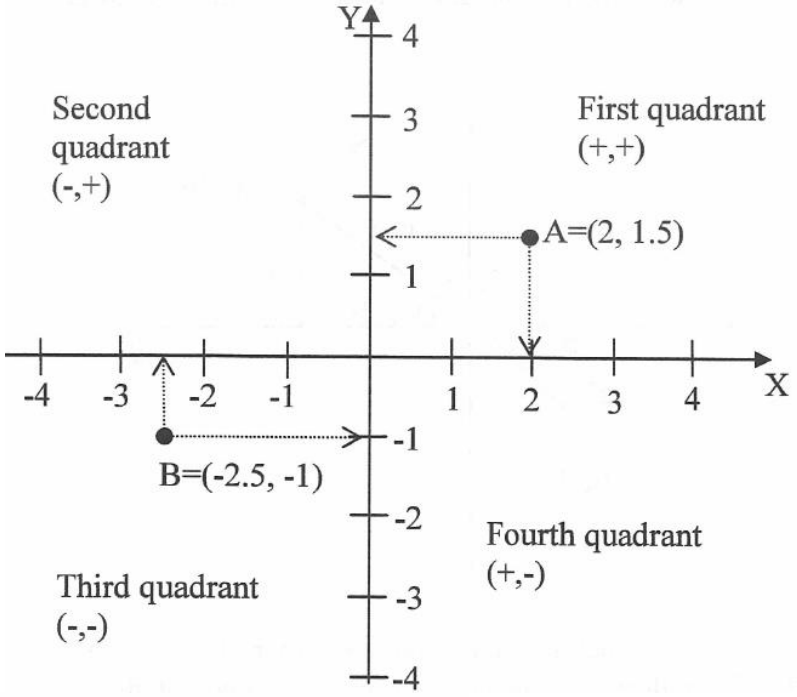


Conceptos geométricos

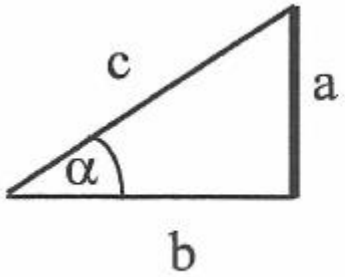
4. A semispherical dome tops the cylindrical main room of the Pantheon in Rome. The apex of the dome is 43 m above the floor, and its internal diameter is also 43 m. Built in 118-128 AD by the emperor Hadrian, the concrete dome has at its center a circular opening (oculus) of a diameter 8.7 m, through which light enters the room and moves around it, as the sun and the moon traverse the sky.
What is the area of the oculus?
What is the surface area of the inside of the dome (assume a smooth, complete semi-sphere)? What is the area of the internal walls? (Assume a complete, smooth cylinder)
What is the volume enclosed by the dome and its supporting cylinder?



Conceptos Trigonométricos



Relaciones Trigonométricas:



$$\sin(\alpha) = \frac{a}{c} \qquad \cos(\alpha) = \frac{b}{c} \qquad \tan(\alpha) = \frac{a}{b}$$

$$a^2 + b^2 = c^2 \qquad c = \sqrt{a^2 + b^2}$$

Conceptos Trigonométricos

2. One of the angles in a right triangle is of 36^0. Using a calculator, find the ratio between (a) the side opposite this angle and the hypotenuse; (b) the side adjacent to the angle and the hypotenuse; (c) the side opposite the angle and the side adjacent to the angle.

3. The hypotenuse in a right triangle is 7.5 m long, and the side adjacent to one angle is 4.5 m. (a) Find the length of the other side. (b) Find the sinus of the angle between the hypotenuse and the 4.5m side.