Math Enrichment - use Mathematica first

Open - get a window entitled "Untitled-1"

5+3 → typewriter enter → nothing → "chalkboard"

Shift-Enter: In[1]= 5+3
Out[1]= 8

Bring cursor back to 3 → with mouse change to 5 → rehit "Shift-Enter,"

now In[2]= 5+5
Out[2]= 10

Mathematica is not necessarily a "decimal" calculator... go to top, type

1/2 +1/3 , S-E.

In[3]= 1/2 +1/3

Out[3]= 5/6

Want a decimal number?

Method #1: put a decimal point onto at least one number

1./2 +1/3 , S-E

In[4]= 1./2 +1/3

Out[4]= 0.833333

Method #2 : use the N[] function

note : [] are used to contain the arguments of a function.

Functions' Names are case sensitive... usually begin with capital letter, followed by lower case,

N[] is a one-letter function that gives you the Numerical value of an expression

N[1/2 + 1/3] S-E
In[5] = N[1/2 + 1/3]
Out[5] = 0.833333

N[] actually can accept a second argument, the number of digits

N[1/2 + 1/3, 2] S-E
In[6] = N[1/2 + 1/3]
Out[6] = 0.83
N[1/2 + 1/3, 20] S-E
In[7] = N[1/2 + 1/3, 20]
Out[7] = 0.83333333333333333333

Special Numbers in Mathematica

Pi S-E
In[8] = Pi Out[8] = π

N [Pi] S-E
In [9] = N [Pi]
Out [9] = 3.14159

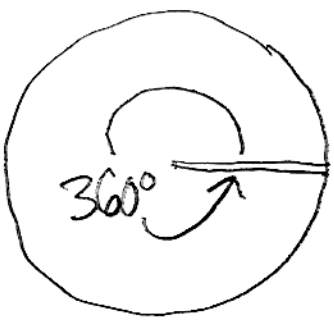
N [Pi, 10] S-E
In [10] = N [Pi, 10]
Out [10] = 3.141592654

Two other numbers :: E, I (= $\sqrt{-1}$).

Entering numbers: multiplication, exponential
division

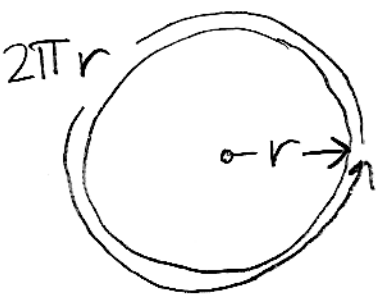
13 * 15 → 195 195/13 → 15
1.5 * 10^4 → 15000.
3^6 → 729
Pi^3 → π^3
Pi^3. → 31.0063

Radians : 360° in one rotation
360 = 6·5·4·3, ≃ days in year



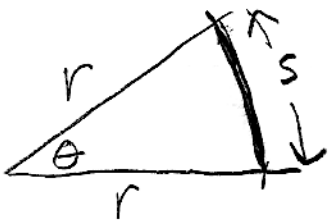
Alternate measure: Radians

360° = 2·π Radians



Perimeter / Radius = # radians = 2π

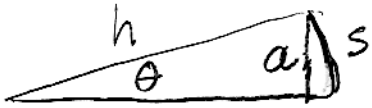
Smaller Angles:



in radians,

$$\theta = \frac{\text{arc length } s}{\text{radius } r}$$

note for θ very small...



in radians only.

$$\theta = \frac{s}{h} \simeq \frac{a}{h} = \sin\theta$$

Or, just a conversion....

N [360 Degree] → 6.28319 ≅ 2π Radians (units.)

N [57.3 Degree] → 1.00007 Radians

Trig Functions: argument in radians

Sin [Pi/4] → 1/√2

Cos [Pi/4] = 1/√2

want decimal number?

N [%]

Try Sin [π/5]

Sin [x] then x=5, x=5.

? Sin and click on more

Lists → {}

x = {1, 2, 3}

x^2, x^3 C-E

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make a simple plot of pairs of points

ListPlot [{{1, 2}, {2, 4}, {3, 7}}]

tiny points . . .

SetOptions [ListPlot, Prolog → PointSize [0.05]]

(go back & forth)

TextStyle → {FontSize → 14}

Can adjust

Plot [Sin [x], {x, 0, 7}]

SetOptions

AxesStyle → {Thickness [0.03], RGBColor [0.5, 0.5, 0.5]}

Homework → parametric plot

ParametricPlot [{(t/(2π)) · Cos (2 · Pi · t), -(t/(2π)) Sin (2 · Pi · t)}, {t, 0, 3}]

Derivatives

$x = \{1, 2, 3\}$

?x

Close window, open .. still there. It. is!

Clear[x]
Remove[x]
Remove["Global`*"]
} reset.

D[x^2, x] → 2x

try Sin[$\sqrt{5+x^2}$]