Sage Instructable

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```
# An example Sage Worksheet for Instructables see:

# A line with a "#" at the beginning is a comment, this line is a comment.
# The next line is probably the easiest way to get a total.
# remember to see the result of the cell you need to evaluate it. This cell evaluates to 1

# blank lines do nothing.  Next line prints 1
1
```

```
1
```

```
# The next line is probably the easiest or at least quickest way to get a total.

5 + 7 + 22 +33.6 + 99
```

```
166.600000000000
```

```
# This is a slightly more indirect way of getting the total
# I like it better because the total is also stored in "mytotal"

mytotal = 5 + 7 + 22 +33.6 + 99
# the line above does not print, to see the answer type the next line
mytotal
```

```
166.600000000000
```

```
# The expression on the last line is always printed, to print with a line anywhere in the cell use
# the word print.  The next two lines show this.
# in this sheet, normally print only at the end of a cell, but in my other work I usually print a lot.

mytotal = 5 + 7 + 22 +33.6 + 99
print mytotal
```

```
166.600000000000
```

```
# Lets compute a fraction ( or a division problem ) where both the numerator and denominator are sums.
# first I will do it the super short way

( 5 + 7 + 22 +33.6 + 99 ) / ( 99.3 + 287 )
```

```
0.431271032876003
```

```
# Same problem as above, but doing it in a more complicated way
# which I like better, but take your choice
# the comments are unnecessary I put them in for you

num = 5 + 7 + 22 +33.6 + 99   # the numerator
denom = 99.3 + 287                  # the denomerator
fract = num/denom        # the fraction
```

```
0.431271032876003
```

```
# Lets add some fractions  -- this can give some cool
# but perhaps some unexpected results:

mytotal   = ( 1/2 )  + ( 1/3 )   # use () to make sure that the math is done in the order you expect
print mytotal  # see next cell for comment
```

5/6

```
# Sage knows a lot of math, including how to find the common denomanator and
# add fractions as fractions, very nice if that is what you want. But you may
# just want a number.  For this use the function n() like below

mytotal   = ( 1/2 )  + ( 1/3 )   # actually we do not have to do this because mytotal from the cell
above is still around
print n( mytotal )  # n() make is a ( decimal ) number -- because n() is a useful function do not use
```

```
0.833333333333333
```

```
# I will not do a lot of calculations in this cell, but will tell you some of the operations you can
use in sage.
# there are lots more

# Common Math Operators and Grouping

# operation       Sage                        Example
# addition         +                          a     = 7 + 3
# subtraction      -                          f     = 7 - 3
# multiplication   *                          area  = length * width  # you need the * "length width"
is not multiplication
# division         /                          q     = 7 / 3
# powers           ^                          a     = 3.14159 * r ^ 2
```

```
# Powers can be cool, lets us the area of a circle  a = pi * ( r ^ 2 )
# lets take r = 93.337
a =  pi * ( 93.337 ^ 2 )
print n( a )

# couple of thinks to note:  Sage knows pi ( it also knows e )
#                            since pi's digits go on forever it leaves pi in the answer unless you
```

```
27368.9129591465
```

```
# Continuing with powers, if you solve the equation for the radius given the are you get
# r = the square root of ( a/pi )
# there are several ways to do the square root but a cool one is to note that the square root
# is the 1/2 or .5 power.  Lets take the area as one close to the cell above, we should get
# a radius close to the one above
r = ( 27000 / pi ) ^ .5
print n( r )
```

```
92.7058084855655
```

```
# Need functions? Sage is Trancendental
# well at least Sage has Trancendental functions.  If you are ready for them
# not much explanation is necessary ( except that angles are in radians not degrees )
#   sin( x )
#   cos( x )
#   tan( x ) ....
#   atan( x ) .....
#   log( x )
#   ln( x )

# and hundreds ( thousands ) more

# here is a nasty calculation done quickly

22. * sin( .22 ) * ( cos( .1 ) ^ 3 )
```

evaluate

```
4.72945480587161
```

```
# There are many more calculations you can do, you should know enough to pull them off now
# Sage can do so much more:
#     calculations with 100s of digits,
#     equations,
#     vectors,
#     matrices,
#     limits,
#     integerals ( calculus ),
#     derivaritives ( calculus ),
#     complex numbers

# Understand all of Sage is a big topic, but just the ability to do simple calculations like this
makes it really useful and is not very hard.

# Here is one more thing just as a tease.  We will plot the area of a circle vs its radius
# it is just a bit harder than the above cells.  I will not explain it much, you can look it up ( the
Sage site or googel SageMath plot )

var( "r" )                  # this odd statement makes r a variable
a = pi * ( r ^ 2 )          # formula for area
```