Experiment No. 1: SageMath as Calculator

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Section: D_1
Roll Number: 13
Date: January 10, 2024

Aim: Use of SageMath as a Calculator

[1]:
```
# Name: Annalhq Shaikh
# Batch: D1
# Roll No: 13
# Experiment No: 1
```

1 Basics

[2]:
```
24+177
```

[2]: 201

[3]:
```
5556*785
```

[3]: 4361460

[4]:
```
2445/565656
```

[4]: 815/188552

[5]:
```
25.0/6
```

[5]: 4.16666666666667

[6]:
```
25/6.0
```

[6]: 4.16666666666667

[7]:
```
25.0/6.0
```

[7]: 4.16666666666667

[8]:
```
2445/314159.n(digits=7)
```

[8]: 0.007782683

[9]:
```
(4546+95)-8989*56/8
```

[9]: -58282

[10]:
```
2^5
```

[10]: 32

[11]:
```
2**5
```

[11]: 32

[12]:
```
45//6
# gives quotient
```

[12]: 7

[13]:
```
csc(1.0)
```

[13]: 1.18839510577812

[14]:
```
show(sin(pi/6))
```

$\frac{1}{2}$

[15]:
```
print(cot(pi/4))
```

1

[16]:
```
show(atan(1.0))
```

0.785398163397448

[17]:
```
show(atan(1))
```

$\frac{1}{4}\,\pi$

[42]:
```
plot?
# gives library documentation
```

[44]:
```
S=factorial(8)
```

[20]:
```
S
```

[20]: 40320

[21]:
```
S.ndigits() # .ndigits gives number of digits present
```

[21]: 5

[22]:
```
S.digits() # .digits() gives list of all digits of S
```

[22]: [0, 2, 3, 0, 4]

[23]:
```
P=S.digits()
P
```

[23]: [0, 2, 3, 0, 4]

[24]:
```
P[1]
```

[24]: 2

[25]:
```
P[3]
```

[25]: 0

[26]:
```
P[0]
```

[26]: 0

[27]:
```
P[4]
```

[27]: 4

[28]:
```
gcd(15,45)
```

[28]: 15

[29]:
```
lcm(15,16)
```

[29]: 240

[30]:
```
log(4.0)
```

[30]: 1.38629436111989

[31]:
```
ln(4.0)
```

[31]: 1.38629436111989

[32]:
```
log(4.0,10)
```

[32]: 0.602059991327962

[33]:
```
exp(0)
```

[33]: 1

[34]:
```
exp(-infinity)
```

[34]: 0

[45]:
```
exp(3).n()
```

[45]: 20.0855369231877

[46]:
```
exp(sin(pi/4)).n()
```

[46]: 2.02811498164747

[47]:
```
show(exp(sin(pi/4)))
```

$e^{\left(\frac{1}{2}\sqrt{2}\right)}$

[48]:
```
a=24
b=47
c=13
```

[49]:
```
a.is_prime()
```

[49]: False

[50]:
```
b.is_prime()
```

[50]: True

[51]:
```
c.is_prime()
```

[51]: True

[52]:
```
is_prime(97)
```

[52]: True

[53]:
```
a.divisors()
```

[53]: [1, 2, 3, 4, 6, 8, 12, 24]

[54]:
```
next_prime(113)
```

[54]: 127

[55]:
```
is_prime(1173)
```

[55]:
```
False
```

2 Defining functions

[56]:
```
var('x,y')
f(x,y) = exp(x) + 7*x*y - x*y + arctan(x)
print(f)
show(f)
```

```
(x, y) |--> 6*x*y + arctan(x) + e^x
```

$(x, y) \mapsto 6\,xy + \arctan\left(x\right) + e^{x}$

[57]:
```
show(f(4.0,17.0))
```

463.923967696812

[58]:
```
var('x,y')
f(x) = (sin(4*exp(2*x)) + sqrt(3*x*y)) / (x^2 + 2*x*y + arcsin(2))
print(f)
show(f)
```

```
x |--> (sqrt(3)*sqrt(x*y) + sin(4*e^(2*x)))/(x^2 + 2*x*y + arcsin(2))
```

$x \mapsto \frac{\sqrt{3}\sqrt{xy}+\sin\left(4\,e^{\left(2\,x\right)}\right)}{x^{2}+2\,xy+\arcsin\left(2\right)}$

[59]:
```
var('x,y')
f(x) = (3*log(4*x) + exp((x^2)/sqrt(y))) / ( cos(2*sqrt(x*y)) + log(sin(x)))
print(f)
show(f)
```

```
x |--> (e^(x^2/sqrt(y)) + 3*log(4*x))/(cos(2*sqrt(x*y)) + log(sin(x)))
```

$x \mapsto \frac{e^{\left(\frac{x^{2}}{\sqrt{y}}\right)}+3\,\log\left(4\,x\right)}{\cos\left(2\,\sqrt{xy}\right)+\log\left(\sin\left(x\right)\right)}$

[60]:
```
f(x) = sin(exp(x)) + 1/(1+exp(-x))
show(f(x))
```

$1\frac{}{e^{\left(-x\right)}+1+\sin\left(e^{x}\right)}$

[61]:
```
show(diff(f(x),x))
# this syntax is used for differentiation
```

$\cos\left(e^{x}\right)e^{x} + \frac{e^{\left(-x\right)}}{\left(e^{\left(-x\right)}+1\right)^{2}}$

[62]:
```
var('a,b,c')
def heron(a,b,c):
    s = (a + b + c)/2
```

```
    Area_of_triangle = sqrt(s*(s-a)*(s-b)*(s-c))
    return Area_of_triangle
```

[63]:
```
heron(24,25,15)
```

[63]:
```
16*sqrt(119)
```

[64]:
```
var('a,b,c')
def quad(a,b,c):
    x1 = (-b + sqrt(b^2 - 4*a*c))/2*a
    x2 = (-b - sqrt(b^2 - 4*a*c))/2*a
    return(x1, x2)
```

[65]:
```
show(quad(1,4,2))
```

$$\left(\sqrt{2}-2, -\sqrt{2}-2\right)$$

[66]:
```
show(quad(24,4,17))
```

$$\left(48\sqrt{-101}-48, -48\sqrt{-101}-48\right)$$

[67]:
```
quad(24,4,17)
```

[67]:
```
(48*sqrt(-101) - 48, -48*sqrt(-101) - 48)
```