1st Year Calculus (Mr. P Solver)

Video Link: https://youtu.be/-SdIZHPuW9o (https://youtu.be/-SdIZHPuW9o)

Codes: https://www.youtube.com/redirect?event=video_description&redir_token=QUFFLUhqblJLemdpVHBkWXhTaHlyZzB3WFZSOG9fZTExUXxBC SdIZHPuW9o (https://www.youtube.com/redirect?event=video_description&redir_token=QUFFLUhqblJLemdpVHBkWXhTaHlyZzB3WFZSOG9fZTExUXxBC SdIZHPuW9o)

In [1]:
```
import sympy as smp
from sympy import *
```

In [2]:
```
x, y, z, m, n = smp.symbols('x y z m n')
```

Limits

Right hand limit,

$$\lim_{x\to 0^+} \frac{2e^{1/x}}{e^{1/x}+1}$$

In [3]:
```
f1r = 2*smp.exp(1/x)/(smp.exp(1/x)+1)
smp.limit(f1r, x, 0, dir='+')
```

Out[3]: 2

Left hand limit,

$$\lim_{x\to 0^-} \frac{2e^{1/x}}{e^{1/x}+1}$$

In [4]:
```
f1l = 2*smp.exp(1/x)/(smp.exp(1/x)+1)
smp.limit(f1l, x, 0, dir='-')
```

Out[4]: 0

$$\lim_{x\to \infty} \frac{\cos(x)-1}{x}$$

In [5]:
```
f1 = (smp.cos(x)-1)/x
# smp.limit(f1, x, smp.oo)
f1.limit(x,smp.oo)
```

Out[5]: 0

Derivatives

$$\frac{d}{dx}(\log_5(x))^{x/2}$$

In [6]:
```
f = smp.log(x,5)**(x/2)
#smp.diff(f,x)
f.diff(x)
```

Out[6]:

$$\left(\frac{\log(x)}{\log(5)}\right)^{\frac{x}{2}}\left(\frac{\log\left(\frac{\log(x)}{\log(5)}\right)}{2}+\frac{1}{2\log(x)}\right)$$

Integrations

$$\int 4\sec(3x)\tan(3x)dx$$

In [7]:
```
f = 4*smp.sec(3*x)*smp.tan(3*x)
smp.integrate(f)
```

Out[7]:

$$\frac{4}{3\cos(3x)}$$

$$\int\left(\frac{2}{\sqrt{1-x^2}}-\frac{1}{x^{1/4}}\right)dx$$

In [8]:
```
f = (2/smp.sqrt(1-x**2)) - 1/x**smp.Rational(1,4)
smp.integrate(f,x)
```

Out[8]:

$$-\frac{4x^{\frac{3}{4}}}{3}+2\operatorname{asin}(x)$$

$$\int\frac{(2x-1)\cos(\sqrt{3(2x-1)^2+6})}{\sqrt{3(2x-1)^2+6}}dx$$

In [9]:
```
f = ((2*x-1)*smp.cos(smp.sqrt(3*(2*x-1)**2+6)))/smp.sqrt(3*(2*x-1)**2+6)
smp.integrate(f,x)
```

Out[9]:

$$\frac{\sin\left(\sqrt{3(2x-1)^2+6}\right)}{6}$$

$$\int_0^{\infty}\frac{16\tan^{-1}(x)}{1+x^2}dx$$

In [10]:
```
f = 16*smp.atan(x)/(1+x**2)
smp.integrate(f, (x,0,smp.oo))
```

Out[10]:

$$2\pi^2$$

Initial Value Problems

Given, $\frac{dy}{dx}=8x+\csc^2(x)$ with the condition $y(\pi/2)=-7$. Solve for $y(x)$.

In [11]:
```
intg = smp.integrate(8*x + smp.csc(x)**2, x)
c = -intg.subs(x, smp.pi/2) -7  # evaluating constant
y = intg +c
y
```

Out[11]:
$$4x^2 - \pi^2 - 7 - \frac{\cos(x)}{\sin(x)}$$

Sequence and Series

$$\sum_{n=0}^{\infty} \frac{6}{4^n}$$

In [12]:
```
an = 6/4**n
smp.Sum(an, (n,0,smp.oo)).doit()
```

Out[12]:
$$8$$

$$\sum_{n=1}^{\infty} \frac{\tan^{-1}(n)}{n^{1.1}}$$

In [13]:
```
an = smp.atan(n)/n**1.1
smp.Sum(an, (n,1,smp.oo)).evalf()
```

Out[13]:
$$15.3028821020457$$

$$\sum_{n=1}^{\infty} \frac{1 + \cos(n)}{n^2}$$

In [14]:
```
an = (1 + smp.cos(n))/n**2
smp.Sum(an, (n,1,smp.oo)).n()
```

Out[14]:
$$1.969$$

In [ ]:
```

```