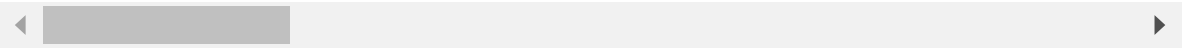


1st Year Calculus (Mr. P Solver)

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

Codes: [https://www.youtube.com/redirect?](https://www.youtube.com/redirect?event=video_description&redir_token=QUFFLUhqblJLemdpVHBkWXhTaHlyZzB3WFZSOG9fZTEsUXxBQjZlZHPuW9o)

[event=video_description&redir_token=QUFFLUhqblJLemdpVHBkWXhTaHlyZzB3WFZSOG9fZTEsUXxBQjZlZHPuW9o](https://www.youtube.com/redirect?event=video_description&redir_token=QUFFLUhqblJLemdpVHBkWXhTaHlyZzB3WFZSOG9fZTEsUXxBQjZlZHPuW9o) ([https://www.youtube.com/redirect?](https://www.youtube.com/redirect?event=video_description&redir_token=QUFFLUhqblJLemdpVHBkWXhTaHlyZzB3WFZSOG9fZTEsUXxBQjZlZHPuW9o)



```
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,

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

```
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,

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

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

Out[4]: 0

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

```
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]:
$$-\frac{4x^{\frac{3}{4}}}{3} + 2 \arcsin(x)$$

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

```
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]:
$$\frac{\sin(\sqrt{3(2x-1)^2+6})}{6}$$

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

```
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 []: