# Calculus, 2019-1-MM-2

Name:
Sequence Number:

**1° °).** Evaluate the following Integrations: (total 100%, each 10% ($\times 10 \times 10$))

a° °). $\int_0^1 (x^3 - 3x^2 + 3)dx \int_0^1 (x^3 - 3x^2 + 3)dx$

b° °). $\int_0^{\pi/2} \sin x \cos^2 x dx \int_0^{\pi/2} \sin x \cos^2 x dx$

c° °). $\int_0^{\pi/2} \cos^2 x dx \int_0^{\pi/2} \cos^2 x dx$

d° °). $\int_0^2 \frac{1}{4+x^2} dx \int_0^2 \frac{1}{4+x^2} dx$

e° °). $\int_0^1 e^x \cos 2x dx \int_0^1 e^x \cos 2x dx$

f° °). $\int_0^{\pi/2} \sin \frac{x}{2} dx \int_0^{\pi/2} \sin \frac{x}{2} dx$

g° °). $\int_0^1 \sqrt{1 - x^2} dx \int_0^1 \sqrt{1 - x^2} dx$

h° °). $\int_{-1}^0 \frac{1}{x^2+2x+2} dx \int_{-1}^0 \frac{1}{x^2+2x+2} dx$

i° °). $\int_{-\pi/2}^{\pi/2} \sin 2x \cos x dx \int_{-\pi/2}^{\pi/2} \sin 2x \cos x dx$

j° °). $\int_1^2 \frac{1+x}{x+x^2} dx \int_1^2 \frac{1+x}{x+x^2} dx$

**2° °).** (total 10%) Describe what the Fundamental Theorem of Calculus is and evaluate the derivative

$$\frac{d}{dx}\int_0^x te^{-t}dt$$

$$\frac{d}{dx}\int_0^x te^{-t}dt$$

# 1 Answer

In [2]:

```
from sympy import *
```

In [3]:

```
x,t,u,C =symbols("x t u C")
from sympy import exp,sin,cos,tan,pi
from mpmath import e
```

In [4]:

```
def Int(f,*args):
    if(len(args)!=0):
        a=args[0]
        b=args[1]
        print("                          ",b)
        print("The definite integral of  ∫ %s dx
        print("                          ",a)
        pprint(integrate(f,(x,a,b)))
    else:
        print("The indefinite integral of  ∫ %s
        pprint(integrate(f,x)+C)
```

In [5]:

```
#1.a)
Int(x**3-3*x**2+2,0, 1)
```

```
                           1
The definite integral of  ∫ x**3 - 3*x*
*2 + 2 dx is
                           0
5/4
```

In [6]:

```
#1.b)
Int((sin(x))*cos(x)**2,0,pi/2)
```

```
                           pi/2
The definite integral of  ∫ sin(x)*cos(
x)**2 dx is
                           0
1/3
```

In [7]:

```
# 1. c)
Int(cos(x)**2,0,pi/2)
```

```
                           pi/2
The definite integral of  ∫ cos(x)**2 d
x is
                           0
π
─
4
```

In [8]:

```
#1.d)
Int(1/(4+x**2),0,2)
```

```
                           2
The definite integral of  ∫ 1/(x**2 + 4
) dx is
                           0
π
─
8
```

In [9]:

```
#1. e)
Int(exp(x)*cos(2*x),0,1)
```

```
                           1
The definite integral of  ∫ exp(x)*cos(
2*x) dx is
                           0
```

$$\frac{e\cdot\cos(2)}{5} - \frac{1}{5} + \frac{2\cdot e\cdot\sin(2)}{5}$$

In [10]:

```
#1. f)
Int(sin(x/2),0,pi/2)
```

```
                           pi/2
The definite integral of  ∫ sin(x/2) dx
is
                           0
```

$$2 - \sqrt{2}$$

In [11]:

```
#1. g)
Int(sqrt(1-x**2),0,1)
```

```
                           1
The definite integral of  ∫ sqrt(1 - x*
*2) dx is
                           0
```

$$\frac{\pi}{4}$$

In [12]:

```
#1. h)
Int(1/(x**2+2*x+2),-1,0)
```

```
                           0
The definite integral of  ∫ 1/(x**2 + 2
*x + 2) dx is
                           -1
π
─
4
```

In [13]:

```
#1. i
Int(sin(2*x)*cos(x),-pi/2,pi/2)
```

```
                           pi/2
The definite integral of  ∫ sin(2*x)*co
s(x) dx is
                           -pi/2
0
```

In [14]:

```
#1. j
Int((1+x)/(x+x**2),1,2)
```

```
                           2
The definite integral of  ∫ (x + 1)/(x*
*2 + x) dx is
                           1
log(2)
```

In [ ]:

```

```

In [17]:

```
#2.

simplify(diff(integrate(t*exp(-t),(t,0,x)),x))
```

Out[17]:

$xe^{-x}xe^{-x}$

In [ ]:

```

```

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b°). $\int_0^{\pi/2} \sin x \cos^2 x dx$

c°). $\int_0^{\pi/2} \cos^2 x dx$

d°). $\int_0^2 \frac{1}{4+x^2} dx$

e°). $\int_0^1 e^x \cos 2x dx$

f°). $\int_0^{\pi/2} \sin\frac{x}{2} dx$

g°). $\int_0^1 \sqrt{1 - x^2} dx$

h°). $\int_{-1}^0 \frac{1}{x^2+2x+2} dx$

i°). $\int_{-\pi/2}^{\pi/2} \sin 2x \cos x dx$

j°). $\int_1^2 \frac{1+x}{x+x^2} dx$

**2°).** (total 10%) Describe what the Fundamental Theorem of Calculus is and evaluate the derivative

$$\frac{d}{dx}\int_0^x te^{-t}dt$$

## Answer

In [2]:

```
```

In [3]:

```
```

In [4]:

```
```

In [5]:

```
                            1
The definite integral of  ∫ x**3 - 3*x**2 + 2 dx is
                            0
5/4
```

In [6]:

```
                            pi/2
The definite integral of  ∫ sin(x)*cos(x)**2 dx is
                            0
1/3
```

In [7]:

```
                          pi/2
The definite integral of  ∫ cos(x)**2 dx is
                          0
π
─
4
```

In [8]:

```
                          2
The definite integral of  ∫ 1/(x**2 + 4) dx is
                          0
π
─
8
```

In [9]:

The definite integral of $\int_0^1 \exp(x)*\cos(2*x)\,dx$ is

$$\frac{e\cdot\cos(2)}{5} - \frac{1}{5} + \frac{2\cdot e\cdot\sin(2)}{5}$$

In [10]:

The definite integral of $\int_0^{pi/2} \sin(x/2)\,dx$ is

$$2 - \sqrt{2}$$

In [11]:

```
                                 1
The definite integral of  ⌠ sqrt(1 - x**2) dx is
                                 0
π
─
4
```

In [12]:

```
                                 0
The definite integral of  ⌠ 1/(x**2 + 2*x + 2) dx is
                                 -1
π
─
4
```

In [13]:

```
                           pi/2
The definite integral of  ∫ sin(2*x)*cos(x) dx is
                           -pi/2
0
```

In [14]:

```
                           2
The definite integral of  ∫ (x + 1)/(x**2 + x) dx is
                           1
log(2)
```

In [ ]:

```

```

In [17]:

```

```

Out[17]:

$$xe^{-x}$$

In [ ]:

```

```