CFerrari_Assignment13

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Write a program to compute the derivative of $f(x) = x^3 + 2x^2$ at any value of x. Your function should take in a value of x and return back an approximation to the derivative of f(x) evaluated at that value. You should not use the analytical form of the derivative to compute it. Instead, you should compute this approximation using limits.

```
derivativex32x2 <- function(limit, x){
  xprime <- x + limit
  deltay <- (xprime**3 + 2*(xprime**2)) - (x**3 + 2*(x**2))

  return(deltay/limit)

}

derivativex32x2(.00005, 3)
```

```
## [1] 39.00055
```

```
# The derivative is 3x^2 +4x, so:

3*(3**2) + 4*3
```

```
## [1] 39
```

```
# Checks out.
```

Now, write a program to compute the area under the curve for the function $3x^2 + 4x$ in the range x = [1, 3]. You should first split the range into many small intervals using some really small delta x value and then compute the approximation to the area under the curve

```
xlist <- seq(1, 3, by=1e-6)
ylist <- 3*(xlist**2) + 4*xlist

ylistAreas <- ylist*1e-6

sum(ylistAreas)
```

```
## [1] 42.00002
```

```
# Lets test

(3**3 + 2*(3**2)) - (1**3 + 2*(1**2))
```

```
## [1] 42
```

```
# Checks out
```

Please solve these problems analytically (i.e. by working out the math) and submit your answers.

$$\int sin(x)cos(x)dx$$

$$\int f(x)g'(x)dx = f(x)g(x) - \int f'(x)g(x)dx$$

$$\int sin(x)cos(x)dx = sin^2(x) - \int cos(x)sin(x)dx$$

$$\int sin(x)cos(x)dx = \frac{1}{2}sin^2(x)$$

$$\int x^2e^x dx$$

$$\int f(x)g'(x)dx = f(x)g(x) - \int f'(x)g(x)dx$$

$$\int x^2e^x dx = x^2e^x - \int 2xe^x dx$$

$$\int x^2e^x dx = x^2e^x - 2xe^x + \int 2e^x dx$$

$$\int x^2e^x dx = x^2e^x - 2xe^x + 2e^x$$

$$\frac{d}{dx}(xcos(x)) = cos(x) - xsin(x)$$

$$\frac{d}{dx}(e^{x4})$$

Use the chain rule I also had to look up the order of operations for two powers… I'm assuming this is $e^{(x}4)$

$$\frac{d}{dx}(e^{x4}) = 4e^{x4}x^3$$