BHao_Assign13

```r
# derivative of f(x) = x^3 + 2x^2
# analytical solution = 3x^2 + 4x
deriv_func = function(x) {
  h = 1e-6
  up = (x + h)^3 + 2*(x + h)^2
  down = (x - h)^3 + 2*(x - h)^2
  return(slope = (up - down) / (2*h))
}

deriv_func(4)
```

```
## [1] 64
```

```r
# integral of f(x) = 3x^2 + 4x in the range [1,3] using intervals 1e-6
integ_func = function() {
  h = 1e-6
  area = 0
  for (x in seq(1, 3, h)) {
    area = area + h * (3*x^2 + 4*x)
  }
  return(area)
}

integ_func()
```

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

Problem 3

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

$$u = \sin(x)$$

$$du = \cos(x)dx$$

$$dx = du/cos(x)$$

$$\int u\cos(x)du/\cos(x)$$

$$\int u \ du$$

$$\frac{1}{2}u^2$$

$$\frac{1}{2}\sin^2(x)$$

Problem 4

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

$$u = x^2$$

$$du = 2x \ dx$$

$$v = e^x$$

$$dv = e^x dx$$

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

substitute again

$$x^2 e^x - 2(xe^x - e^x)$$

$$e^x(x^2 - 2x - 2)$$

Problem 5

$$\frac{d}{dx}(x \cos(x))$$

$$\cos(x) - x \sin(x)$$

###Problem 6

$$\frac{d}{dx} e^{x^4}$$

$$e^{x^4} \left(\frac{d}{dx} x^4 \right)$$

$$e^{x^4} 4x^3$$