data 605 hw 14

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ASSIGNMENT 14 - TAYLOR SERIES

This week, we'll work out some Taylor Series expansions of popular functions

$f(x) = \frac{1}{(1-x)}$

```
library(calculus)
myf=function(x) 1/(1-x)
taylor(myf, var=c(x=1), order=6)
```

```
## $f
## [1] "(NaN) * 1 + (NaN) * (x-1)^1 + (-Inf) * (x-1)^2 + (Inf) * (x-1)^3 + (Inf) * (x-1)^4 + (Inf) * (x
##
## $order
## [1] 6
##
## $terms
##       var coef degree
## 0       1  NaN      0
## 1 (x-1)^1  NaN      1
## 2 (x-1)^2 -Inf      2
## 3 (x-1)^3  Inf      3
## 4 (x-1)^4  Inf      4
## 5 (x-1)^5  Inf      5
## 6 (x-1)^6 -Inf      6
```

for this expression:

$f(x) = e^x$

```
myf=function(x) exp(x)
taylor(myf, var=c(x=1), order=6)
```

```
## $f
## [1] "(2.71828182845905) * 1 + (2.71828182841867) * (x-1)^1 + (1.35914091422767) * (x-1)^2 + (0.45304
##
## $order
## [1] 6
##
## $terms
##       var        coef degree
```

```
## 0       1 2.718281828      0
## 1 (x-1)^1 2.718281828      1
## 2 (x-1)^2 1.359140914      2
## 3 (x-1)^3 0.453046968      3
## 4 (x-1)^4 0.113261723      4
## 5 (x-1)^5 0.022652211      5
## 6 (x-1)^6 0.003775323      6
```

for the expression : $f(x) = ln(1 + x)$

```
myf=function(x) log1p(x)
taylor(myf, var=c(x=1), order=6)
```

```
## $f
## [1] "(0.693147180559945) * 1 + (0.499999999986567) * (x-1)^1 + (-0.124999999994923) * (x-1)^2 + (0.04
##
## $order
## [1] 6
##
## $terms
##       var         coef degree
## 0       1  0.693147181      0
## 1 (x-1)^1  0.500000000      1
## 2 (x-1)^2 -0.125000000      2
## 3 (x-1)^3  0.041666661      3
## 4 (x-1)^4 -0.015624854      4
## 5 (x-1)^5  0.006245848      5
## 6 (x-1)^6 -0.002594325      6
```

for the expression: $f(x) = x^{(1/2)}$

```
myf=function(x) x^(1/2)
taylor(myf, var=c(x=1), order=6)
```

```
## $f
## [1] "(1) * 1 + (0.499999999993442) * (x-1)^1 + (-0.125000000007528) * (x-1)^2 + (0.0624999125751056)
##
## $order
## [1] 6
##
## $terms
##       var        coef degree
## 0       1  1.00000000      0
## 1 (x-1)^1  0.50000000      1
## 2 (x-1)^2 -0.12500000      2
## 3 (x-1)^3  0.06249991      3
## 4 (x-1)^4 -0.03905852      4
## 5 (x-1)^5  0.02710740      5
## 6 (x-1)^6 -0.01923195      6
```