605-Wk14-Discussion

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26. $f(x) = e^{-x}$

```
for (n in 1:10) {
    sympy("var('p')")
    sympy("var('x')")
    equation <- paste("p=series(exp(-x), x, 0,", n, ")")
    xt <- sympy(equation)
    xt0 <- sympy("p.removeO()")

    x <- 1/4
    T1 <- eval(parse(text = xt0))
    T2 <- exp(-x)
    Difference <- (T1 - T2)
    cat("\nAt", n, " terms, The Taylor expansion is", xt0, ". \n Evaulating at ",
        x, ", the difference between the Taylor expansion and the built-in function is\n",
        Difference, "\n")
    rm(x)
}
```

```
##
## At 1  terms, The Taylor expansion is 1 .
##  Evaulating at  0.25 , the difference between the Taylor expansion and the built-in function is
##  0.2211992
##
## At 2  terms, The Taylor expansion is 1 - x .
##  Evaulating at  0.25 , the difference between the Taylor expansion and the built-in function is
##  -0.02880078
##
## At 3  terms, The Taylor expansion is 1 - x + x**2/2 .
##  Evaulating at  0.25 , the difference between the Taylor expansion and the built-in function is
##  0.002449217
##
## At 4  terms, The Taylor expansion is 1 - x + x**2/2 - x**3/6 .
##  Evaulating at  0.25 , the difference between the Taylor expansion and the built-in function is
##  -0.0001549497
##
## At 5  terms, The Taylor expansion is 1 - x + x**2/2 - x**3/6 + x**4/24 .
##  Evaulating at  0.25 , the difference between the Taylor expansion and the built-in function is
##  7.810679e-06
##
## At 6  terms, The Taylor expansion is 1 - x + x**2/2 - x**3/6 + x**4/24 - x**5/120 .
##  Evaulating at  0.25 , the difference between the Taylor expansion and the built-in function is
##  -3.273422e-07
##
```

```
## At 7  terms, The Taylor expansion is 1 - x + x**2/2 - x**3/6 + x**4/24 - x**5/120 + x**6/720 .
##  Evaulating at  0.25 , the difference between the Taylor expansion and the built-in function is
##  1.174196e-08
##
## At 8  terms, The Taylor expansion is 1 - x + x**2/2 - x**3/6 + x**4/24 - x**5/120 + x**6/720 - x**7/5
##  Evaulating at  0.25 , the difference between the Taylor expansion and the built-in function is
##  -3.681869e-10
##
## At 9  terms, The Taylor expansion is 1 - x + x**2/2 - x**3/6 + x**4/24 - x**5/120 + x**6/720 - x**7/5
##  Evaulating at  0.25 , the difference between the Taylor expansion and the built-in function is
##  1.025524e-11
##
## At 10  terms, The Taylor expansion is 1 - x + x**2/2 - x**3/6 + x**4/24 - x**5/120 + x**6/720 - x**7/
##  Evaulating at  0.25 , the difference between the Taylor expansion and the built-in function is
##  -2.570166e-13
```

29. $f(x) = e^x \sin x$ (only find the first 4 terms)

```
for (n in 1:4) {
    sympy("var('p')")
    sympy("var('x')")
    equation <- paste("p=series(exp(x)*sin(x), x, 0,", n, ")")
    xt <- sympy(equation)
    xt0 <- sympy("p.removeO()")

    x <- 1/4
    T1 <- eval(parse(text = xt0))
    T2 <- exp(x) * sin(x)
    Difference <- (T1 - T2)
    cat("\nAt", n, " terms, The Taylor expansion is", xt0, ". \n Evaulating at ",
        x, ", the difference between the Taylor expansion and the built-in function is\n",
        Difference, "\n")
    rm(x)
}
```

```
##
## At 1  terms, The Taylor expansion is 0 .
##  Evaulating at  0.25 , the difference between the Taylor expansion and the built-in function is
##  -0.317673
##
## At 2  terms, The Taylor expansion is x .
##  Evaulating at  0.25 , the difference between the Taylor expansion and the built-in function is
##  -0.06767297
##
## At 3  terms, The Taylor expansion is x + x**2 .
##  Evaulating at  0.25 , the difference between the Taylor expansion and the built-in function is
##  -0.005172972
##
## At 4  terms, The Taylor expansion is x + x**2 + x**3/3 .
##  Evaulating at  0.25 , the difference between the Taylor expansion and the built-in function is
##  3.536146e-05
```