PShaji_Assignment14

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$\int 4e^{-7x}dx$

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

$f(x) = 1/(1-x)$

$f(x) = e^x$

$f(x) = ln(1+x)$

For each function, only consider its valid ranges as indicated in the notes when you are computing the Taylor Series expansion. Please submit your assignment as a R-Markdown document.

Answer

1) $f(x) = 1/(1-x)$

$f(a) = 1/1-a, f(0) = 1$

$f^{'}(a) = 1/(1-a)^2, f^{'}(0) = 1$

$f^{''}(a) = 2/(1-a)^3, f^{''}(0) = 2$

$f^{'''}(a) = 6/(1-a)^3, f^{'''}(0) = 6$

$f^{''''}(a) = 24/(1-a)^5, f^{''''}(0) = 24$

Plug in the relevant expressions into formula for Taylor Series expansion:

$f(a) + f^{'}(a)(x-a) + f^{''}(x-a)/2! + f^{'''}(x-a)/3! + f^{''''}(x-a)/4!...$

$1 + 1x + 2x^2/2! + 6x^3/3! + 24x^4/4! + ...$

$1 + x + x^2 + x^3 + x^4 + x^5...$

$\sum_{n=0}^{\infty} x^n$

2) $f(x) = e^x$

$f(a) = e^a, f(0) = 1$

$f^{'}(a) = e^a, f^{'}(0) = 1$

$f^{''}(a) = e^a, f^{''}(0) = 1$

$f^{'''}(a) = e^a, f^{'''}(0) = 1$

$f^{''''}(a) = e^a, f^{''''}(0) = 1$

Plug in the relevant expressions into formula for Taylor Series expansion:

$f(a) + f'(a)(x-a) + f''(x-a)/2! + f'''(x-a)/3! + f^{''''}(x-a)/4! + ...$

$= 1 + x^2/2 + x^3/3 + x^4/4 + ...$

$= \sum_{n=0}^{\infty} x^n/n!$

3) $f(x) = ln(1+x)$

$f(a) = ln(1+a), = f(0) = 0$

$f'(a) = 1/1+a, = f'(0) = 1$

$f''(a) = -1/(1+a)^2, = f''(0) = -1$

$f'''(a) = 2/(1+a)^3, = f'''(0) = 2$

$f^{''''}(a) = -6/(1+a)^4, = f^{''''}(0) = -6$

Plug in the relevant expressions into formula for Taylor Series expansion:

$f(a) + f'(a)(x-a) + f''(x-a)/2! + f'''(x-a)/3! + f^{''''}(x-a)/4! + ...$

$= x - x^2/2 + x^3/3 - x^4/4 + ...$

$= \sum_{n=0}^{\infty}(-1)^{n+1}x^n/n!$