Math 122 - #27
Taylor and Maclaurin Series

Find the Taylor or Maclaurin Series for the following (write out the first 4 non-zero terms):

1. $f(x) = e^{2x}$ at $c = 1$

2. $f(x) = \cos x$ at $c = \frac{\pi}{2}$

3. $f(x) = e^{x^2}$ at $c = 0$

4. $f(x) = x \sin 2x$ at $c = 0$

5. $f(x) = e^x \sin x$ at $c = 0$

6. $f(x) = \ln\left[\frac{1+x}{1-x}\right]$ at $c = 0$

7. $f(x) = x \arctan x$ at $c = 0$

Answers

1. $e^{2x} = e^2 + 2e^2(x-1) + 2e^2(x-1)^2 + \frac{4}{3}e^2(x-1)^3 + \frac{2}{3}e^2(x-1)^4 + \ldots$

2. $\cos x = -\left(x - \frac{\pi}{2}\right) + \frac{1}{6}\left(x - \frac{\pi}{2}\right)^3 - \frac{1}{120}\left(x - \frac{\pi}{2}\right)^5 + \frac{\left(x - \frac{\pi}{2}\right)^7}{5040} + \ldots$

3. $e^{x^2} = 1 + x^2 + \frac{x^4}{2} + \frac{x^6}{3!} + \ldots$

4. $x \sin 2x = 2x^2 - \frac{8x^4}{3!} + \frac{32x^6}{5!} - \frac{128x^8}{7!} + \ldots$

5. $e^x \sin x = x + x^2 + \frac{x^3}{3} - \frac{x^5}{30} + \ldots$

6. $\ln\left[\frac{1+x}{1-x}\right] = 2x + \frac{2x^3}{3} + \frac{2x^5}{5} + \frac{2x^7}{7} + \ldots$

7. $x \arctan x = x^2 - \frac{x^4}{3} + \frac{x^6}{5} - \frac{x^8}{7} + \ldots$