

Taylor and Maclaurin Series – WKST 1

I. Write the first four nonzero terms of the Taylor series for $f(x)$ about $x=c$.

1. $f(x) = e^x, c = 1$

2. $f(x) = \cos x, c = \frac{\pi}{4}$

3. $f(x) = \frac{1}{x}, c = 1$

II. Write the first four nonzero terms and the general term of the Maclaurin series for $f(x)$.

4. $f(x) = e^{x/2}$

5. $f(x) = \ln(1+x)$

6. $f(x) = \sin 3x$

7. $f(x) = \cos x^{3/2}$

8. $f(x) = x \sin x$

ANSWERS

$$1. f(x) = e^x = e + e(x-1) + \frac{e(x-1)^2}{2!} + \frac{e(x-1)^3}{3!} + \dots$$

$$2. f(x) = \cos x = \frac{\sqrt{2}}{2} - \frac{\sqrt{2}(x-\pi/4)}{2} + \frac{\sqrt{2}(x-\pi/4)^2}{2 \cdot 2!} + \frac{\sqrt{2}(x-\pi/4)^3}{2 \cdot 3!} + \dots$$

$$3. f(x) = \frac{1}{x} = 1 - (x-1) + (x-1)^2 - (x-1)^3 + \dots$$

$$4. f(x) = e^{x/2} = 1 + \frac{x^2}{2} + \frac{x^4}{4 \cdot 2!} + \frac{x^6}{8 \cdot 3!} + \dots + \frac{x^{2n}}{2^n n!} + \dots$$

$$5. f(x) = \ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \dots + \frac{(-1)^n x^{n+1}}{n+1} + \dots$$

$$6. f(x) = \sin 3x = 3x - \frac{(3x)^3}{3!} + \frac{(3x)^5}{5!} - \frac{(3x)^7}{7!} + \dots + \frac{(-1)^n (3x)^{2n+1}}{(2n+1)!} + \dots$$

$$7. f(x) = \cos x^{3/2} = 1 - \frac{x^3}{2!} + \frac{x^6}{4!} - \frac{x^9}{6!} + \dots + \frac{(-1)^n x^3}{(2n)!} + \dots$$

$$8. f(x) = x \sin x = x^2 - \frac{x^4}{3!} + \frac{x^6}{5!} - \frac{x^8}{7!} + \dots + \frac{(-1)^n x^{2n+2}}{(2n+1)!} + \dots$$