ADVANCED HIGHER MATHEMATICS

MacLAURIN SERIES 1

$$f(x) = f(0) + f'(0)x + \frac{f''(0)}{2!}x^2 + \frac{f'''(0)}{3!}x^3 + \dots$$

Find the MacLaurin series for each function $f(x)$ up to and including the term in x^4:

1. $f(x) = e^x$ **2.** $f(x) = \sin x$ **3.** $f(x) = \ln(1+x)$

4. $f(x) = e^{3x}$ **5.** $f(x) = \cos x$ **6.** $f(x) = e^{-2x}$

7. $f(x) = (1+x)^{-1}$ **8.** $f(x) = (1+x)^{\frac{1}{2}}$ **9.** $f(x) = \sin 2x$

10. $f(x) = (1-x)^{-2}$ **11.** $f(x) = \cos 3x$ **12.** $f(x) = (1-2x)^{-1}$

13. $f(x) = \ln(1-2x)$ **14.** $f(x) = e^{\frac{1}{2}x}$ **15.** $f(x) = (1+x)^{\frac{1}{3}}$

16. $f(x) = (1-x)^3$ **17.** $f(x) = (1+x)^{\frac{3}{2}}$ **18.** $f(x) = (1-x)^{-\frac{1}{2}}$

19. $f(x) = \sqrt{1+2x}$ **20.** $f(x) = (1+x)^n$, where n is a constant

ANSWERS

1. $1 + x + \frac{1}{2}x^2 + \frac{1}{6}x^3 + \frac{1}{24}x^4 + \dots$ **2.** $x - \frac{1}{6}x^3 + \dots$

3. $x - \frac{1}{2}x^2 + \frac{1}{3}x^3 - \frac{1}{4}x^4 + \dots$ **4.** $1 + 3x + \frac{9}{2}x^2 + \frac{9}{2}x^3 + \frac{27}{8}x^4 + \dots$

5. $1 - \frac{1}{2}x^2 + \frac{1}{24}x^4 + \dots$ **6.** $1 - 2x + 2x^2 - \frac{4}{3}x^3 + \frac{2}{3}x^4 + \dots$

7. $1 - x + x^2 - x^3 + x^4 - \dots$ **8.** $1 + \frac{1}{2}x - \frac{1}{8}x^2 + \frac{1}{16}x^3 - \frac{5}{128}x^4 + \dots$

9. $2x - \frac{4}{3}x^3 + \dots$ **10.** $1 + 2x + 3x^2 + 4x^3 + 5x^4 + \dots$

11. $1 - \frac{9}{2}x^2 + \frac{27}{8}x^4 + \dots$ **12.** $1 + 2x + 4x^2 + 8x^3 + 16x^4 + \dots$

13. $-2x - 2x^2 - \frac{8}{3}x^3 - 4x^4 - \dots$ **14.** $1 + \frac{1}{2}x + \frac{1}{8}x^2 + \frac{1}{48}x^3 + \frac{1}{384}x^4 + \dots$

15. $1 + \frac{1}{3}x - \frac{1}{9}x^2 + \frac{5}{81}x^3 - \frac{10}{243}x^4 + \dots$ **16.** $1 + 3x + 6x^2 + 10x^3 + 15x^4 + \dots$

17. $1 + \frac{3}{2}x + \frac{3}{8}x^2 - \frac{1}{16}x^3 + \frac{3}{128}x^4 + \dots$ **18.** $1 + \frac{1}{2}x + \frac{3}{8}x^2 + \frac{5}{16}x^3 + \frac{35}{128}x^4 + \dots$

19. $1 + x - \frac{1}{2}x^2 + \frac{1}{2}x^3 - \frac{5}{8}x^4 + \dots$

20. $1 + nx + \frac{n(n-1)}{2}x^2 + \frac{n(n-1)(n-2)}{6}x^3 + \frac{n(n-1)(n-2)(n-3)}{24}x^4 + \dots$