

Answer on Question #75302 – Math / Other

Question:

calculate the third degree Taylor polynomial about $x_0=0$ for $f(x) = (1+x)^{1/2}$

Solution:

Third degree Taylor polynomial can be expressed in a form:

$$T_3 = f(x_0) + \frac{f'(x_0)}{1!}(x - x_0) + \frac{f''(x_0)}{2!}(x - x_0)^2 + \frac{f'''(x_0)}{3!}(x - x_0)^3$$

Let's find derivatives:

$$f(x = 0) = (1 + x)^{\frac{1}{2}} = 1$$

$$f'(x = 0) = \frac{1}{2}(1 + x)^{-\frac{1}{2}} = \frac{1}{2}$$

$$f''(x = 0) = -\frac{1}{4}(1 + x)^{-\frac{3}{2}} = -\frac{1}{4}$$

$$f'''(x = 0) = \frac{3}{8}(1 + x)^{-\frac{5}{2}} = \frac{3}{8}$$

Then we can write:

$$T_3 = 1 + \frac{1}{2}x - \frac{1}{8}x^2 + \frac{1}{16}x^3$$

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