

## Taylor and Maclaurin Series

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**Solutions should show all of your work, not just a single final answer.**

- For a function  $f(x)$ , define its Maclaurin series and also its Taylor polynomial at a number  $a$ .
- Why doesn't  $\sqrt{x}$  have a Maclaurin series?
  - Compute the terms up through degree 4 in the Taylor series of  $\sqrt{x}$  at 9. (Hint: Start by computing  $f'(x)$ ,  $f''(x)$ ,  $f'''(x)$ , and  $f^{(4)}(x)$  when  $f(x) = \sqrt{x}$ .)
- Use the formulas  $e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!}$  for all  $x$  and  $\arctan x = \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n+1}}{2n+1}$  for  $|x| < 1$  to find the Taylor series centered at 0 for the following functions. Specify the *radius* of convergence of each new series.
  - $f(x) = e^{3x}$
  - $f(x) = \arctan(x/3)$
- T/F (with justification)  
If  $f(x) = 1 + 3x - 2x^2 + 5x^3 + \dots$  for  $|x| < 1$  then  $f'''(0) = 30$ .