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# Linear Approximations and Differentials

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

1. (a) Find the linearization of the function  $f(x) = \sqrt{x}$  at 9.  
(b) Use the linear approximation obtained in part (a) (no other methods) to approximate  $\sqrt{9.2}$ . Your answer based on that linearization can be given either as an exact fraction or rounded to four digits after the decimal point.
  
2. (a) Find the linearization of the function  $f(x) = \frac{1}{1+x^2}$  at 7.  
(b) Use the linear approximation obtained in part (a) (no other methods) to approximate  $\frac{1}{37}$ . Round your answer to three digits after the decimal point.
  
3. The side length of a cube is measured to be  $x = 1.3$  feet, with an error of at most 1 inch.
  - (a) (No calculus) Determine the difference, in  $\text{ft}^3$ , between the volume of the cube computed with the measured side length and the volume computed with the largest (resp., smallest) value for the side length in the error range. Remember first to convert all lengths to feet! Round your final answers to three digits after the decimal point.
  - (b) Use differentials to estimate the error in calculating the volume of the cube using the measured value and error estimate for the side length of the cube. Round your final answer to three digits after the decimal point.