Show all work, including mental steps, in a clearly organized way that speaks for itself. Use proper mathematical notation, identifying expressions by their proper symbols (introducing them if necessary), and use arrows and equal signs when appropriate. Always simplify expressions. BOX final short answers. LABEL parts of problem. Keep answers EXACT (but give decimal approximations for interpretation). Indicate where technology is used and what type (Maple, GC).

1. \( f(x, y) = x \cdot y \).  
   a) Evaluate \( f_x(5, 4) \), \( f_y(5, 4) \), \( f(x, y)(5, 4) \).  
   b) Find the linear approximation \( L(x, y) \) to \( f \) at the point \((5, 4)\).  
   c) Use it to approximate \( f(4.97, 4.02) \).  
   d) Evaluate the fractional error \( E = \frac{L(4.97, 4.02) - f(4.97, 4.02)}{f(4.97, 4.02)} \) made in using this approximation.

2. The length and width of a rectangle are measured as 30cm and 24cm respectively, with an error in measurement of at most 0.1cm in each. Use differentials to estimate the maximum error in the calculated area of the rectangle.  
   **Optional:** Compare your estimate to the actual largest and smallest values the computed area could have with these errors in the dimensions.

\[ \text{solution} \]