Fun Problems

1. Determine the number of 0’s that are at the end of:

\[ 100! = 100 \cdot 99 \cdot 98 \cdot 97 \cdots 3 \cdot 2 \cdot 1 \]

Warm-up Problems

2. What does it mean for a function to be continuous at a point \( x = c \)?
   **Solution:** \( \lim_{x \to c} f(x) = f(c) \)

3. What does it mean for a function to be continuous?
   **Solution:** This means that the function is continuous at all points in the domain of the function.

4. What does it mean for a function to be differentiable at a point \( x = c \)?
   **Solution:** That \( f'(c) \) exists, or that \( \lim_{h \to 0} \frac{f(c+h)-f(c)}{h} \) exists.

5. What does it mean for a function to be differentiable?
   **Solution:** This means that the function is differentiable at all points in the domain of the function.

6. Multiply out, simplify, write out your solution nicely organized.
   \begin{align*}
   (a) \quad (x+h)^2 &= x^2 + 2xh + h^2 \\
   (b) \quad (x+h)^3 &= x^3 + 3x^2h + 3xh^2 + h^3 \\
   (c) \quad (x+h)^4 &= x^4 + 4x^3h + 6x^2h^2 + 4xh^3 + h^4 \\
   (d) \quad (x+h)^5 &= x^5 + 5x^4h + 10x^3h^2 + 10x^2h^3 + 5xh^4 + h^5 \\
   
   \end{align*}

Lecture Problems

7. Compute the derivatives
   \begin{align*}
   (a) \quad \frac{d}{dx} (x^4) &= 4x^3 \\
   (b) \quad \frac{d}{dx} \left( \frac{1}{x^4} \right) &= -4x^{-5} \\
   (c) \quad \frac{d}{dx} (6x^4) &= 24x^3 \\
   (d) \quad \frac{d}{dx} \left( \frac{1}{6x^4} \right) &= -\frac{4}{6}x^{-5} \\
   (e) \quad \frac{d}{dx} (6x^{102}) &= 612x^{101} \\
   (f) \quad \frac{d}{dx} \left( \frac{43x}{x^{99}} \right) &= (-43 \cdot 98)x^{-99} \\
   \end{align*}