Homework 3/31

Part 1:
1. Use differentials to approximate \((2.002)^5\).
2. Use differentials to approximate \((1.997)^5\).
3. Use differentials to approximate \((2 + h)^5\).
4. Use differentials to approximate \((x)^5\) near \(x = 2\).
   NOTE: Your answer to this problem is called the linearization of \(x^5\) at \(x = 2\).
5. Graph \(y = x^5\) and the linearization at \(x = 2\) on the same axes. Your graph must extend at least from \(x = 0\) to \(x = 3\).
6. Use your linearization to solve \(x^5 = 35\).
7. Use your calculator to solve \(x^5 = 35\).

Part 2: Warning!. Work this problem in radians!
1. Use differentials to approximate \(\tan 46^\circ\).
   [Hint: Convert \(\Delta x = 1^\circ\) to radians.]
2. Use differentials to approximate \(\tan 44^\circ\).
3. Use differentials to approximate \(\tan(\pi/4 + h)\).
4. Use differentials to approximate \(\tan x\) near \(x = \pi/4\). Simplify your answer.
   NOTE: Your answer to this problem is called the linearization of \(\tan x\) at \(x = \pi/4\).
5. Graph \(y = \tan x\) and your answer to part (4) on the same axes. Your graph must extend at least from \(x = 0\) to \(x = \pi/2\).
6. Use your linearization to solve \(\tan x = 5/6\).
7. Use your calculator to solve \(\tan x = 5/6\).

Part 3:
Suppose that \(f(x) = x + \sin x - 0.2e^{0.1x}\).
1. Find the linearization of \(f(x)\) at \(x = 1\).
2. Use your linearization to find a root of \(f\). (That is, solve \(f(x) = 0\).)
3. Find the linearization of \( f(x) \) at \( x = 0 \).

4. Use your linearization to find a root of \( f \).

5. If possible, use your calculator to solve \( f(x) = 0 \).

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**Answers**

**Part 1:**
1) 32.16; 2) 31.76; 3) \( 32 + 80h \); 4) \( 32 + 80(x - 2) \); 6) \( x = 2 + 3/80 \approx 2.0375 \); 7) \( x \approx 2.0362 \).

**Part 2:**
1) \( 1 + \pi/90 \); 2) \( 1 - \pi/90 \); 3) \( 1 + 2h \); 4) \( 1 + 2(x - \pi/4) \);
6) \( x = \pi/4 - 1/12 \approx 0.7021 \); 7) \( x = \arctan(5/6) \approx 0.6947 \).

**Part 3:**
1) \( f(x) \approx (1 + \sin 1 - 0.2e^{0.1}) + (1 + \cos 1 - 0.02e^{0.1})(x - 1) \approx 1.620 + 1.518(x - 1) \).
2) \( x \approx 1 - \frac{1 + \sin 1 - 0.2e^{0.1}}{1 + \cos 1 - 0.02e^{0.1}} \approx -0.0673 \).
3) \( f(x) \approx -0.2 + 1.98x \).
4) \( x \approx \frac{2}{1.98} \approx 1.01 \).
5) \( x \approx 0.1011 \).