Instructions: Do all work on the “work-sheets” that I supply. Do no more than two (2) problems per page. Box your final answer to each question. Circle important “sub-answers.” Draw a horizontal line between each problem. Do not... repeat – do not!!! (a) write anything except the page numbers in the top margin; (b) write anything whatsoever in the left margin; (c) write anything whatsoever on the back of any page, including this. Points will be deducted for each instruction violation!!!!

YOU MAY USE THE “RULES” OF THE DERIVATIVES UNLESS OTHERWISE INSTRUCTED.

#6/10 The curve with equation $y^2 = x^4 - 9x^2$ is a funky kampyle of Eudoxus. Find an equation in standard form for the tangent line to this curve at the point $P(5, 20)$

#7/10 If $f(x) = \frac{x}{x^2 + 1}$, find $f'(x)$ and $f''(x)$.

#8/10 Given: $y^2 - x^2 = 4$. Find $y'$ and $y''$.

#9/10 Sand is being dumped from a conveyor belt at the rate of $10 \text{ ft}^3 \text{ min}^{-1}$, and its coarseness is such that it forms a pile in the shape of a cone whose base radius is always twice the height of the cone. How fast is the radius of the pile increasing when the radius is 15 ft?

#10/10 Use differentials (or, equivalently, a linear approximation) to estimate the given number.

\[ \frac{1}{1002} \]

#BONUS Find, analytically, a second degree polynomial $P$ such that

$P(3) = 2$
$P'(-2) = 7$
$P''(2) = 6$