TEST 1 PRACTICE PROBLEMS 2

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Problem 1. Suppose $f(x) = x^2 + 1$ and $g(x) = -x^3$. Compute the derivative of $h(x) = \dfrac{f(x)}{g(x)}$.

Problem 2. Suppose $f(x) = \sin x$ and $g(x) = \cos x$. What is the instantaneous rate of change of the functions $a(x) = f(x) - g(x)$ and $b(x) = \dfrac{f(x)}{g(x)}$ when $x = 0$.

Problem 3. Let $m(x) = e^x$. What is the tangent line to the graph of $f(x) = \dfrac{m(x) + x}{mx + 1}$ when $x = 0$?

Problem 4. Let $f(x) = x - 1$. For what x values, if any, does the function $g(x) = \dfrac{f(x) + 1}{f(x)}$ have a horizontal tangent? What about a vertical tangent?

Problem 5. Let $f(x) = x - 1$. For what x values, if any, does the function $g(x) = \dfrac{f(x) + x^2 + 1}{f(x) + 1}$ have a horizontal tangent? What about a vertical tangent?

Problem 6. Let $f(x) = x^2$. At what point does the line passing through $(2, 2)$ and $(3, 3)$ intersect the graph of $f(x)$?

Problem 7. Find the equation to the tangent AND normal lines to the graph of $f(x) = x^3$ at the point $(1, 1)$.

Problem 8. Find the instantaneous rate of change of $y = (x^2 + 3)(2x^3 - 5)$ at $x = 0$.

Problem 9. Find the derivative of the INVERSE function of $f(x) = \dfrac{x + 1}{x - 1}$.

Problem 10. Classify the points of discontinuity to the graph of $y = \dfrac{x - 1}{x^2 - 1}$.

Problem 11. Compute the derivatives for the following:
(a) $(x^2 + x)(x + 1)$
(b) $\dfrac{x^2 - 3x - 10}{x + 2}$

Problem 12. Find the limit $\lim_{x \to +\infty}(x - \sqrt{x^2 - 1})$.