MAT 111 **Sample Basic Skills Exam #3**

Calculators are not allowed on this exam. Please show your work and be as neat as possible.

1. [5 points] State the definition of $f'(x)$ at $x = a$.

2. [10 points] Use the definition of the derivative to compute $f'(1)$ when $f(x) = 3-4x+x^2$.

3. [7.5 points each] Evaluate the following limits:

   a) $\lim_{x\to\infty} \dfrac{5x^2+1}{2x^3-3x-1}$

   b) $\lim_{x\to 4^-} \dfrac{x^2-4}{2x-8}$

4. [10 points] Find the equation of the line tangent to the graph of $f(x) = 4x - \ln x$ at the point where $x = 1$.

5. [10 points each] Compute derivatives of the following:

   a) $f(x) = e^{2x^3} + \arctan(2x) + \tan(2x)$

   b) $g(x) = x^\pi + 3\ln x + 2^x$

   c) $h(x) = \dfrac{\cos x}{(1-x)^2} + \sin(3\pi/2) - \sqrt[7]{x}$

6. [10 points] Given $\sin(5y) + 3xy = -5x + 2$, compute $\dfrac{dy}{dx}$ in terms of x and y.

7. [10 points each] Find antiderivatives for each of the following:

   a) $f(x) = 2x^{-3} + \dfrac{1}{x^2+1} - \sin(3x)$

   b) $g(x) = 10 + \sec^2(x) + 2x^{-1}$