Problem 1: (8 points) (1) Use the definition of the derivative to find $f'(x)$ for the function $f(x) = \frac{1}{x+1}$.

(2) Find the slope of the tangent line to the curve $y = \frac{x^2 + \sqrt{x} + 1}{x}$ at $x = 1$.

Problem 2: (8 points) Find the $\frac{dy}{dx}$ for each of the following functions:

(1) $y = \frac{x^2 + 3}{x^3 + x} + \pi^3$
(2) $y = u^2 + u$ and $u = x + \frac{1}{x}$

**Problem 3:** (8 points) (1) Find the rate of change in the volume $V$ of a sphere with respect to the radius $r$ when $r = 7$. (Note that $V = \frac{4}{3} \pi r^3$)

(2) An object is thrown up from the top of a building so that its distance (in feet) from the ground is $s(t) = 32t - 2t^2 + 72$, find the velocity of the object when it hits the ground.