

**Problem.** Find derivative of each function using first principles (use definition) and then evaluate the slope of the tangent line at the given point.  $y(x) = \frac{x}{x-1}$ , the point is  $(-3, 3/4)$ .

**Solution.**  $y = \frac{x-1+1}{x-1} = 1 + \frac{1}{x-1}$ . So  $y'(x) = \lim_{\Delta x \rightarrow 0} \frac{y(x+\Delta x) - y(x)}{\Delta x} = \lim_{\Delta x \rightarrow 0} \frac{\frac{1}{x+\Delta x-1} - \frac{1}{x-1}}{\Delta x} = \lim_{\Delta x \rightarrow 0} \frac{-\Delta x}{(x+\Delta x-1)(x-1)\Delta x} = -\frac{1}{(x-1)^2}$ . The slope of the tangent line at the point  $(-3, 3/4)$  equals to  $y'(-3) = -1/16$ .

**Answer.**  $y'(x) = -\frac{1}{(x-1)^2}$ , the slope of the tangent line at point  $(-3, 3/4)$  equals to  $-1/16$ .