6. Let f be the function given by $f(x) = \dfrac{2x}{1 + x^2}$.

   (a) Write the first four nonzero terms and the general term of the Taylor series for f about $x = 0$.

   (b) Does the series found in part (a), when evaluated at $x = 1$, converge to $f(1)$? Explain why or why not.

   (c) The derivative of $\ln\left(1 + x^2\right)$ is $\dfrac{2x}{1 + x^2}$. Write the first four nonzero terms of the Taylor series for $\ln\left(1 + x^2\right)$ about $x = 0$.

   (d) Use the series found in part (c) to find a rational number A such that $\left| A - \ln\left(\dfrac{5}{4}\right) \right| < \dfrac{1}{100}$. Justify your answer.