Find
\[ \int \arctan x \, dx. \]

Check your answer.

**Answer:** Use integration by parts

\[ \int u \, dv = uv - \int v \, du. \]

Take \( u = \arctan x \) and \( dv = dx \). It follows that \( du = \frac{dx}{1+x^2} \) and \( v = x \). The original integral equals

\[ x \arctan x - \int \frac{x \, dx}{1+x^2} = x \arctan x - \frac{1}{2} \ln(1+x^2) + C. \]

**Check:** The derivative of the proposed answer is

\[ \frac{x}{1+x^2} + \arctan x - \frac{1}{2} \frac{2x}{1+x^2}. \]