Instructions.
Please make sure to SHOW YOUR WORK, and do NOT skip steps.

1. (5 pts) Consider \( f(x) = 3 + \arctan(2x) \).
   (a) \( f'(x) =? \)
   (b) Does \( f(x) \) increase, decrease or neither?

\[
f'(x) = \frac{2}{1 + (2x)^2} > 0 \quad \text{increase.}
\]

2. (5 pts) (from 2014 Fall midterm)
A boat is pulled towards the dock by a rope from the bow through a ring on the dock 6 ft above the bow. The rope is hauled in at the rate of 2 ft/s. How fast is the boat approaching the dock when 10 feet of rope are out?

(The picture is a screenshot of that midterm. Copyrights belong to the professor. :])

\[
x: \text{length of rope} \quad \frac{dx}{dt} = 2 \quad x = 10
\]
\[
y: \text{distance of boat from dock} \quad \frac{dy}{dt} = ?
\]
\[
x^2 = 6^2 + y^2
\]
\[
\frac{2x}{\frac{dt}{dx}} = 2y \frac{dy}{dt}
\]
\[
\frac{10}{2} = \frac{dy}{dt}
\]
\[
y = \sqrt{x^2 - 6^2} = \sqrt{10^2 - 6^2} = 8
\]
\[
10 \cdot 2 = 8 \frac{dy}{dt}
\]
\[
\Rightarrow \frac{dy}{dt} = \frac{2 \cdot 10}{8} = \frac{5}{2} \text{ ft/s}
\]