

Problem 1. Calculate derivatives / higher-order derivatives.

1. $(e^x \sin^{-1} x)' =$

2. $(\cos^{-1}(\ln x + e^{-x^2}) - e^{\sin^{-1} x})' =$

3. $((\sin x + 2x)^{\tan x})' =$

4. $((x^2 + 1)^{x \sin x})' =$

5. $(e^{3x})^{(31)} =$

6. $(e^{-x^2})''' =$

Problem 2. An airplane is flying at a height of 400m with a speed 150m/s. A person is standing on the ground. When the airplane has a distance 500m from the person and is flying away from the person, how fast is their distance increasing?

Problem 3. A bubble is shrinking. When its surface area is 10 and decreasing at a rate of 2, how fast is its volume decreasing? (Given: volume of a sphere $V = \frac{4}{3}\pi r^3$; surface area of a sphere $S = 4\pi r^2$)