1. (a) Apply the first derivative test to classify each of the critical points of the function \( f(x) = x^2e^{-x/3} \). If you have a graphics calculator, plot \( y = f(x) \) to see whether the appearance of the graph corresponds to your classification of the critical points.

(b) Determine the open intervals on the \( x \)-axis on which the function \( f(x) = 3x^4 + 4x^3 - 12x^2 \) is increasing as well as those on which it is decreasing. If you have a graphics calculator, plot the graph \( y = f(x) \) to see whether it agrees with your result.
2. Find $\frac{dy}{dx}$

(a) $y = e^{-2x}\sin 3x$

(b) $x \ln y = x + y$
3. (a) Write an equation of the line tangent to the given curve at \( x^2 - 3xy + 2y^2 = 0 \).

(b) Find \( \frac{dy}{dx} \) if \( y = \left(1 + \frac{1}{x}\right)^x \).
4. An airplane flying horizontally at an altitude of 3 mi and at a speed of 480 mi/h passes directly above an observer on the ground. How fast is the distance from the observer to the airplane increasing 30 s later?

5. A ladder 41 ft long that was leaning against a vertical wall begins to slip. Its top slides down the wall while its bottom moves along the level ground at a constant speed of 4 ft/s. How fast is the top of the ladder moving when it is 9 ft above the ground?