Assignment 1: due date February 3rd-5th

Problems 1.1: 1, 4, 5: Verify by substitution that each given function is a solution of the given differential equation.

\[ y' = 3x^2; \quad y = x^3 + 7 \]
\[ y'' = 9y; \quad y_1 = e^{3x}, \quad y_2 = e^{-3x} \]
\[ y' = y + 2e^{-x}; \quad y = e^x - e^{-x} \]

Problem 1.1: 32: Write a differential equation that is a mathematical model of the situation described.

*The time rate of a population \( P \) is proportional to the square root of \( P \).*

Problem 1.2: 2, 7: Solve the following IVP.

\[ \frac{dy}{dx} = (x - 2)^2, \quad y(2) = 1 \]
\[ \frac{dy}{dx} = \frac{10}{x^2 + 1}, \quad y(0) = 0 \]

Problems 1.2: 11, 14: Find the position function \( x(t) \) of a moving particle with the given acceleration \( a(t) \), initial position \( x_0 = x(0) \), and initial velocity \( v_0 = v(0) \).

\[ a(t) = 50, \quad v_0 = 10, \quad x_0 = 20 \]
\[ a(t) = 2t + 1, \quad v_0 = -7, \quad x_0 = 4 \]

Problems 1.2: 25: The brakes of a car are applied when it is moving at 100 \( Km/h \) and provide a constant deceleration of 10 meters per second per second \( (m/s^2) \). How far does the car travel before coming to a stop?

Problem 1.2: 27: A ball is thrown straight downward from the top of a tall building. The initial speed of the ball is 10 \( m/s \). It strikes the ground with a speed of 60 \( m/s \). How tall is the building?

Problem 1.2: 37: At noon a car starts from rest at point \( A \) and proceeds at constant acceleration along a straight road toward point \( B \). If the car reaches \( B \) at 12 : 50 PM with a velocity of 60 \( mi/h \), what is the distance from \( A \) to \( B \)?