Chapter 1.1

In exercises 3, 6 and 11, verify by substitution that each given function is a solution of the given differential equation.

(3) \( y'' + 4y = 0; \quad y_1 = \cos 2x, \quad y_2 = \sin 2x \)

(6) \( y'' + 4y' + 4y = 0; \quad y_1 = e^{-2x}, \quad y_2 = xe^{-2x} \)
(11) \( x^2y'' + 5xy' + 4y = 0; \quad y_1 = \frac{1}{x^2}, \quad y_2 = \frac{\ln x}{x^2} \)

(15) Substitute \( y = e^{rx} \) into the given differential equation to determine all values of the constant \( r \) for which \( y = e^{rx} \) is a solution of the equation.

\[ y'' + y' - 2y = 0 \]
(43)(a) If $k$ is a constant, show that a general solution of the differential equation
\[
\frac{dx}{dt} = kx^2
\]
is given by $x(t) = \frac{1}{(C-kt)}$, where $C$ is an arbitrary constant.

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Chapter 1.2

In exercises 2 and 6, find a solution to the given initial value problem.

(2) $\frac{dy}{dx} = (x - 2)^2; \quad y(2) = 1$

(6) $\frac{dy}{dx} = x\sqrt{x^2 + 9}; \quad y(-4) = 0$
In exercises 13 and 18, 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 \( v_0 = v(0) \).

(13) \( a(t) = 3t, \quad v_0 = 5, \quad x_0 = 0 \)

(18) \( a(t) = 50 \sin 5t, \quad v_0 = -10, \quad x_0 = 8 \)

Chapter 1.3

For the following initial value problems, sketch a solution curve using a slope field (using Maple, or by hand). Use this curve to estimate the value of the solution at the given value of \( x \).

(22) \( y' = y - x, \quad y(4) = 0, \quad y(-4) =? \)

(24) \( y' = x + \frac{1}{2} y^2, \quad y(-2) = 0, \quad y(2) =? \)