Determine if the function is a solution of the differential equation.

1) \( x \frac{dy}{dx} - y = 0; \ y = Cx \)

2) \( \frac{dy}{dx} \frac{x}{y} = 0; \ y = \sqrt{1 - x^2} \)

Find the particular solution that satisfies the given condition.

3) \( \frac{dy}{dx} = x - 6; \) curve passes through (2, 5)
4) \[ \frac{du}{dt} = u^3(t - 2t^3); \ u = 3 \text{ at } x = 0 \]

Solve the differential equation.

5) \[ y' + 2xy = 17x \]

Solve the differential equation subject to the initial conditions.

6) \[ t \frac{dy}{dt} + 7y = t^3; \ t > 0, \ y = 1 \text{ when } t = 2 \]

Solve the differential equation.

7) \[ 2x \frac{dy}{dx} + y = 5x^4 \]
Solve the differential equation subject to the initial conditions.

8) \(2 \frac{dy}{dx} - 4xy = 8x; \ y = 18 \text{ when } x = 0\)

9) \(x \frac{dy}{dx} + y = \cos x; \ x > 0; \ x = \pi \text{ when } y = 1\)

Solve the problem.

10) First find a general solution of the differential equation \(\frac{dy}{dx} = 3y^2\). Then find a particular solution that satisfies the initial condition \(y(3) = -\frac{1}{9}\).

11) A tank contains 2000 L of a solution consisting of 50 kg of salt dissolved in water. Pure water is pumped into the tank at the rate of 10L/s, and the mixture (kept uniform by stirring) is pumped out at the same rate. How long will it be until only 5 kg of salt remain in the tank?
Solve the initial value problem.

12) \(2 \frac{dy}{dx} - 4xy = 8x; \ y(0) = 7\)

Solve the differential equation.

13) \(5y' = e^{x/5} + y\)

14) \(\cos x \frac{dy}{dx} + y \sin x = \sin x \cos x\)

15) \(\frac{dy}{dx} - \frac{y}{x} = (\ln x)^5\)
Solve the problem.

16) \( \frac{dy}{dt} = ky + f(t) \) is a population model where \( y \) is the population at time \( t \) and \( f(t) \) is some function to describe the net effect on the population. Assume \( k = .02 \) and \( y = 10,000 \) when \( t = 0 \). Solve the differential equation of \( y \) when \( f(t) = 8t \).

17) \( \frac{dy}{dt} = ky + f(t) \) is a population model where \( y \) is the population at time \( t \) and \( f(t) \) is some function to describe the net effect on the population. Assume \( k = .02 \) and \( y = 10,000 \) when \( t = 0 \). Solve the differential equation of \( y \) when \( f(t) = -6t \).
1) Yes
   Objective: (4.9) Verify Solution to Differential Equation

2) No
   Objective: (4.9) Verify Solution to Differential Equation

3) \( y = \frac{x^2}{2} - 6x + 15 \)
   Objective: (4.9) Solve Initial Value Problem

4) \( u = \frac{1}{\sqrt{t^4 - t^2 + \frac{1}{9}}} \)
   Objective: (4.9) Solve Initial Value Problem

5) \( y = \frac{17}{2} + Ce^{-x^2} \)
   Objective: (7.7) Solve First-Order Linear Differential Equation I

6) \( y = t^3 + \frac{128}{5}t^{-7}, \ t > 0 \)
   Objective: (7.7) Find Indicated Particular Solution

7) \( y = \frac{5}{9}x^4 + \frac{c}{\sqrt{x}} \)
   Objective: (7.7) Solve First-Order Linear Differential Equation I

8) \( y = -2 + 20e^{x^2} \)
   Objective: (7.7) Find Indicated Particular Solution

9) \( y = \frac{\sin x + \pi}{x}, \ x > 0 \)
   Objective: (7.7) Find Indicated Particular Solution

10) \( y(x) = -\frac{1}{3(x + C)}; \ y(x) = -\frac{1}{3x} \)
    Objective: (Chapter9) Simple Equations and Models

11) approximately 518 seconds
    Objective: (Chapter9) Linear Equations and Applications

12) \( y = -2 + 9e^{x^2} \)
    Objective: (7.8) Solve Warm-Up Initial Value Problems

13) \( y = \frac{xe^{x/5} + Ce^{x/5}}{5} \)
    Objective: (7.8) Solve Linear First-Order Differential Equation

14) \( y = \cos x \ln|\sec x| + C \cos x \)
    Objective: (7.8) Solve Linear First-Order Differential Equation
15) \( y = \frac{1}{6} x (\ln x)^6 + Cx \)

**Objective:** (7.8) Solve Linear First-Order Differential Equation

16) \( y = -400t - 20,000 + 30,000e^{0.02t} \)

**Objective:** (7.8) Solve Apps: First-Order Differential Equations

17) \( y = 300t + 15,000 - 5000e^{0.02t} \)

**Objective:** (7.8) Solve Apps: First-Order Differential Equations