

**First Order Linear ODEs; Integrating Factors**

Solve the following first order linear differential equations, and state an interval where your solution is valid.

1.  $x \frac{dy}{dx} - 4y = x^6 e^x$

2.  $\frac{dy}{dx} + 2xy = x; y(0) = -3$

3.  $y' + 3x^2 y = x^2$

4.  $\frac{dy}{dx} + 5y = 20; y(0) = 2$

5.  $x dy = (x \sin x - y) dx$

6.  $(1 + e^x) \frac{dy}{dx} + e^x y = 0$

7.  $x \frac{dy}{dx} + 4y = x^3 - x$

8.  $(x + 1) \frac{dy}{dx} + y = \ln x; y(1) = 10$

9.  $(x + 2)^2 \frac{dy}{dx} = 5 - 8y - 4xy$

10.  $\frac{dy}{dx} + y = \frac{1 - e^{-2x}}{e^x + e^{-x}}$

11.  $x^2 y' + x(x + 2)y = e^x$

12.  $x \frac{dy}{dx} + (3x + 1)y = e^{-3x}$

13.  $x(x - 2)y' + 2y = 0; y(3) = 6$

14.  $\frac{dy}{dx} = \frac{y}{y - x}; y(5) = 2$

15.  $(x + 4y^2) dy + 2y dx = 0$

16.  $y dx + (xy + 2x - ye^y) dy = 0.$