

Solve the following ODEs.

1.  $y' = e^x y + e^x$   $y(0) = 2$
2.  $y' - \frac{xy}{x^2 + 1} = \frac{1}{\sqrt{x^2 + 1}}$   $y(0) = 3$
3.  $y' - \frac{xy}{x^2 + 1} = \frac{1}{x^2 + 1}$   $y(1) = 3$
4.  $y' + 5y = 3,$   $y(3) = 1$
5.  $y' - y = e^x,$   $y(\pi) = 3$
6.  $xy' + 3y = x \ln x,$   $y(1) = 3$
7.  $xy' + y = x \sin x,$   $y(1) = 1$
8.  $(x^2 + 1)y' + 2xy = x^3 + x,$   $y(0) = 0$

Determine whether the following ODE is linear or not, and show why.

9.  $y' = e^x y^2 + e^x$
10.  $y'' - \frac{xy}{x^2 + 3} = 0$
11.  $y''' - 3y'' + 2y' = 4y$