# Math 2150 - Homework # 3 -
# First order linear ODEs

1. Find all solutions to the given linear ODE on the given interval $I$.

   (a) $y' - 2y = 1$ on $I = (-\infty, \infty)$

   (b) $y' + 2xy = x$ on $I = (-\infty, \infty)$

   (c) $\dfrac{dy}{dx} + e^x y = 3e^x$ on $I = (-\infty, \infty)$

   (d) $\dfrac{dy}{dx} + 2xy = xe^{-x^2}$ on $I = (-\infty, \infty)$

   (e) $y' = e^{3x} + \sin(x)$ on $I = (-\infty, \infty)$

   (f) $y' - (\tan(x))y = e^{\sin(x)}$ on $I = (0, \pi/2)$

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2. Find all solutions to the given linear ODE on the given interval $I$.

   (a) $3\dfrac{dy}{dx} + y = 2e^{-x}$ on $I = (-\infty, \infty)$

   (b) $xy' + y = 3x^3 - 1$ on $I = (0, \infty)$

   (c) $x^2y' + x(x+2)y = e^x$ on $I = (0, \infty)$

   (d) $(x^2 + 9)\dfrac{dy}{dx} + xy = 0$ on $I = (-\infty, \infty)$

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3. In the problems above you showed that the general solution to

$$(x^2 + 9)\frac{dy}{dx} + xy = 0$$

   on $I = (-\infty, \infty)$ is given by

$$y = \frac{C}{\sqrt{x^2 + 9}}$$

Use this information to solve the initial value problem

$$(x^2 + 9)\frac{dy}{dx} + xy = 0, \quad y(0) = 3$$

on the interval $I = (-\infty, \infty)$.

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4. Solve the initial value problem

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

on the interval $I = (-\infty, \infty)$.

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5. Solve the initial value problem

$$xy' + y = 2x, \quad y(1) = 0$$

on the interval $I = (0, \infty)$.

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