Math 3331 - Spring 2026 - HW 2

1. Solve the following ODEs (separable)

$$
\begin{aligned}
&(i) \quad \frac{dy}{dx} = 1 - y^2 \\
&(ii) \quad y' = 2xy^2, \;\; y(0) = 1 \\
&(iii) \quad \frac{dy}{dx} = \frac{xy + 2y - x - 2}{xy - 3y + x - 3} \\
&(iv) \quad \frac{dy}{dx} + 2y = 1,
\end{aligned}
$$

2. Solve the following ODEs (linear)

$$
\begin{aligned}
&(i) \quad xy' = 4y + x^4 e^x \\
&(ii) \quad (x+1)\frac{dy}{dx} + y = \ln x, \;\; y(1) = 10 \\
&(iii) \quad x\frac{dy}{dx} + 2y = 6x^3 + 2 \\
&(iv) \quad \frac{dy}{dx} + \tan x \, y = \cos^2 x, \;\; y(0) = -1
\end{aligned}
$$

3. Solve the following ODEs (Bernoulli)

$$
\begin{aligned}
&(i) \quad \frac{dy}{dx} - xy = \;\; x^3 y^3 \;\; (T5) \\
&(ii) \quad y' - 2y = 2y^{1/2}, \;\; y(0) = 1 \;\; (T10) \\
&(iii) \quad \frac{dy}{dx} - 4y = \;\; \frac{48x}{y^2}, \;\; y(0) = 1 \;\; (T11)
\end{aligned}
$$

Due: Friday Feb. 6, 2026

Math 3331 - Spring 2026 - HW 3

1. Solve the following ODEs (homogeneous)

$$(i) \quad \frac{dy}{dx} = \frac{x+y}{x-y} \quad (T28)$$

$$(ii) \quad \frac{dy}{dx} = \frac{x+2y}{2x+y} \quad (T31)$$

$$(iii) \quad \frac{dy}{dx} = \frac{x^3+x^2y+2xy^2+y^3}{x(x+y)^2} \quad (T30)$$

2. Solve the following (exact).

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

$$(ii) \quad \frac{dy}{dx} = \frac{3y+2xe^y}{2y-3x-x^2e^y}$$

$$(iii) \quad \frac{dy}{dx} = \frac{y+3x^2}{8y-x}$$

$$(iv) \quad \frac{dy}{dx} = \frac{2x-y}{x+2y}$$

Due: Monday Feb. 9, 2026

Solns

$$(i) \quad \tfrac{1}{2}x^2y^2+x^2y+xy^2=c$$

$$(ii) \quad 3xy+x^2e^y-y^2=c$$

$$(iii) \quad x^3+xy-4y^2=c$$

$$(iv) \quad x^2-xy-y^2=c$$