

Instructions: Complete each of the following on separate, stapled sheets of paper.

1. Produce a direction field (on graph paper) for each of the following first-order ODEs in the range $-5 \leq x, y \leq 5$, and then sketch an approximate solution curve to the ODE with the given initial condition.

(a) $\frac{dy}{dx} = x^2 - y^2; y(3) = 0$

(b) $y \frac{dy}{dx} = -x; y(1) = 1$

2. Solve the following (separable) ODEs.

(a) $\frac{dy}{dx} = y \sin(5x)$

(c) $\frac{dy}{dx} = \exp(3x + 2y)$

(e) $\frac{dy}{dx} = e^x \cos(y)$

(b) $x \frac{dy}{dx} = 5y$

(d) $y \ln(x) \frac{dy}{dx} = \left(\frac{y+1}{x}\right)^2$

(f) $\frac{dQ}{dt} = k(Q - 70)$

3. Solve each of the following IVPs.

(a) $\frac{dy}{dx} = \frac{2x+1}{2y}, y(-2) = -1$

(b) $y \frac{dy}{dx} + \sin(x) = 0, y(0) = 1$