

## Differential Equations Error Analysis

In each differential equation solution below, there is a major mistake! Unfortunately, that means that every step *after* the mistake occurred is *also* wrong. Your task is to identify the precise step in which the mistake occurs. Correct the error and then correct all of the steps that follow the error so that the problem is worked correctly.

**Problem 1**       $\frac{dy}{dx} = \frac{-xy^2}{2}$

**Step 1**       $\int -y^{-2} dy = \int \frac{x}{2} dx$

**Step 2**       $y^{-1} = \frac{x^2}{4} + c_1$

**Step 3**       $y = \frac{4}{x^2} + c_2$

**Corrected Work:**

**Problem 2**       $\frac{dy}{dx} = e^{x-y}$

**Step 1**       $\int e^{-y} dy = \int e^x dx$

**Step 2**       $-e^{-y} = e^x + c_1$

**Step 3**       $e^{-y} = -e^x + c_2$

**Step 4**       $\ln e^{-y} = \ln(-e^x + c_2)$

**Step 5**       $-y = \ln(-e^x + c_2)$

**Step 6**       $y = -\ln(-e^x + c_2)$

**Corrected Work:**

**Problem 3**  $\frac{dy}{dx} = \frac{xy}{2}$

**Step 1**  $\int \frac{1}{y} dy = \int \frac{x}{2} dx$

**Step 2**  $\ln|y| = \frac{x^2}{4}$

**Step 3**  $e^{\ln|y|} = e^{\frac{x^2}{4}}$

**Step 4**  $|y| = e^{\frac{x^2}{4}}$

**Step 5**  $y = \pm e^{\frac{x^2}{4}} + c_1$

**Corrected Work:**

**Problem 4**  $\frac{dy}{dx} = \frac{-2x}{y}$

**Step 1**  $\int y dy = \int -2x dx$

**Step 2**  $\frac{y^2}{2} = -x^2 + c_1$

**Step 3**  $y^2 = -2x^2 + c_2$

**Step 4**  $y = \sqrt{-2x^2 + c_2}$

**Corrected Work:**

**Problem 5**       $\frac{dy}{dt} = -2v - 32$

**Step 1**       $\int 2v \, dy = \int -32 \, dt$

**Step 2**       $v^2 = -32t + c_2$

**Step 3**       $v = \pm\sqrt{-32t + c_2}$

**Corrected Work:**