

Show all work, including indications of mental steps, in a clearly organized presentation on the other lined paper provided. Label each problem and part, clearly separating parts, boxing any short final responses requested by each part. Try to identify expressions you write down with appropriate symbols for them linked by an equal sign.

① Find the general solution, giving your final result in the form $y = y(x)$:

a) $\frac{dy}{dx} = x^2 y^{2/3}$ b) $\frac{dy}{dx} = \frac{3}{x^2} - \frac{2y}{x}$ (assume $x > 0$)

c) Choose either a) or b) and find the particular solution which satisfies the initial condition $y(3) = 1$, giving your final result in the form $y = y(x)$.

② $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + 5y = 0$, a) Find the general solution $y = y(t)$.

$y(0) = 1$, $\frac{dy}{dt}(0) = 3$ b) Find the initial value problem solution $y = y(t)$.

③ $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + y = 8e^{-t}$ a) Find the complementary solution $y_c = y_c(t)$.

$y(0) = 4$, $\frac{dy}{dt}(0) = -1$ b) Find the particular solution $y_p = y_p(t)$ which is produced by the method of undetermined constants.

c) Find the general solution $y = y(t)$ of this DE.

d) Find the solution $y = y(t)$ which satisfies the initial conditions.