1. (5 points) $y = x^2 + 3$ is a solution of the differential equation

(a) $y'' + 3y' = 0$
(b) $y'' + 3x = 0$
(c) $3y' - 6 = 0$
(d) $xy'' - y' = 0$

**Answer:** $y' = 2x$ and $y'' = 2$. So none of $y'' + 3y'$, $y'' + 3x$, $3y' - 6$ equal zero, but $xy'' - y' = 0$. So the correct answer is (d).

2. (5 points) A solution of the differential equation $y' = 3y$ is

(a) $y = t^3$
(b) $y = \ln 3t$
(c) $y = \cos 3t + \sin 3t$
(d) $y = e^{3t}$

**Answer:** $(t^3)' = 3t^2 \neq 3(t^3)$, $(\ln 3t)' = t^{-1} \neq 3(\ln 3t)$, $(\cos 3t + \sin 3t)' = -3 \sin 3t + 3 \cos 3t \neq 3(\cos 3t + \sin 3t)$, but $(e^{3t})' = 3e^{3t} = 3(e^{3t})$. So the correct answer is (d).
3 (5 points) The equation \( \frac{dy}{dx} + 2y = e^{-x} \) is most accurately described as a

(a) second degree first order differential equation  
(b) first order homogeneous differential equation  
(c) first order partial differential equation  
(d) first order linear differential equation

**Answer:** (d). See page 864 of the book.

4 (15 points) Find the general solution of the differential equation in the previous problem.

**Answer:** As described on page 865 of the book, the general solution is

\[
y = e^{-\int 2dx} (\int e^{-x} e^{\int 2dx} dx + C) = e^{-2x} (\int e^{-x} e^{2x} dx + C) = e^{-2x} (e^{x} + C) = e^{-x} + Ce^{-2x}.
\]

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There are 130 scores

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Mean score = 24.7. Mean grade = 3.25.