Each problem is worth 5 points. For full credit provide complete justification for your answers.

1. Determine whether \( y = e^{3x} \) is a solution to the differential equation \( y'' - 4y' + 3y = 0 \).

\[
y = e^{3x} \\
y' = 3e^{3x} \\
y'' = 9e^{3x}
\]

\[
9e^{3x} - 4(3e^{3x}) + 3(e^{3x}) = 0 \\
9e^{3x} - 12e^{3x} + 3e^{3x} = 0 \\
0 = 0
\]

Yes, the solution works!! 😊

2. Determine whether \( y = x \sin x \) is a solution to the differential equation \( y'' + y = 2 \cos x \).

\[
y = x \sin x \\
y' = \sin x + x \cos x \\
y'' = \cos x + \cos x - x \sin x \\
y'' = 2 \cos x - x \sin x
\]

\[
2 \cos x - x \sin x + x \sin x = 2 \cos x \\
2 \cos x = 2 \cos x
\]

Yes, solution works.

Yes, solution works! 😊