1. Find a particular solution to the differential equation using the Method of Undetermined Coefficients.

$$\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 2y = x e^x$$

A solution is $y_p(x) =$ ____________.

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2. Using the Method of Undetermined Coefficients, determine the form of a particular solution for the differential equation. (Do not evaluate coefficients.)

$$y'' + 36y = 20t^3 \sin 6t$$

The root(s) of the auxiliary equation associated with the given differential equation is/are ____________.
(Use a comma to separate answers as needed.)

Write the form of a particular solution. Choose the correct answer below.

- **A.** $y_p(t) = \left(A_3t^3 + A_2t^2 + A_1t + A_0\right) \cos 6t + \left(B_3t^3 + B_2t^2 + B_1t + B_0\right) \sin 6t$
- **B.** $y_p(t) = \left(A_3t^4 + A_2t^3 + A_1t^2 + A_0t\right) e^t \cos 6t + \left(B_3t^4 + B_2t^3 + B_1t^2 + B_0\right) e^t \sin 6t$
- **C.** $y_p(t) = t\left(A_3t^3 + A_2t^2 + A_1t + A_0\right) \cos 6t + t\left(B_3t^3 + B_2t^2 + B_1t + B_0\right) \sin 6t$
- **D.** $y_p(t) = t\left(A_3t^3 + A_2t^2 + A_1t + A_0\right) e^t \cos 6t + t\left(B_3t^3 + B_2t^2 + B_1t + B_0\right) e^t \sin 6t$

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3. A nonhomogeneous equation and a particular solution are given. Find a general solution for the equation.

$$y'' + 6y' + 8y = 8x^2 + 12x + 2 + 15e^x, \quad y_p(x) = e^x + x^2$$

The general solution is $y(x) =$ ____________.
(Do not use d, D, e, E, i, or I as arbitrary constants since these letters already have defined meanings.)

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4. Find a general solution to the given differential equation.

$$y'' + 2y' - 3y = 0$$

A general solution is $y(t) =$ ____________.

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5. Find a general solution to the differential equation using the method of variation of parameters.

$$y'' + 25y = 5 \sec 5t$$

The general solution is $y(t) =$ ____________.

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6. The auxiliary equation for the given differential equation has complex roots. Find a general solution.

$$y'' - 10y' + 34y = 0$$

$y(t) =$ ____________

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7. Solve the given initial value problem.

$$y'' + 8y' + 16y = 0; \qquad y(0) = 3, \quad y'(0) = -16$$

The solution is $y(t) =$ ____________.

8. Solve the given initial value problem.

$$y'' + 64y = 0; \quad y(0) = 1, \quad y'(0) = 7$$

$y(t) =$ ____________

9. Given that $y_1(t) = \cos t$ is a solution to $y'' - y' + y = \sin t$ and $y_2(t) = \frac{e^{2t}}{3}$ is a solution to $y'' - y' + y = e^{2t}$, use the superposition principle to find solutions to the differential equations in parts (a) through (c) below.

(a) $y'' - y' + y = 21 \sin t$

A solution is $y(t) =$ ____________.

(b) $y'' - y' + y = 2 \sin t - 24 e^{2t}$

A solution is $y(t) =$ ____________.

(c) $y'' - y' + y = 5 \sin t + 6 e^{2t}$

A solution is $y(t) =$ ____________.

1. $\left(-\frac{1}{3}x+\frac{4}{9}\right)e^{x}$

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2. $6i, -6i$

C. $y_p(t) = t\left(A_3t^3 + A_2t^2 + A_1t + A_0\right)\cos 6t + t\left(B_3t^3 + B_2t^2 + B_1t + B_0\right)\sin 6t$

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3. $e^{x} + x^2 + c_1 e^{-4x} + c_2 e^{-2x}$

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4. $c_1 e^{t} + c_2 e^{-3t}$

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5. $c_1 \cos(5t) + c_2 \sin(5t) + t\sin(5t) - \frac{1}{5}\ln\left|\sec(5t)\right|\cos(5t)$

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6. $c_1 e^{5t}\cos 3t + c_2 e^{5t}\sin 3t$

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7. $3e^{-4t} - 4te^{-4t}$

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8. $\cos 8t + \frac{7}{8}\sin 8t$

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9. $21\cos t$

$2\cos t - 8e^{2t}$

$5\cos t + 2e^{2t}$
