

1) Solve Bernoulli type differential equation $y - \frac{y}{x} = y^2$

A) $y^{-1} = \frac{C}{x} - \frac{x}{2}$

B) $y = \frac{C}{x} - \frac{x}{2}$

C) $y^{-1} = \frac{C}{x} + \frac{x}{2}$

D) $y = \frac{1}{Ce^x + 1}$

E) $y^{-1} = Ce^x + \frac{x}{2}$

2) Linearly independent solutions of homogeneous part of a nonhomogeneous equation for $x > 0$ are $y_1 = x^2$ and $y_2 = x^{-1}$. The nonhomogeneous term is $g(x) = -x^{-2}$. Find particular solution y_p by Variation of Parameters.

A) $y_p = \frac{x^{-2}}{2}$

B) $y_p = -\frac{1}{2}$

C) $y_p = x^2$

D) $y_p = \frac{1}{2}$

E) $y_p = -\frac{x^{-2}}{2}$

3) Solve Separable type differential equation $xyy' = \sqrt{1-y^2}$, $x > 0$

A) $\frac{\sqrt{1-y^2}}{x} = C$

B) $\sqrt{1-y^2} + \ln x = C$

C) $\frac{1}{\sqrt{1-y^2}} + \ln x = C$

D) $y = \ln x + C$

E) $1 - y^2 = \ln x + C$

4) Solve Homogeneous type differential equation $y' = \frac{x^2 + 2y^2}{2xy}$

A) $y^2 = \ln|x| + C$

B) $y^2 = x^2 \ln|x| + C$

C) $y^2 = x^2 \ln|x| + Cx^2$

D) $y = \ln|x| + C$

E) $x^2 + y^2 = \ln|x| + C$

5) Solve IVP $2xy' - y = 3x^2$; $y(1) = 0$

A) $y = x^2 - x$

B) $y = x - \sqrt{x}$

C) $y = \sqrt{x} - x^2$

D) $y = x^2 - 1$

E) $y = x^2 - \sqrt{x}$

6) Find the form of the particular solution to $y'' + 4y = \sin 2t - \cos t$ by the method of undetermined coefficients.

- A) $y_p = A \sin 2t + B \cos t$
- B) $y_p = A \sin 2t + B \cos 2t + C \sin t + D \cos t$
- C) $y_p = A \sin 2t + B \cos 2t + C \sin t + D \cos t$
- D) $y_p = A \sin 2t + B \cos 2t + C \sin t + D \cos t$
- E) $y_p = A \sin 2t + B \cos t$

7) Solve IVP $\frac{dy}{dx} + y^2 \sin x = 0$, $y(\pi) = 1$.

- A) $y = -\sec x$
- B) $y = \frac{2}{1 - \cos x}$
- C) $y = \sec x$
- D) $y = \frac{1}{1 - \cos x}$
- E) $y = -\operatorname{cosec} x$

8) Which of the following differential equations are linear?

- I. $y = (\sin x)y + e^x$ II. $y = x(\sin y) + e^x$ III. $y = 5$ IV. $y = y^2 + x$

- A) All of them
- B) I
- C) I and III
- D) III
- E) II and III

9) Find the form of the particular solution to $y'' + 2y' + y = t^2 e^{-t}$ by the method of undetermined coefficients.

- A) $y_p = t^3 (At + B) e^{-t}$
- B) $y_p = t^2 (At^2 + Bt + C) e^{-t}$
- C) $y_p = t (At^2 + Bt + C) e^{-t}$
- D) $y_p = (At^2 + Bt + C) e^{-t}$
- E) $y_p = At^2 e^{-t}$

10) Solve IVP given by $(2x + y) + (x - 2y) y' = 0$, $y(0) = 0$

- A) $(x+y)^2 = xy$
- B) $y = x + xy$
- C) $y^2 + x^2 = xy$
- D) $y^2 = x^2 - xy$
- E) $y^2 = x^2 + xy$

Answer Key

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- 1) A
- 2) D
- 3) B
- 4) C
- 5) E
- 6) D
- 7) A
- 8) C
- 9) B
- 10) E