Multiple choice questions - Differential equations

Year: Further Maths · 10

Question 1 The integrating factor for $\frac{dy}{dx} + 3y = e^x$ is:

- **A.** e^{3x}
- **B.** e^{-3x}
- **C.** $3x$
- **D.** e^{x}

Question 2 The integrating factor for $\frac{dy}{dx} + \frac{2}{x}y = 1$ is:

- **A.** $2x$
- **B.** x^2
- **C.** $\ln x^2$
- **D.** e^{2x}

Question 3 Roots $m = 2,\ -1$ give CF:

- **A.** $(A + Bx)e^{2x}$
- **B.** $Ae^{2x} + Be^{-x}$
- **C.** $e^{2x}(A\cos x + B\sin x)$
- **D.** $Ae^{x} + Be^{-2x}$

Question 4 A repeated root $m = 3$ gives CF:

- **A.** $(A + Bx)e^{3x}$
- **B.** Ae^{3x}
- **C.** $Ae^{3x} + Be^{-3x}$
- **D.** $e^{3x}(A\cos x + B\sin x)$

Question 5 Roots $m = -1 \pm 2i$ give CF:

- **A.** $e^{-x}(A\cos 2x + B\sin 2x)$
- **B.** $e^{x}(A\cos 2x + B\sin 2x)$
- **C.** $Ae^{-x} + Be^{2x}$
- **D.** $e^{-2x}(A\cos x + B\sin x)$

Question 6 To find a PI for $y'' - y = e^x$ you should try:

- **A.** λe^{x}
- **B.** $\lambda x e^{x}$

- ◯ **C.** $\lambda x^2 e^x$
- ◯ **D.** $\lambda \sin x$

Question 7 The period of motion with $\ddot{x} = -25x$ is:

- ◯ **A.** $\frac{2\pi}{5}$
- ◯ **B.** 5π
- ◯ **C.** $\frac{2\pi}{25}$
- ◯ **D.** $\frac{\pi}{5}$

Question 8 When should initial conditions be applied?

- ◯ **A.** to the CF only
- ◯ **B.** to the PI only
- ◯ **C.** to the full general solution
- ◯ **D.** before solving

Question 9 Roots $m = -1, -3$ correspond to:

- ◯ **A.** underdamped motion
- ◯ **B.** critically damped motion
- ◯ **C.** overdamped motion
- ◯ **D.** no damping

Question 10 The solution of $\frac{dy}{dx} = ky$ is:

- ◯ **A.** $y = Ae^{kx}$
- ◯ **B.** $y = kx + A$
- ◯ **C.** $y = A \ln x$
- ◯ **D.** $y = Ae^{x/k}$

Answer grid - Differential equations

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Question	Answer	Explanation
1	**A**	$e^{\int 3dx}$.
2	**B**	$e^{2\ln x} = x^2$.
3	**B**	Distinct real roots.
4	**A**	Repeated root.
5	**A**	$p = -1$, $q = 2$.
6	**B**	e^x is in the CF ($m = 1$).
7	**A**	$\omega = 5$.
8	**C**	CF + PI first.
9	**C**	Two distinct real roots.
10	**A**	Standard exponential growth/decay.