

Problem set-3 for MA1201

Prepared by Dr. Asit Saha

Lecture-9: Class Problems: (Linear differential equations of higher order)

1. Solve: $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$. Ans: $y = c_1e^{2x} + c_2e^{3x}$.
2. Solve: $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 0$. Ans: $y = (c_1 + c_2x)e^{2x}$.
3. Solve: $\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} + 4y = 0$. Ans: $y = (c_1 + c_2x)e^{2x} + c_3e^{-x}$.
4. Solve: $(D^2 - 2D + 2)y = 0$, where $D \equiv \frac{d}{dx}$, Ans: $y = e^x\{c_1 \cos x + c_2 \sin x\}$.

Homework:

1. Solve: $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 9y = 0$. Ans: $y = (c_1 + c_2x)e^{-3x}$.
2. Solve: $\frac{d^2y}{dx^2} + 4y = 0$. Ans: $y = c_1 \cos 2x + c_2 \sin 2x$.
3. Solve: $(D^2 - D + 1)y = 0$, where $D \equiv \frac{d}{dx}$.

Lecture-10: Class Problems: (Linear differential equations of higher order)

1. Solve: $(D^3 + D^2 + 4D + 4)y = 0$, where $D \equiv \frac{d}{dx}$.
2. Solve: $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = 0$.
3. Solve: $(D - 2)^3(D^2 + 1)y = 0$, where $D \equiv \frac{d}{dx}$.
4. Solve: $(D^2 + 5D + 6)y = e^{2x}$, where $D \equiv \frac{d}{dx}$, Ans: $y = c_1e^{2x} + c_2e^{-3x} + \frac{1}{20}e^{2x}$.

Homework:

1. Solve: $\frac{d^3y}{dx^3} + 7\frac{d^2y}{dx^2} - 6y = 0$.
2. Solve $(D^2 + 5D + 6)y = e^{-2x}$, where $D \equiv \frac{d}{dx}$, Ans: $y = c_1e^{2x} + c_2e^{-3x} + xe^{-2x}$.

Lecture-11: Class Problems: (Linear differential equations of higher order)

1. Solve: $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} + \frac{dy}{dx} = e^{2x} + \sin 2x$, $PI = \frac{1}{18}e^{2x} + \frac{6}{100}\cos 2x - \frac{8}{100}\sin 2x$.
2. Solve: $\frac{d^2y}{dx^2} - 4y = x^2$. $PI = -\frac{1}{8}(2x^2 + 1)$.
3. Solve: $(D^2 - 4D + 3)y = \sin 3x \cos 2x$, where $D \equiv \frac{d}{dx}$.

Homework:

1. Solve: $\frac{d^2y}{dx^2} + \frac{dy}{dx} = x^2 + 2x + 4$, $PI = \frac{x^3}{3} + 4x - 4$.
2. Solve: $\frac{d^3y}{dx^3} + 4\frac{dy}{dx} = \sin 2x$, $PI = -\frac{1}{8}x \sin 2x$.

Lecture-12: Class Problems: (Linear differential equations of higher order)

1. Solve: $(D^2 - 2D + 4)y = e^x \cos x$, $PI = \frac{1}{2}e^x \cos x$.
2. Solve: $(D^2 - 2D + 1)y = xe^x \sin x$, $PI = e^x(-2 \cos x - x \sin x)$.
3. *Solve: $(D^2 - 1)y = x \sin 3x$, where $D \equiv \frac{d}{dx}$.

Homework:

1. Solve: $(D^3 + 1)y = \cos(2x - 1)$, $PI = \frac{1}{65}\cos(2x - 1) - \frac{8}{65}\sin(2x - 1)$.
2. *Solve: $(D^2 + 1)y = x \sin^2 x$, where $D \equiv \frac{d}{dx}$.

Problems for Remedial Class:

1. Solve: $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = 0$.
2. Solve: $\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 16y = 0$.
3. Solve: $(D - 2)^2y = e^{2x} + \sin 2x$, where $D \equiv \frac{d}{dx}$.
4. Solve: $\frac{d^2y}{dx^2} + 9y = 3x^3$.