Mon | Tue | Wed | Thu | Fri | Sat

Question # 15

$$y''' + 4y'' - 5y' = 0$$

Auxiliary eqn

$$m^3 + 4m^2 - 5m = 0$$

$$m(m^2 + 4m - 5) = 0$$

$$m(m^2 + 5m - m - 5) = 0$$

$$m(m(m+5) - 1(m+5)) = 0$$

$$m(m-1)(m+5) = 0$$

$$m = 0 \quad m - 1 = 0 \quad m + 5 = 0$$

$$m = 0 \quad m = 1 \quad m = -5$$

$$m = (0, 1, -5)$$

$$y(x) = c_1 e^{0x} + c_2 e^{x} + c_3 e^{-5x}$$

Question # 16

$$y''' - y = 0$$

$$m^3 - m = 0 \qquad m^3 - 1 = 0$$

$$(m)^3 - (1)^3$$

$$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

$$(m-1)(m^2 + m + 1) = 0$$

$$a = 1 \quad b = 1 \quad c = 1$$

$$\frac{-(1) \pm \sqrt{1-4}}{2}$$

$$\frac{-1 \pm \sqrt{-3}}{2} \Rightarrow -\frac{1}{2} \pm \frac{\sqrt{3}i}{2}$$

$m=1 \quad m: -\frac{1}{2} - \frac{\sqrt{3}}{2}i, -\frac{1}{2} + \frac{\sqrt{3}}{2}i$

$$y(x) = c_1 e^{x} + e^{-1/2}\left[c_1 \cos\frac{\sqrt{3}}{2}x + c_2 \sin\frac{\sqrt{3}}{2}x\right]$$

Question #17

$$y''' - 5y'' + 3y' + 9y = 0$$

$$m^3 - 5m^2 + 3m + 9 = 0$$

	1	-5	3	9
3		3	-6	-9
	1	-2	-3	0

$$m^2 - 2m - 3 = 0$$

$$m^2 - 3m + m - 3 = 0$$

$$m(m-3) + 1(m-3) = 0$$

$$m + 1 = 0, \quad m - 3 = 0$$

$$m = -1 \qquad m = 3$$

$$y = c_1 e^{-1x} + c_2 e^{3x} + c_3 e^{3x}$$

Question # 018

$$y''' + 3y'' - 4y' - 12y = 0$$

$$m^3 + 3m^2 - 4m - 12 = 0$$

	1	3	-4
-2		-2	-2
	1	1	-6

$$(m+2)(m^2 + m - 6) = 0$$

$$m^2 + 3m - 2m - 6 = 0$$

$$m(m+3) - 2(m+3) = 0$$

$$m + 3 = 0, \quad m - 2 = 0$$

$$m = -3 \qquad m = 2$$

$$m = (-2, -3, 2)$$

$$y = c_1 e^{-2x} + c_2 e^{-3x} + c_3 e^{2x}$$

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Question # 19

$$\frac{d^3u}{dt^3} + \frac{d^2u}{dt^2} - 2u = 0$$

Auxiliary equation

$$m^3 + m^2 - 2u = 0$$

$$m^3u + m^2u - 2u = 0$$

$$(m^3 + m^2 - 2)u = 0$$

$$m^3 + m^2 - 2 = 0$$

	1	0	-2
1		1	2	2
	1	2	2	0

$$(m-1)(m^2 + 2m + 2) = 0$$

$$(m^2 + 2m + 2) = 0$$

$$= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$a = 1 \quad b = 2 \quad c = 2$

$$= \frac{-(2) \pm \sqrt{(2)^2 - 4(1)(2)}}{2(1)}$$

$$= \frac{-2 \pm \sqrt{4 - 8}}{2}, \quad \frac{-2 \pm \sqrt{-4}}{2}$$

$$= \frac{-2 \pm 2i}{2} = 1 \pm 1i$$

$$y = c_1e^t + e^{1t}[c_2\cos t + c_2\sin t]$$