Discussion 5

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a)

$$\frac{\mathrm{d}^2y}{\mathrm{d}x^2} + x(y-1) = 0 \implies \frac{\mathrm{d}^2y}{\mathrm{d}x^2} + xy - x = 0 \implies \frac{\mathrm{d}^2y}{\mathrm{d}x^2} + xy = x$$

This DE is of the form $L(y) = g(x)$ where

$$L = D^2 + x \qquad \text{and} \qquad g(x) = x \not\equiv 0$$

making it **nonhomogenous**.

b)

$$y'' + y' = \mathrm{e}^{3x}$$

This DE is of the form $L(y) = g(x)$ where

$$L = D^2 + D \qquad \text{and} \qquad g(x) = \mathrm{e}^{3x} \not\equiv 0$$

making it **nonhomogenous**.

c)

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

This DE is of the form $L(y) = 0$ where

$$L = xD^3 + xD - 3$$

making it **homogenous**.

d)

$$\frac{\mathrm{d}x}{\mathrm{d}y} + 5y = 0$$

This DE is of the form $L(y) = 0$ where

$$L = D + 5$$

making it **homogenous**.