Equation-Writing in Latex

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1 Linear Differential Equation

$$\frac{d^2w}{dx^2} - \frac{4u^2w}{l^2} = \frac{-qlx}{2D} + \frac{qx^2}{2D}$$

Here u, l, q, D are constants.

Auxiary Equation is

$$D^2 - \frac{4u^2}{l^2}w = 0$$

$$(D + \frac{2u}{l})(D - \frac{2u}{l}) = 0$$

$$D = \frac{-2u}{l}, \frac{2u}{l}$$

So C.F is

$$C_1e^{\frac{-2ux}{l}} + C_2e^{\frac{2ux}{l}}$$

or

$$C_1cosh(\frac{2u}{l})x$$

Because

$$cosh(x) = \frac{e^-x + e^x}{2}$$

Now Particular Integral (P. I) is

$$PI = \frac{1}{(D^2 - \frac{4u^2}{l^2})}(\frac{-qlx}{2D} + \frac{qx^2}{2D})$$

$$= \frac{-q}{2D}\frac{1}{(D^2 - \frac{4u^2}{l^2})}(lx - x^2)$$

$$= \frac{-ql}{2D}\frac{1}{(D^2 - (\frac{2u}{l})^2)}x + \frac{q}{2D}\frac{1}{(D^2 - (\frac{2u}{l})^2)}x^2$$

Taking 4u$\hat{2}$/l$\hat{2}$ common from denominator

$$= \frac{-ql}{2D}\frac{l^2}{-4u^2}(1 + \frac{-l^2D^2}{4u^2})^-1 + \frac{q}{2D}\frac{l^2}{-4u^2}(1 + \frac{-l^2D^2}{4u^2})^-1$$

Solving binomial as it is of the form

$$(1-x)^-1 = 1 + x^2 + x^3 + ...$$

$$= \frac{ql^3}{8Du^2}(1 + \frac{l^4D^4}{16u^4} + ...)x + \frac{-ql^2}{8Du^2}(1 + \frac{l^4D^4}{16u^4} + ...)x^2$$

$$= \frac{ql^3x}{8Du^2} - \frac{ql^2x^2}{8Du^2}$$

Solution of Differential Equation is C. S = A. E + P. I

$$w = C_1cosh(\frac{2u}{l})x + \frac{ql^3x}{8Du^2} - \frac{ql^2x^2}{8Du^2}$$