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Civil Engineering
181ENG03102z

a) $dy/dx = 2\sinh x - y\tanh x$

$dy/dx + y\tanh x = \sinh x$

$P = \tanh x$

$Q = 2\sinh x$

$SP\,dx = \int \tanh x\,dx = \int \frac{\sinh x}{\cosh x}\,dx$

$\cosh x = u$

$\int \frac{\sinh x}{u}\,dx$

$u = \cosh x \quad dx = \frac{du}{\sinh x}$

$du/dx = \sinh x$

$\int 1/u\,du = \ln u = \ln \cosh x$

$I.F = e^{SP\,dx} = e^{\ln \cosh x}$

$I.F = \cosh x$

Then $y\ I.F = \int Q\ I.F\,dx$

$y\cosh x = \int 2\sinh x \cdot \cosh x\,dx$

$2\sin x \cos x = \sin(2x)$

$2\sinh x \cosh x = \sinh(2x)$

$y\cdot\cosh x = \frac{1}{2}\cdot 2\cosh x + c$

$\cosh x\,y = \cosh 2x + c$

$y = \frac{\cosh 2x}{\cosh x} + \frac{c}{\cosh x}$

$y = \frac{\cosh 2x + 2c}{\cosh x}$

Let $2c = A$

$y = \frac{\cosh 2x + A}{\cosh x}$

b) $dy/dx + 2y = e^{5x}$

$P = 2 \quad SP\,dx = 2x$

$Q = e^{5x}$

$I.F = e^{SP\,dx} = e^{2x}$

$y\ I.F = \int Q \cdot I.F\,dx$

$y\cdot e^{2x} = \int e^{5x}\cdot e^{2x}\,dx$

$y\cdot e^{2x} = \int e^{5x}\,dx$

$y\cdot e^{2x} = \frac{1}{5}e^{5x} + c$

$y = \frac{\frac{1}{5}e^{5x} + c}{e^{2x}}$

c) $2\,dy/dx = x^2 + 2x - 5$

$dy/dx = x + 2 - 3/x$

$\int dy/dx = \int x + 2 - 3/x\,dx$

$y = x^2/2 + 2x - 3\ln x + c$

d) $dy/dx + y/x = y^3$

$dy/dx\,y^{-3} + y^{-3}/x = 1 \quad (i)$

$z = y^{1-n}, \quad n = 3$

$z = y^{1-3}, \quad z = y^{-2} \quad (ii)$

$dz/dy = 2y^{-3}\,dy/dx \quad (iii)$

Then multiplying eqn(i) by $1-n$

$-2y^{-3}\,dy/dx - 2y^{-2}/x = -2$

and $dz/dy = -2y^{-3}\,dy/dx$

sub eqn(ii) & (iii) into (iv)

$dz/dy - 2z/x = -2$