

Linear First Order DE's
§9.5#5 $y' + 2y = 2e^x$

SOLUTION $y' + P(x)y = Q(x)$
 $I = e^{\int P(x) dx}$

• Find the integrating factor, I .
 $P(x) = 2$

$$I = e^{\int 2 dx} = e^{2x}$$

• Multiply through by I

$$e^{2x} y' + 2e^{2x} y = 2e^x \cdot e^{2x}$$

• Write the left hand side as
 $(Iy)'$

$$(e^{2x} y)' = 2e^{3x}$$

• Integrate both sides.

$$\int (e^{2x} y)' dx = \int 2e^{3x} dx + C$$

$$e^{2x} y = \frac{2}{3} e^{3x} + C$$

$$y = \frac{2e^{3x} + 3C}{3e^{2x}}$$

$$y = \frac{2e^{3x}}{3e^{2x}} + \frac{3C}{3e^{2x}}$$

$$y = \frac{2}{3} e^{3x} \cdot e^{-2x} + C e^{-2x}$$

$$y = \frac{2}{3} e^x + C e^{-2x}$$