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Math 2150, Fall 2006, Quiz 6
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1. Find the general solution to $y'' + 2y' - 3y = 0$.
2. Find the particular solution which satisfies $y(0) = 2$ and $y'(0) = -14$.
3. Does this solution ever equal 0? If so, where?

1. $r^2 + 2r - 3 = 0$

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

$r_1 = -3, \quad r_2 = 1$

$$\boxed{y = c_1 e^{-3t} + c_2 e^{t}}$$

2. $y' = -3c_1 e^{-3t} + c_2 e^{t}$ so

$$2 = y(0) = c_1 + c_2$$
$$-14 = y'(0) = -3c_1 + c_2$$

$$\left[\begin{array}{cc|c} 1 & 1 & 2 \\ -3 & 1 & -14 \end{array}\right] \xrightarrow{+3R_1} \left[\begin{array}{cc|c} 1 & 1 & 2 \\ 0 & 4 & -8 \end{array}\right] \xrightarrow{*\frac{1}{4}} \left[\begin{array}{cc|c} 1 & 1 & 2 \\ 0 & 1 & -2 \end{array}\right] \xrightarrow{-R_1} \left[\begin{array}{cc|c} 1 & 0 & 4 \\ 0 & 1 & -2 \end{array}\right]$$

$$\boxed{y = 4e^{-3t} - 2e^{t}}$$

3. $y = 0 \Rightarrow 0 = 4e^{-3t} - 2e^{t}$

$\Rightarrow 4e^{-3t} = 2e^{t}$

$\Rightarrow 2e^{-3t} = e^{t}$

$\Rightarrow 2 = e^{4t}$

$\Rightarrow t = \frac{1}{4}\ln 2$

$\approx .17$

$$\boxed{\text{Yes, } y = 0 \text{ at } t = \frac{1}{4}\ln 2}$$