Solve the given initial -value problem:

$$4y'' - 4y' - 3y = 0$$
, $y(0) = 1$, $y'(0) = 5$

SOL: linear DE u/ constant coef., homogeneous.

Aux equation:
$$4m^2 - 4m - 3 = 0$$

$$m = \frac{4 \pm \sqrt{(-4)^2 - 4(4)(-3)}}{2(4)} = \frac{4 \pm \sqrt{16 + 48}}{8}$$

$$= \frac{4 \pm \sqrt{64}}{8}$$

$$= \frac{4 \pm 8}{8}$$

$$= \frac{1}{2} \pm 1$$

 $M = -\frac{1}{2} \quad \text{or} \quad M = \frac{3}{3}$ distinct real roots (case I on p113)

$$y = c_1 e^{-x/2} + c_2 e^{3x/2}$$

Now substitute the initial conditions:

$$y(0) = 1 = C_1 e^0 + C_2 e^0 = C_1 + C_2$$

so $C_1 = 1 - C_2$

$$y' = c_1(-\frac{1}{2})e^{-x/2} + c_2(\frac{3}{2})e^{3x/2}$$

$$-\frac{(1-c_2)}{2} + \frac{3c_2}{2} = 5 \implies -\frac{c_1}{2} + \frac{3c_2}{2} = 5 \implies -1 + 4c_2 = 10 \implies c_2 = \frac{11}{4}, c_1 = 1 - \frac{11}{4} = \frac{-7}{4}$$

So
$$y = -\frac{7}{4}e^{-x/2} + \frac{11}{4}e^{3x/2}$$

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 $y_0 = y_0 - y_0$

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 $y^* = 2v^* + 10 = cos(2x)$

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