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Dis 2A

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$$tan\phi = -\frac{1}{\sqrt{3}} \Rightarrow \phi = -\frac{\pi}{6}$$

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$$0.2y'' + 5y = 0 or y'' + 25y = 0$$
$$\lambda^2 + 25 = 0 \Rightarrow \lambda = \pm 5$$
$$y(t) = C_1 cos5t + C_2 sin5t$$
$$\Rightarrow y'(t) = -5C_1 sin5t + 5C_2 cos5t$$
$$y(0) = 0.5 \Rightarrow C_1 = 0.5, y'(0) = 0 \Rightarrow C_2 = 0$$
$$y(t) = 0.5cos5t$$

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a:

$$k = 2kg/s^2$$

b:

$$y'' + 3y' + 2y = 0 \Rightarrow w_0 = \sqrt{2}, c = 1.5$$

$$\lambda^2 + 3\lambda + 2 = 0 \Rightarrow \lambda_1 = -1\lambda_2 = -2$$

$$y(t) = C_1 e^{-t} + C_2^{-2t} \Rightarrow y'(t) = -C_1 e^{-t} - 2C_2 e^{-2t}$$

$$y(t) = -3e^{-t} + 2e^{-2t}$$

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$$k = 1.5kg/s$$

$$0.1y'' + 1.5y' + 9.8y = 0 \text{ or } y'' + 15y' + 98y = 0$$

$$\lambda^2 + 15\lambda + 98 = 0 \Rightarrow \lambda = \frac{-15 \pm \sqrt{167}i}{2}$$

$$y(t) = e^{-\frac{15t}{2}}(C_1 cos\frac{167}{2}t + C_2 sin\frac{167}{2}t)$$

$$C_1 = \frac{1}{10}C_2 \approx 0.12$$

$$A = \sqrt{C_1^2 + C_2^2} = \approx 0.15, \phi \approx 0.86$$

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$$y(t) = ae^{-t} \Rightarrow y'(t) = -ae^{-t} \Rightarrow y''(t) = ae^{-t}$$
$$(ae^{-t}) + 6(-ae^{-t}) + 8(ae^{-t}) = -3e^{-t}$$
$$a = 3 \Rightarrow y_p = 3e^{-t}$$

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$$y(t) = acos3t + bsin3t$$
$$y'(t) = -3asin3t + 3cos3t$$
$$y''(t) = -9acos3t - 9bsin3t$$
$$-9acos3t - 9bsin3t + 7(-3asin3t + 3cos3t) +$$
$$6(y(t) = acos3t + bsin3t) = -4sin3t$$
$$\Rightarrow a + 21b = 0 \text{ and } -21a + b = -4$$
$$a = \frac{42}{221}, b = -\frac{2}{221}$$
$$y_p = \frac{42}{221}cos3t - \frac{2}{221}sin3t$$

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$$z = Ae^{i2t}$$
$$((2i)^2 + 7(2i) + 6)A = 3 \Rightarrow A = \frac{3}{100} - \frac{21i}{100}$$
$$z = (\frac{3}{100} - \frac{21i}{100})(cos2t + isin2t)$$
$$y(t) = -\frac{21}{100}cos2t + \frac{3}{100}sin2t$$

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$$y(t) = at^2 + bt + c$$
$$y'(t) = 2at + b$$
$$y''(t) = 2a$$
$$2a + 5(2at + b) + 6(at^2 + bt + c) = -t^2 + 4$$
$$a = -\frac{1}{6}, b = \frac{5}{18}, c = \frac{53}{108}$$
$$y(t) = -\frac{1}{6}t^2 + \frac{5}{18}t + \frac{53}{108}$$

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$$y_h = e^{-t}(C_1 costt + C_2 sint)$$
$$z = Ae^{i2t} \Rightarrow z' = (2i)Ai2t \Rightarrow z'' = 4i^2 Ae^{i2t}$$
$$A = -\frac{1}{5} - \frac{2}{5}i$$
$$y_p = \frac{1}{5}cos2t + \frac{2}{5}sin2t$$
$$y(t) = e^{-t}(C_1 costt + C_2 sint) + \frac{1}{5}cos2t + \frac{2}{5}sin2t$$
$$C_1 = -\frac{9}{5}C_2 = -\frac{13}{5}$$
$$y(t) = e^{-t}(-\frac{9}{5}costt + -\frac{13}{5}sint) + \frac{1}{5}cos2t + \frac{2}{5}sin2t$$

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$$y_h = (C_1 + C_2 t)e^{-2t}$$
$$y_p(t) = Ate^{=2t}$$
$$y_p'(t) = 2Ae^{-2t}(t - t^2)$$
$$y + p''(t) = 2Ae^{-2t}(2t^2 - 4t + 1)$$
$$A = 1$$
$$y_p = t^2 e^{-2t}$$

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$$y = at + b$$
$$25at + 25b = 2 + 3t$$
$$y = \frac{2}{25}t + \frac{3}{25}$$
$$\lambda^2 + 25 = 0 \Rightarrow \lambda = \pm 5i$$
$$z = Ate^{5it}$$
$$A = -\frac{1}{10i}$$
$$z = -\frac{1}{10}it(cos5t + isin5t)$$
$$y = \frac{2}{25}t + \frac{3}{25} + \frac{1}{10}tsin5t$$

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$$y = (at+b)e^{-3t}$$
$$y' = e^{-3t}((a-3b)-3at)$$
$$y'' = 3e^{-3t}((-2a+3b)+3at)$$
$$a = \frac{1}{20}, b = \frac{9}{400}$$
$$y = (\frac{1}{20}t + \frac{9}{400})e^{-3t}$$