Particular Solution :- $x = Ae^{-3t} + Be^{-2t} + 0.1\sin t + 0.1\cos t$.

when $t = 0$ $\quad x = 0.1 \quad \frac{dx}{dt} = 0$.

$0.1 = A + B + 0.1$

$A + B$

$dy = -3Ae^{-3t} - 2Be^{-2t} + 0.1\sin t + 0.1 t\cos t$.

$0 = -3A - 2B + 0.1$

from eqn (6) $\therefore B = -A$.

$0 = -3A - 2C - A + 0.1$

$0 = -A + 0.1$

$A = 0.1$

and $B = -A$.

$B = -0.1$

$GS = 0.1e^{-3t} - 0.1e^{-2t} + 0.1\sin t + 0.1\cos t$.

b.) Command window

```
clear
clc
close all
syms x t.
x = 0.1 * exp(-3 * t) - 0.1 * exp(-2 * t) + 0.1 * cos(3t) + 0.1 * sin t.
t = 0 : 0.01 : 15
Fun = Fun(t, x)
plot (t, Fun)
xlabel ('time')
grid on
grid minor
axis tight.
```

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Auxiliary equation = $m^2 + 5m + 6 = 0$.

$m^2 + 3m + 2m + 6 = 0$.

$m(m+3)\ 2(m+3) = 0$

$(m+2)(m+5) = 0$

$m_1 = -2 \quad m_2 = -5$.

$CF = Ae^{-2x} + Be^{-3x}$.

PI = $C\cos t + D\sin t$.

$\frac{dx}{dt} = -C\sin t + D\cos t$.

$\frac{d^2x}{dt^2} = -C\cos t - D\sin t$.

Putting the value $\frac{d^2x}{dt^2} + 8\frac{dx}{dt} + 6x$ in the eqn.

$-C\cos t - D\sin t + 5(-C\sin t + D\cos t) + 6(C\cos t + D\sin t) = \cos t$

Comparing Coeffcient

Coefficient of Cost : $-C + 5D + 6C = 1$.

Coefficient of Sint : $-D - 5C + 6D = 0$.

from equ (1) $5C + 5D = 1$

from eqn (2) $= 5D + 5C = 0$

from equ (1) $5D = 1 - 5C$.

Put eqn (5) in eqn (4)

$1 - 5C - 5C = 0$

$1 - 10C = 0$

$C = 1/10$

$5D = 1 - 5C$.

Put the value of C in eqn (5)

$5D = 1 - 5(0.1)$

$5D = 0.5$

$D = 0.5/5 = 0.1$

c) $0.1\cos t + 0.1\sin t = k(\sin(t+\alpha))$

$0.1\cos t + 0.1\sin t = k\sin t\cos\alpha + k\sin\alpha\cos t$

Comparing Coefficient

Coefficient of $\cos t$ $0.1 = k\sin\alpha$.

" $\sin t$ $0.1 = k\cos\alpha$

Square $k\sin\alpha$ and $k\cos\alpha$ and equate to the addition.

$k^2\sin^2\alpha + k^2\cos^2\alpha = 0.1 + 0.1$

$k^2(\sin^2\alpha + \cos^2\alpha) = 0.2$

$k^2 = 0.2$

$k = 2/100$

$k = \frac{\sqrt{2}}{10}$

$\frac{k\sin\alpha}{k\cos\alpha} = \frac{0.1}{0.1}$

$\tan\alpha = 1$

$\alpha = \tan^{-1}(1)$

$\theta = 45^\circ$ or $\frac{\pi}{4}$

In steady state;

$k_{ss} = \frac{\sqrt{2}}{10}\sin\left(\frac{\pi}{4} + t\right)$

$\sin t$.