

## QUESTION 2

```
commandwindow

clear

clc

syms T1(t) T2(t)
philip = [diff(T1,t) + 3*T2 == exp(-2*t), diff(T2,t) - 3*T1 == exp(2*t)]
philipcondition = [T1(0)==30, T2(0)==30]
phil = dsolve(philip, philipcondition)
T1 = phil.T1
T2 = phil.T2
pretty (T1)
pretty (T2)
pn = [0:0.1:3.5]
T1n = subs(T1, pn)
T2n = subs(T2, pn)
figure (1)
plot(pn,T1n,pn,T2n)
axis tight
grid minor
xlabel ('pn')
ylabel ('T1n,T2n')
```

philip(t) =

[ 3\*T2(t) + diff(T1(t), t) == exp(-2\*t), diff(T2(t), t) - 3\*T1(t) == exp(2\*t)]

philipcondition =

[ T1(0) == 30, T2(0) == 30]

phil =

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struct with fields:

T2: [1×1 sym]

T1: [1×1 sym]

T1 =

$$(5 \cdot 12170^{1/2} \cdot \cos(3t + \operatorname{atan}(77/79))) / 13 - (3 \cdot \exp(2t)) / 13 - (2 \cdot \exp(-2t)) / 13$$

T2 =

$$(3 \cdot \exp(-2t)) / 13 + (2 \cdot \exp(2t)) / 13 + (5 \cdot 12170^{1/2} \cdot \cos(3t - \operatorname{atan}(79/77))) / 13$$

$$\frac{\sqrt{12170} \cos(3t + \operatorname{atan}\left(\frac{77}{79}\right))}{13} - \frac{\exp(2t)}{13} - \frac{\exp(-2t)}{13}$$

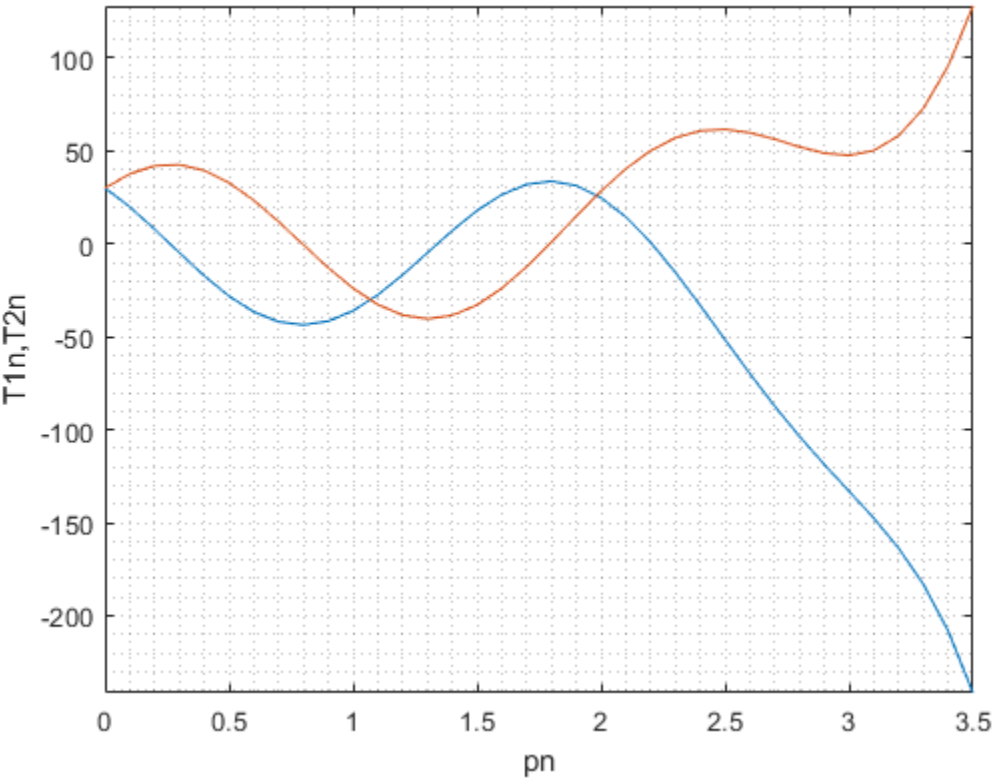
$$\frac{\sqrt{12170} \cos(3t - \operatorname{atan}\left(\frac{79}{77}\right))}{13} + \frac{\exp(2t)}{13} + \frac{\exp(-2t)}{13}$$

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$$\frac{\exp(-2t)^3 - \exp(2t)^2}{13} \sqrt{77} //$$

----- + ----- + -----

13                      13                      13



pn =

Columns 1 through 7

0      0.1000      0.2000      0.3000      0.4000      0.5000      0.6000

Columns 8 through 14

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0.7000      0.8000      0.9000      1.0000      1.1000      1.2000      1.3000

Columns 15 through 21

1.4000      1.5000      1.6000      1.7000      1.8000      1.9000      2.0000

Columns 22 through 28

2.1000      2.2000      2.3000      2.4000      2.5000      2.6000      2.7000

Columns 29 through 35

2.8000      2.9000      3.0000      3.1000      3.2000      3.3000      3.4000

Column 36

3.5000

T1n =

```
[ 30, (5*12170^(1/2)*cos(atan(77/79) + 3/10))/13 - (3*exp(1/5))/13 - (2*exp(-1/5))/13,  
(5*12170^(1/2)*cos(atan(77/79) + 3/5))/13 - (3*exp(2/5))/13 - (2*exp(-2/5))/13,  
(5*12170^(1/2)*cos(atan(77/79) + 9/10))/13 - (3*exp(3/5))/13 - (2*exp(-3/5))/13,  
(5*12170^(1/2)*cos(atan(77/79) + 6/5))/13 - (3*exp(4/5))/13 - (2*exp(-4/5))/13,  
(5*12170^(1/2)*cos(atan(77/79) + 3/2))/13 - (3*exp(1))/13 - (2*exp(-1))/13,
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(5*12170^(1/2)*cos(atan(77/79) + 9/5))/13 - (3*exp(6/5))/13 - (2*exp(-6/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 21/10))/13 - (3*exp(7/5))/13 - (2*exp(-7/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 12/5))/13 - (3*exp(8/5))/13 - (2*exp(-8/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 27/10))/13 - (3*exp(9/5))/13 - (2*exp(-9/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 3))/13 - (3*exp(2))/13 - (2*exp(-2))/13,
(5*12170^(1/2)*cos(atan(77/79) + 33/10))/13 - (3*exp(11/5))/13 - (2*exp(-11/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 18/5))/13 - (3*exp(12/5))/13 - (2*exp(-12/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 39/10))/13 - (3*exp(13/5))/13 - (2*exp(-13/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 21/5))/13 - (3*exp(14/5))/13 - (2*exp(-14/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 9/2))/13 - (3*exp(3))/13 - (2*exp(-3))/13,
(5*12170^(1/2)*cos(atan(77/79) + 24/5))/13 - (3*exp(16/5))/13 - (2*exp(-16/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 51/10))/13 - (3*exp(17/5))/13 - (2*exp(-17/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 27/5))/13 - (3*exp(18/5))/13 - (2*exp(-18/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 57/10))/13 - (3*exp(19/5))/13 - (2*exp(-19/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 6))/13 - (3*exp(4))/13 - (2*exp(-4))/13,
(5*12170^(1/2)*cos(atan(77/79) + 63/10))/13 - (3*exp(21/5))/13 - (2*exp(-21/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 33/5))/13 - (3*exp(22/5))/13 - (2*exp(-22/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 69/10))/13 - (3*exp(23/5))/13 - (2*exp(-23/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 36/5))/13 - (3*exp(24/5))/13 - (2*exp(-24/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 15/2))/13 - (3*exp(5))/13 - (2*exp(-5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 39/5))/13 - (3*exp(26/5))/13 - (2*exp(-26/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 81/10))/13 - (3*exp(27/5))/13 - (2*exp(-27/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 42/5))/13 - (3*exp(28/5))/13 - (2*exp(-28/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 87/10))/13 - (3*exp(29/5))/13 - (2*exp(-29/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 9))/13 - (3*exp(6))/13 - (2*exp(-6))/13,
(5*12170^(1/2)*cos(atan(77/79) + 93/10))/13 - (3*exp(31/5))/13 - (2*exp(-31/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 48/5))/13 - (3*exp(32/5))/13 - (2*exp(-32/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 99/10))/13 - (3*exp(33/5))/13 - (2*exp(-33/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 51/5))/13 - (3*exp(34/5))/13 - (2*exp(-34/5))/13,
(5*12170^(1/2)*cos(atan(77/79) + 21/2))/13 - (3*exp(7))/13 - (2*exp(-7))/13]
```

T2n =

```
[ 30, (3*exp(-1/5))/13 + (2*exp(1/5))/13 + (5*12170^(1/2)*cos(atan(79/77) - 3/10))/13,
(3*exp(-2/5))/13 + (2*exp(2/5))/13 + (5*12170^(1/2)*cos(atan(79/77) - 3/5))/13,
(3*exp(-3/5))/13 + (2*exp(3/5))/13 + (5*12170^(1/2)*cos(atan(79/77) - 9/10))/13,
(3*exp(-4/5))/13 + (2*exp(4/5))/13 + (5*12170^(1/2)*cos(atan(79/77) - 6/5))/13,
(3*exp(-1))/13 + (2*exp(1))/13 + (5*12170^(1/2)*cos(atan(79/77) - 3/2))/13, (3*exp(-
6/5))/13 + (2*exp(6/5))/13 + (5*12170^(1/2)*cos(atan(79/77) - 9/5))/13, (3*exp(-
7/5))/13 + (2*exp(7/5))/13 + (5*12170^(1/2)*cos(atan(79/77) - 21/10))/13, (3*exp(-
8/5))/13 + (2*exp(8/5))/13 + (5*12170^(1/2)*cos(atan(79/77) - 12/5))/13, (3*exp(-
9/5))/13 + (2*exp(9/5))/13 + (5*12170^(1/2)*cos(atan(79/77) - 27/10))/13, (3*exp(-
2))/13 + (2*exp(2))/13 + (5*12170^(1/2)*cos(atan(79/77) - 3))/13, (3*exp(-11/5))/13 +
(2*exp(11/5))/13 + (5*12170^(1/2)*cos(atan(79/77) - 33/10))/13, (3*exp(-12/5))/13 +
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$$\begin{aligned} & (2\exp(12/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 18/5))/13, (3\exp(-13/5))/13 + \\ & (2\exp(13/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 39/10))/13, (3\exp(-14/5))/13 + \\ & (2\exp(14/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 21/5))/13, (3\exp(-3))/13 + \\ & (2\exp(3))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 9/2))/13, (3\exp(-16/5))/13 + \\ & (2\exp(16/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 24/5))/13, (3\exp(-17/5))/13 + \\ & (2\exp(17/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 51/10))/13, (3\exp(-18/5))/13 + \\ & (2\exp(18/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 27/5))/13, (3\exp(-19/5))/13 + \\ & (2\exp(19/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 57/10))/13, (3\exp(-4))/13 + \\ & (2\exp(4))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 6))/13, (3\exp(-21/5))/13 + \\ & (2\exp(21/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 63/10))/13, (3\exp(-22/5))/13 + \\ & (2\exp(22/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 33/5))/13, (3\exp(-23/5))/13 + \\ & (2\exp(23/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 69/10))/13, (3\exp(-24/5))/13 + \\ & (2\exp(24/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 36/5))/13, (3\exp(-5))/13 + \\ & (2\exp(5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 15/2))/13, (3\exp(-26/5))/13 + \\ & (2\exp(26/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 39/5))/13, (3\exp(-27/5))/13 + \\ & (2\exp(27/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 81/10))/13, (3\exp(-28/5))/13 + \\ & (2\exp(28/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 42/5))/13, (3\exp(-29/5))/13 + \\ & (2\exp(29/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 87/10))/13, (3\exp(-6))/13 + \\ & (2\exp(6))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 9))/13, (3\exp(-31/5))/13 + \\ & (2\exp(31/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 93/10))/13, (3\exp(-32/5))/13 + \\ & (2\exp(32/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 48/5))/13, (3\exp(-33/5))/13 + \\ & (2\exp(33/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 99/10))/13, (3\exp(-34/5))/13 + \\ & (2\exp(34/5))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 51/5))/13, (3\exp(-7))/13 + \\ & (2\exp(7))/13 + (5 \cdot 12170^{(1/2)} \cdot \cos(\operatorname{atan}(79/77) - 21/2))/13] \end{aligned}$$