```
> # 1
> get_decay_constant := proc(T12)
    return ln(2)/T12
  end
```

$$get\_decay\_constant := \mathbf{proc}(T12)\ \mathbf{return}\ \ln(2)/T12\ \mathbf{end\ proc} \tag{1}$$

```
> evalf(get_decay_constant(5730))
```

$$0.0001209680943 \tag{2}$$

```
> evalf(get_decay_constant(4.468e9))
```

$$1.551358954 \times 10^{-10} \tag{3}$$

```
> evalf(get_decay_constant(706e6))
```

$$9.817948734 \times 10^{-10} \tag{4}$$

```
> # 2
> F := unapply(rhs(dsolve([diff(x(t),t) = -k*x(t), x(0) = 3], x(t))), k, t)
```

$$F := (k,t) \mapsto 3\cdot e^{-t\cdot k} \tag{5}$$

```
> k0 := solve(F(k,2) = 0.9, k)
```

$$k0 := 0.6019864022 \tag{6}$$

```
> T12 := evalf(ln(2)/k0)
```

$$T12 := 1.151433285 \tag{7}$$

```
> # 3
> k0 := evalf(ln(2)/5730)
```

$$k0 := 0.0001209680943 \tag{8}$$

```
> F := unapply(rhs(dsolve([diff(x(t),t) = -k0*x(t), x(0) = q], x(t))), c, t)
```

$$F := (c,t) \mapsto q\cdot e^{-\frac{1209680943\cdot t}{10000000000000}} \tag{9}$$

```
> # F(T)=x1 => x1 over x0 = p over 100, but e^(-kt) = x1 over x0
> solve(exp(-k0*T) = 91.57/100, T)
```

$$728.0141047 \tag{10}$$

```
> solve(exp(-k0*T) = 93.021/100, T)
```

$$598.0495294 \tag{11}$$

```
> # 4
  restart;
> N_eq(T_env) := diff(T(t),t) = -k*(T(t) - T_env)
```

$$N\_eq := T\_env \mapsto \frac{d}{dt}T(t) = -k\cdot(T(t) - T\_env) \tag{12}$$

```
> TF := unapply(rhs(dsolve([N_eq(21), T(0) = 34.22], T(t))), k, t)
```

$$TF := (k,t) \mapsto 21 + \frac{661\cdot e^{-t\cdot k}}{50} \tag{13}$$

```
>
> sol := solve([ TF(k, 1) = 34.11], k)
```

$$sol := \{k = 0.008355536648\} \quad (14)$$

```
> k := rhs(sol[1] )
```

$$k := 0.008355536648 \quad (15)$$

```
>
> TF_sol(t) := TF(k, t)
```

$$TF\_sol := t \mapsto TF(k, t) \quad (16)$$

```
> h_rel := solve(TF_sol(x) = 36, x)
```

$$h\_rel := -15.11804352 \quad (17)$$

```
> 24 + 11.5 + h_rel
```

$$20.38195648 \quad (18)$$

```
> #5
  restart;
```

```
> Tout(t) := 35·exp( -(t - 12)^2 / 74 )
```

$$Tout := t \mapsto 35 \cdot e^{-\frac{(t-12)^2}{74}} \quad (19)$$

```
> T0 := 15
```

$$T0 := 15 \quad (20)$$

```
> k := 0.2
```

$$k := 0.2 \quad (21)$$

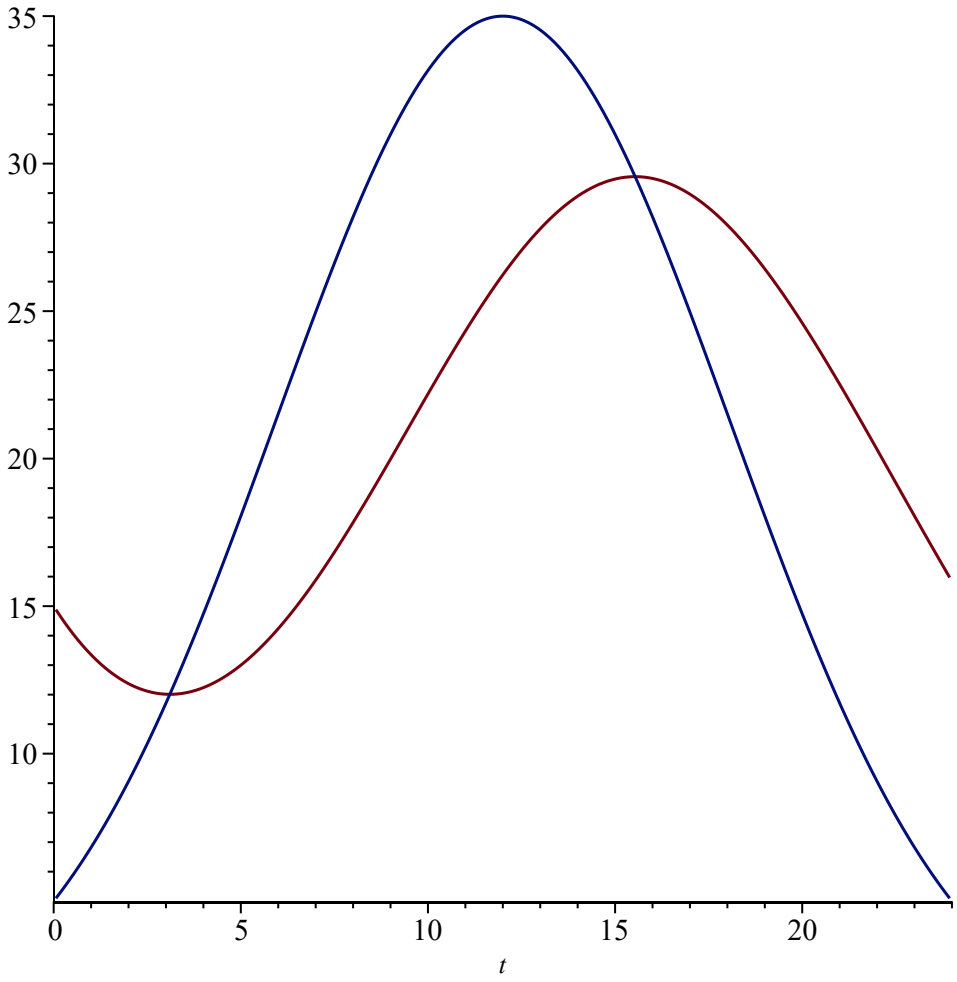
```
>
> N_eq_var := diff(T(t), t) = -k·(T(t) - Tout(t))
```

$$N\_eq\_var := \frac{d}{dt} T(t) = -0.2\, T(t) + 7.0\, e^{-\frac{(t-12)^2}{74}} \quad (22)$$

```
> TF := unapply(rhs(dsolve([N_eq_var, T(0) = T0], T(t))), t)
```

$$TF := t \mapsto \frac{1}{2}\left(\left(7 \cdot \sqrt{\pi} \cdot e^{\frac{157}{50}} \cdot \sqrt{74} \cdot \operatorname{erf}\left(\frac{97 \cdot \sqrt{74}}{370}\right) + 7 \cdot \sqrt{\pi} \cdot e^{\frac{157}{50}} \cdot \sqrt{74} \cdot \operatorname{erf}\left(\frac{\sqrt{74} \cdot (5 \cdot t - 97)}{370}\right) + 30\right) \cdot e^{-\frac{t}{5}}\right) \quad (23)$$

```
> plot([TF(t), Tout(t) ], t = 0 ..24)
```


35
30
25
20
15
10
0
5
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t