```
> restart
```

HW #3
Problem 1
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Helpful functions

```
> with(inttrans):
> u := t -> Heaviside(t):
> PAR := (Za, Zb) -> simplify( Za·Zb / (Za + Zb) ):
> SCS := X -> sort(collect(simplify(expand(numer(X))/expand(denom(X))), s), s):
> IL := (X, s, t) -> simplify(convert(invlaplace(convert(X, parfrac, s), s, t), expsincos)):
> ILTS := (X, s, t) -> simplify(convert(invlaplace(X, s, t), expsincos)):

> R := SCS(laplace((u(t)), t, s))
```

$$R := \frac{1}{s} \tag{1}$$

a)

```
> H := 2/(s + 2):
> C := R·H:
> c = IL(C, s, t)
```

$$c = -e^{-2t} + 1 \tag{2}$$

b)

```
> H := 5/((s + 3)·(s + 6))
```

$$H := \frac{5}{(s+3)\,(s+6)} \tag{3}$$

```
> C := R·H:
> c = IL(C, s, t)
```

$$c = -\frac{5\,e^{-3t}}{9} + \frac{5\,e^{-6t}}{18} + \frac{5}{18} \tag{4}$$

c)

```
> H := 10(s + 7)/((s + 10)·(s + 20))
```

$$H := \frac{10s + 70}{(s+10)\,(s+20)} \tag{5}$$

```
> C := R·H:
> c = IL(C, s, t)
```

$$c = -\frac{13\,e^{-20t}}{20} + \frac{3\,e^{-10t}}{10} + \frac{7}{20} \tag{6}$$

d)

> $H := \dfrac{20}{s^2 + 6\,s + 144}$

$$H := \frac{20}{s^2 + 6\,s + 144} \tag{7}$$

> $C := R \cdot H$:

> $c = IL(C, s, t)$

$$c = -\frac{e^{-3\,t}\sin\left(3\sqrt{15}\,t\right)\sqrt{15}}{108} - \frac{5\,e^{-3\,t}\cos\left(3\sqrt{15}\,t\right)}{36} + \frac{5}{36} \tag{8}$$

d)

> $H := \dfrac{s + 2}{s^2 + 9}$

$$H := \frac{s + 2}{s^2 + 9} \tag{9}$$

> $C := R \cdot H$:

> $c = IL(C, s, t)$

$$c = -\frac{2\cos(3\,t)}{9} + \frac{\sin(3\,t)}{3} + \frac{2}{9} \tag{10}$$

e)

> $H := \dfrac{s + 5}{(s + 10)^2}$

$$H := \frac{s + 5}{(s + 10)^2} \tag{11}$$

> $C := R \cdot H$:

> $c = IL(C, s, t)$

$$c = \frac{1}{20} + \frac{e^{-10\,t}\,(-1 + 10\,t)}{20} \tag{12}$$

>