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```
> restart
```

I'll start by defining some useful functions

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> with(inttrans) :
> u := t → Heaviside(t) :
> SCS := X → sort(collect(simplify(expand(numer(X))/expand(denom(X)), s), s)
```

$$SCS := X \mapsto sort\left(collect\left(simplify\left(\frac{expand(numer(X))}{expand(denom(X))}\right), s\right), s\right) \quad (1)$$

Nise 2.1

a)

```
> SCS(laplace((u(t)), t, s))
```

$$\frac{1}{s} \quad (2)$$

b)

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> SCS(laplace(t·u(t), t, s))
```

$$\frac{1}{s^2} \quad (3)$$

c)

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> SCS(laplace(sin(omega · t) · u(t), t, s))
```

$$\frac{\omega}{s^2 + \omega^2} \quad (4)$$

d)

```
> SCS(laplace(cos(omega · t) · u(t), t, s))
```

$$\frac{s}{s^2 + \omega^2} \quad (5)$$

Nise 2.2

a)

```
> eqn2A := exp(-a · t) · sin(omega · t) · u(t)
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$$eqn2A := e^{-a\,t} \sin(\omega\, t)\ \text{Heaviside}(t) \quad (6)$$

```
> SCS(laplace(eqn2A, t, s))
```

$$\frac{\omega}{s^2 + 2\,a\,s + a^2 + \omega^2} \quad (7)$$

b)

```
> eqn2B := exp(-a*t)*cos(omega*t)*u(t)
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$$eqn2B := e^{-a\,t} \cos(\omega\, t)\ \text{Heaviside}(t) \quad (8)$$

```
> SCS(laplace(eqn2B, t, s))
```

$$\frac{s + a}{s^2 + 2\,a\,s + a^2 + \omega^2} \quad (9)$$

c)

> $eqn2C := t^3 \cdot u(t)$

$$eqn2C := t^3 \,\text{Heaviside}(t) \tag{10}$$

> $SCS(laplace(eqn2C, t, s))$

$$\frac{6}{s^4} \tag{11}$$

Nise 2.6

a)

> $eqn6A := 8 \cdot t^2 \cdot \cos\left(3 \cdot t + \frac{45 \cdot \text{Pi}}{180}\right) \cdot \text{Heaviside}(t)$

$$eqn6A := 8\, t^2 \cos\left(3\, t + \frac{\pi}{4}\right) \text{Heaviside}(t) \tag{12}$$

> $simplify(SCS(laplace(eqn6A, t, s)))$

$$\frac{8\sqrt{2}\,(s+3)\left(s^2 - 12\,s + 9\right)}{\left(s^2+9\right)^3} \tag{13}$$

b)

> $eqn6B := 3 \cdot t \cdot \exp(-2 \cdot t) \cdot \sin\left(4 \cdot t + \frac{60 \cdot \text{Pi}}{180}\right) \cdot \text{Heaviside}(t)$

$$eqn6B := 3\, t\, e^{-2\,t} \sin\left(4\, t + \frac{\pi}{3}\right) \text{Heaviside}(t) \tag{14}$$

> $SCS(laplace(eqn6B, t, s))$

$$\frac{3\sqrt{3}\,s^2 + \left(12\sqrt{3} + 24\right)s - 36\sqrt{3} + 48}{2\left(s^2 + 4\,s + 20\right)^2} \tag{15}$$

>