MAT250 Assignment 4
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Problem 1

```
> with(inttrans):
> invlaplace(1/(s-4), s, t)
```

$$e^{4t} \quad (1)$$

```
> invlaplace(1/(s^2+3), s, t)
```

$$\frac{\sqrt{3}\,\sin(\sqrt{3}\,t)}{3} \quad (2)$$

```
> invlaplace(1/(s+4)^5, s, t)
```

$$\frac{t^4 e^{-4t}}{24} \quad (3)$$

```
>
```

Problem 2

```
> F := (5·s^2 + 20·s + 6)/(s^3 + 2·s^2 + s)
```

$$F := \frac{5s^2+20s+6}{s^3+2s^2+s} \quad (4)$$

```
> invlaplace(F, s, t)
```

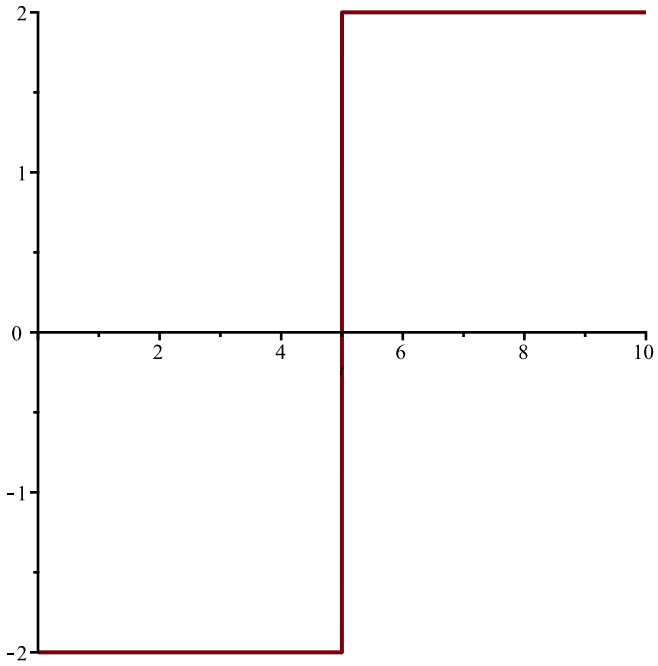
$$6 + (9t - 1)\,e^{-t} \quad (5)$$

Problem 3

```
> p := piecewise(0 ≤ t < 5, -2, t ≥ 5, 2)
```

$$p := \begin{cases} -2 & 0 \le t < 5 \\ 2 & 5 \le t \end{cases} \quad (6)$$

```
> plot(p, t=0..10)
```




```
> laplace(p, t, s)
```

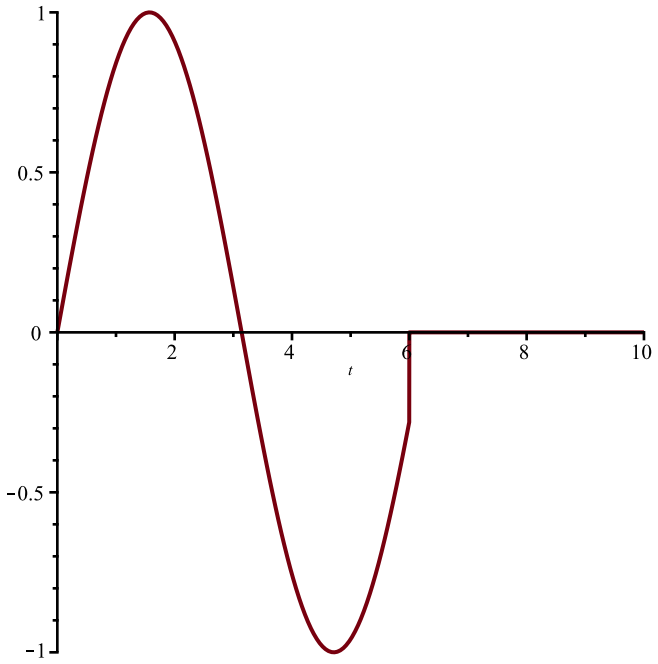
$$-\frac{2\left(-2\,e^{-5s}+1\right)}{s} \tag{7}$$

Problem 4

```
> q := piecewise(0 ≤ t < 2·3, sin(t), t ≥ 2·3, 0)
```

$$q := \begin{cases} \sin(t) & 0 \le t < 6 \\ 0 & 6 \le t \end{cases} \tag{8}$$

```
> plot(q, t = 0..10)
```



> $laplace(q, t, s)$

$$\frac{1 + e^{-6\,s}\,(-\sin(6)\,s - \cos(6))}{s^2 + 1} \tag{9}$$

Problem 5

> $sol := diff(x(t), t, t) + x(t) = \sin(3 \cdot t)$

$$sol := \frac{d^2}{dt^2}\,x(t) + x(t) = \sin(3\,t) \tag{10}$$

> $y := laplace(sol, t, s)$

$$y := s^2\,\mathcal{L}(x(t), t, s) - D(x)(0) - s\,x(0) + \mathcal{L}(x(t), t, s) = \frac{3}{s^2 + 9} \tag{11}$$

> $y(t) := dsolve(sol)$

$$y := t \mapsto dsolve(sol) \tag{12}$$

> $Y := solve(y, laplace(x(t), t, s))$

$$Y := \frac{x(0)\,s^3 + D(x)(0)\,s^2 + 9\,s\,x(0) + 9\,D(x)(0) + 3}{(s^2 + 9)\,(s^2 + 1)} \tag{13}$$

> $invlaplace(Y, s, t)$

$$x(0)\cos(t) - \frac{\sin(3\,t)}{8} + \frac{\sin(t)\,(8\,D(x)(0) + 3)}{8} \tag{14}$$