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#Лабораторная работа 4(Вариант 4)
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#Задание 1
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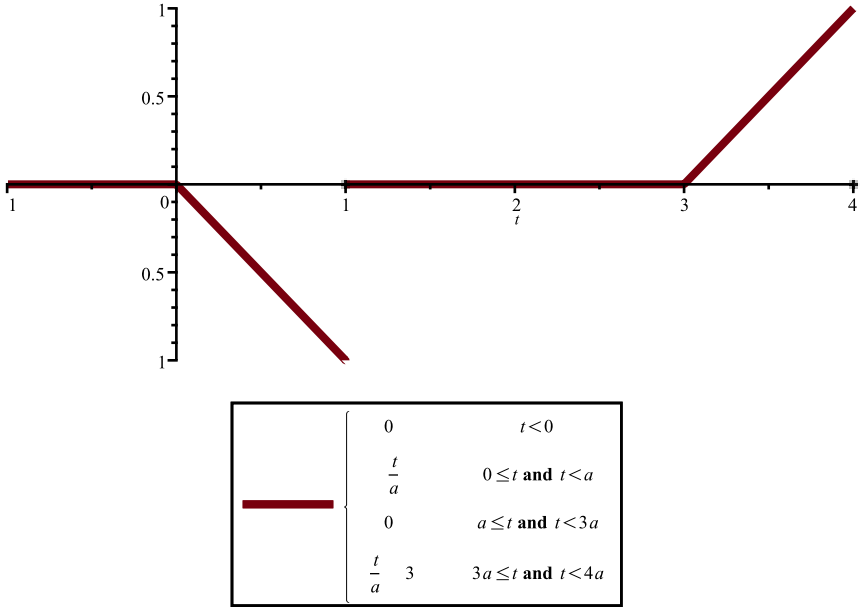
```
with(inttrans) :
```

```
f := piecewise(t < 0, 0, 0 ≤ t < a, -t/a, a ≤ t < 3·a, 0, 3·a ≤ t < 4·a, 1/a ·t - 3)
```

$$f := \begin{cases} 0 & t < 0 \\ -\frac{t}{a} & 0 \le t < a \\ 0 & a \le t < 3\,a \\ \frac{t}{a} - 3 & 3\,a \le t < 4\,a \end{cases} \tag{1}$$

```
plot(subs(a = 1, f), t = -1 ..4, discont = true, thickness = 3, legend = f)
    # График функции при a = 1
```



$$\begin{cases} 0 & t<0 \\ \frac{t}{a} & 0\le t \text{ and } t<a \\ 0 & a\le t \text{ and } t<3a \\ \frac{t}{a}\ 3 & 3a\le t \text{ and } t<4a \end{cases}$$

```

```

```
fp := ( t)·Heaviside(t)  ( t)·Heaviside(t  1) + (t  3)·Heaviside(t  3)
```

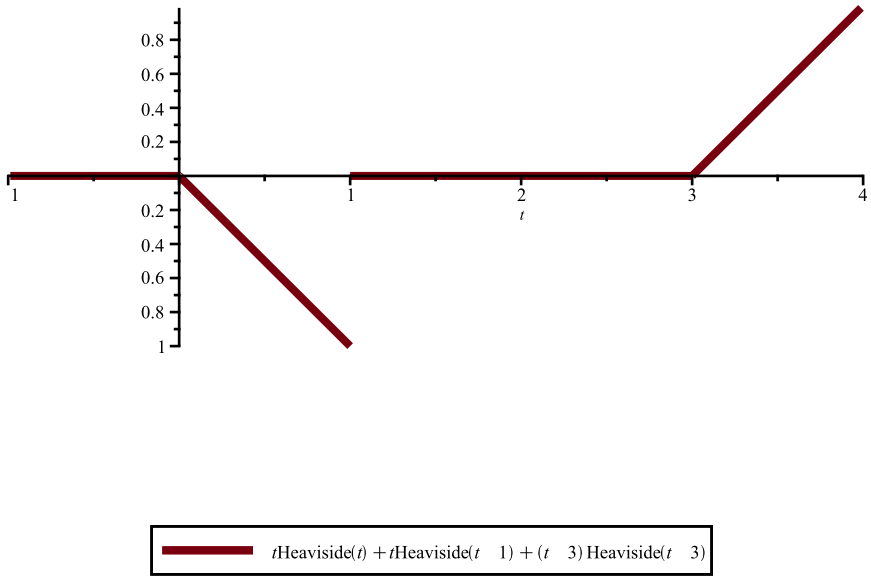
$$fp := t\,\text{Heaviside}(t) + t\,\text{Heaviside}(t - 1) + (t - 3)\,\text{Heaviside}(t - 3) \tag{2}$$

```
laplace(fp, t, p) assuming a > 0 ;
expand(%)
```

$$\frac{1 + e^{-3p} + e^{-p}\,(p+1)}{p^2}$$

$$\frac{1}{p^2} + \frac{1}{p^2\,(e^{p})^3} + \frac{1}{p\,e^{p}} + \frac{1}{p^2\,e^{p}} \tag{3}$$

```
plot(fp, t =  1 ..4, scaling = constrained, thickness = 3, legend = fp)
```




```
> restart :
```

```
> #Задание 2
```

```
> with(inttrans) :
```

```
> f := (p + 5) / ((p + 1)·(p^2  2·p + 5))
```

$$f := \frac{p+5}{(p+1)\left(p^2 \quad 2p+5\right)} \tag{4}$$

```
> invlaplace(f, p, t);
```

$$\frac{e^{t}}{2} + \frac{(\ \cos(2t) + 2\sin(2t)\ )\, e^{t}}{2} \tag{5}$$

```
> restart :
```

```
> #Задание 3
```

```
> f := diff(y(t), t$2)  2·diff(y(t), t) + y(t) = exp(t)/(t + 1);
```

$$f := \frac{d^2}{dt^2} y(t) \quad 2\frac{d}{dt} y(t) + y(t) = \frac{e^{t}}{t+1} \tag{6}$$

```
> dsolve({f, y(0) = 0, y'(0) = 0});
```

$$y(t) = e^{t}\,(t\ln(t+1) + \ln(t+1) \quad t) \tag{7}$$

```
> restart :
```

```
> #Задание 4
```

```
> with(inttrans) :
```

```
> f := diff(y(t), t$2) - 2*diff(y(t), t) - 3*y(t) = exp(t);
```

$$f := \frac{d^2}{dt^2} y(t) - 2 \frac{d}{dt} y(t) - 3\, y(t) = e^t \tag{8}$$

```
> expand(dsolve({f, y(0) = 1, y'(0) = 1}));
```

$$y(t) = \frac{5\,(e^t)^3}{8} + \frac{5}{8\,e^t} - \frac{e^t}{4} \tag{9}$$

```
> restart:
```

```
> #Задание 5
```

```
> with(inttrans):
```

```
> sys_diff := {diff(x(t), t) = x(t) + 2*y(t) + 1, diff(y(t), t) = 4*x(t) - y(t)};
```

$$sys\_diff := \left\{ \frac{d}{dt} x(t) = x(t) + 2\, y(t) + 1,\ \frac{d}{dt} y(t) = 4\, x(t) - y(t) \right\} \tag{10}$$

```
> dsolve({sys_diff[1], sys_diff[2], x(0) = 0, y(0) = 1});
```

$$\left\{ x(t) = \frac{5\, e^{3t}}{9} - \frac{4\, e^{-3t}}{9} - \frac{1}{9},\ y(t) = \frac{5\, e^{3t}}{9} + \frac{8\, e^{-3t}}{9} - \frac{4}{9} \right\} \tag{11}$$

```
> restart:
```

```
>
```