

Questão 1

```
1 % Luiz Henrique Gariglio dos Santos – 2022421137
2
3 clear
4 close all
5 clc
6 %% 1
7
8 t = linspace(0, 10, 1000);
9
10 x = -10*exp(-t) + cos(5*t); % Resposta total
11 x_t = -10*exp(-t);          % Resposta transitória
12 x_p = cos(5*t);             % Resposta permanente
13
14 figure;
15 hold on;
16 plot(t, x, 'b');
17 plot(t, x_t, 'r');
18 plot(t, x_p, 'g');
19 xlabel('Tempo');
20 ylabel('Amplitude');
21 legend('Resposta Total (x(t))', 'Resposta Transitória
22 (-10e^{-t})', 'Resposta Permanente (cos(5t))');
23 grid on;
24 hold off;
```

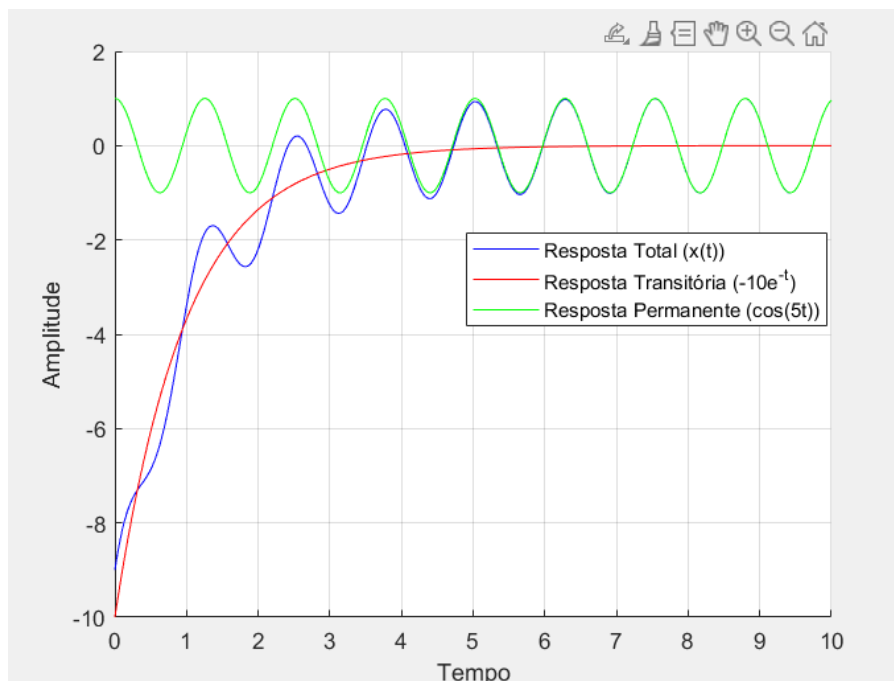


Figura 1: Resultados da Questão 1

Questão 2

```
1 %% 2
2
3 syms m c k s
4 G = 1/(m*s^2 + c*s + k);
5 pretty(G)
6
7 m = 1;
8 c = 2;
9 k = 4;
10
11 num = 1;
12 den = [m c k];
13 G = tf(num, den);
14
15 figure;
16 step(G);
17 xlabel('Tempo');
18 ylabel('Deslocamento');
19 grid on;
```

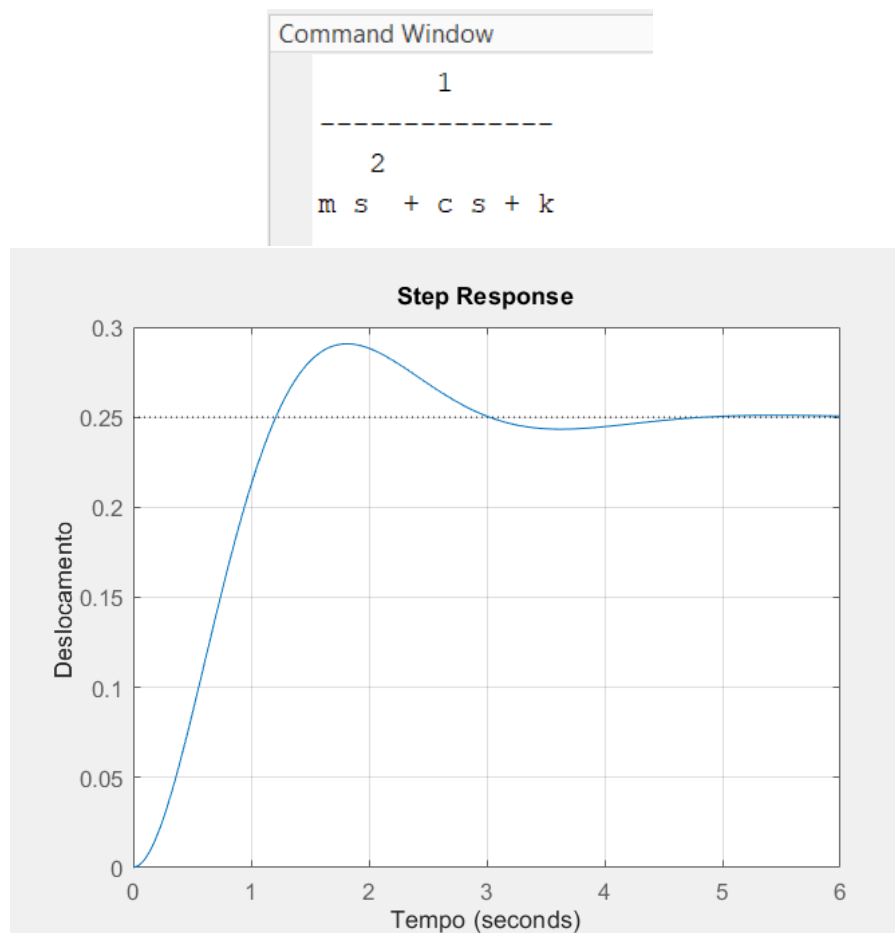


Figura 2: Resultado da Questão 2

Questão 3

```
1 %% 3
2
3 syms m c k s
4 G = (c*s + k) / (m*s^2 + c*s + k);
5 pretty(G)
6
7 m = 1;
8 c = 2;
9 k = 4;
10 num = [c k];
11 den = [m c k];
12 G = tf(num, den);
13
14 t = 0:0.01:20;
15 y = 2 * sin(t);
16 x = lsim(G, y, t);
17
18 figure;
19 plot(t, x, 'b');
20 hold on;
21 plot(t, y, 'r');
22 xlabel('Tempo (s)');
23 ylabel('Deslocamento');
24 hold off;
```

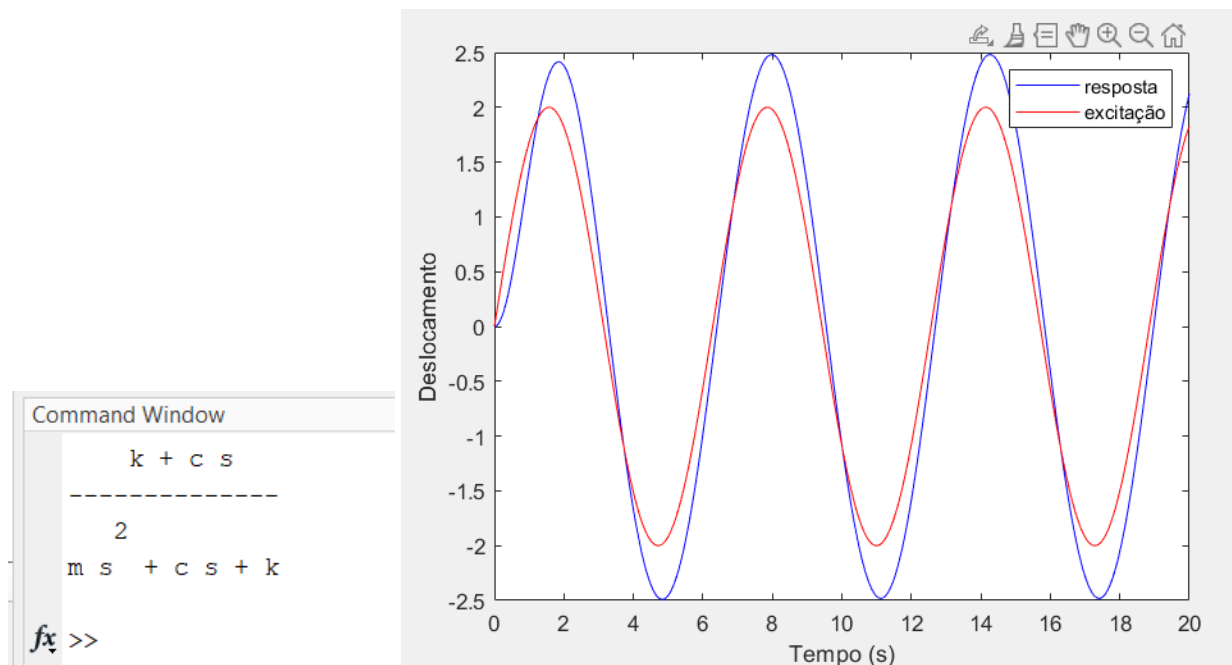


Figura 3: Resultado da Questão 3

Questão 4

Equação do sinal descrito na figura 19:

$$f(t) = \begin{cases} 2t, & 0 \leq t \leq 0,5 \\ 0, & t > 0,5 \end{cases} \quad (1)$$

Transformada de Laplace do sinal:

$$F(s) = \int_0^{0,5} 2te^{-st} dt \quad (2)$$

$$\int_0^{0,5} 2te^{-st} dt = \left[-2t \frac{e^{-st}}{s} \right]_0^{0,5} + \int_0^{0,5} \frac{2}{s} e^{-st} dt = -\frac{e^{-0,5s}}{s} - \frac{2e^{-0,5s}}{s^2} + \frac{2}{s^2} \quad (3)$$
$$u = 2t, du = 2dt$$
$$dv = e^{-st} dt, v = -\frac{1}{s} e^{-st}$$

$$F(s) = -\frac{e^{-0,5s}}{s} - \frac{2e^{-0,5s}}{s^2} + \frac{2}{s^2} \quad (4)$$

```
1 %% 4
2 t = linspace(0, 1, 100);
3
4 f = zeros(size(t));
5 f(t <= 0.5) = 2 * t(t <= 0.5);
6 f(t > 0.5) = 0;
7
8 figure;
9 plot(t, f);
10 xlabel('Tempo (s)');
11 ylabel('f(t)');
```

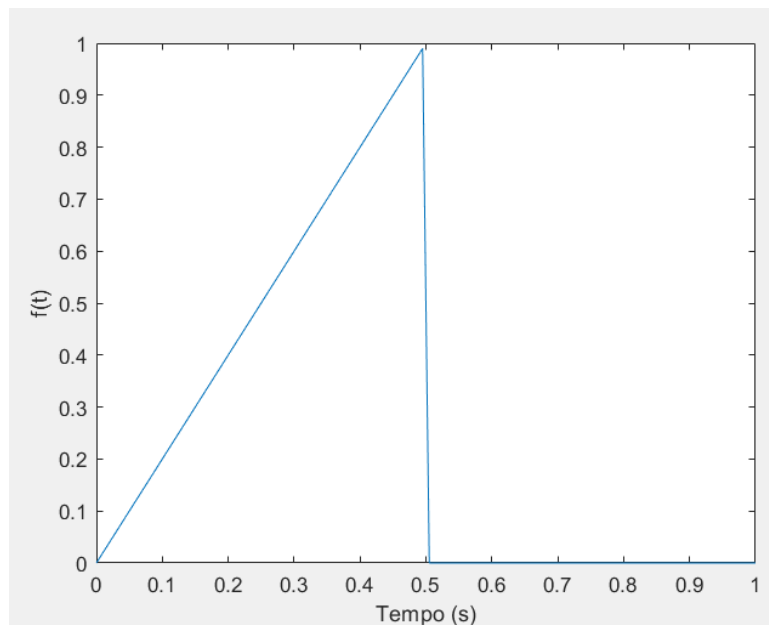


Figura 4: Sinal

Questão 5

```

1 %% 5
2 t = 0:0.1:3;
3
4 f = zeros(size(t));
5 f(t <= 1) = 2 * t(t <= 1);
6 f(t > 1 & t <= 2) = 4 - 2 * t(t > 1 & t <= 2);
7
8 figure;
9 plot(t, f);
10 xlabel('Tempo (t)');
11 ylabel('f(t)');

```

Pulso triangular:

$$f(t) = \begin{cases} 2t, & 0 \leq t \leq 1 \\ -2t + 4, & 1 \leq t \leq 2 \\ 0, & t > 2 \end{cases} \quad (5)$$

Transformada de Laplace do Pulso Triangular:

$$F(s) = \int_0^1 e^{-st} 2t dt + \int_1^2 e^{-st} (-2t + 4) dt \quad (6)$$

$$\begin{aligned} \int_0^1 e^{-st} 2t dt &= \left[-2t \frac{e^{-st}}{s} \right]_0^1 + \int_0^1 \frac{2}{s} e^{-st} dt = -\frac{2e^{-s}}{s} - \frac{2e^{-s}}{s^2} + \frac{2}{s^2} \\ u &= 2t, du = 2dt \\ dv &= e^{-st} dt, v = -\frac{1}{s} e^{-st} \end{aligned} \quad (7)$$

$$\begin{aligned} \int_1^2 e^{-st} (-2t + 4) dt &= -2 \int_1^2 t e^{-st} dt + 4 \int_1^2 e^{-st} dt = \frac{2e^{-s}}{s} - \frac{2e^{-s}}{s^2} + \frac{2e^{-2s}}{s^2} \\ u &= t, du = dt \\ dv &= e^{-st} dt, v = -\frac{1}{s} e^{-st} \end{aligned} \quad (8)$$

$$F(s) = \frac{2(1 - e^{-s})^2}{s^2} \quad (9)$$

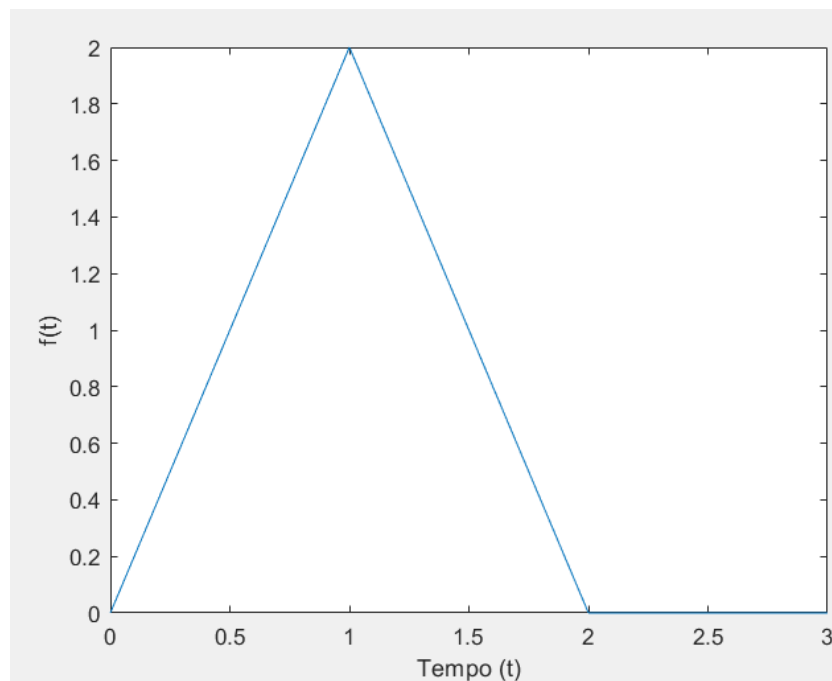


Figura 5: Resultado da Questão 5

Questão 6

```
1 %% 6
2
3 syms t s
4 f = -4*t^2+4*t;
5
6 F = laplace(f, t, s);
7 pretty(F);
8
9 t_var = linspace(0, 1, 100);
10 f_var = -4*t_var.^2+4*t_var;
11
12 figure;
13 plot(t_var, f_var);
14 xlabel('tempo [s]');
15 ylabel('f(t)');
```

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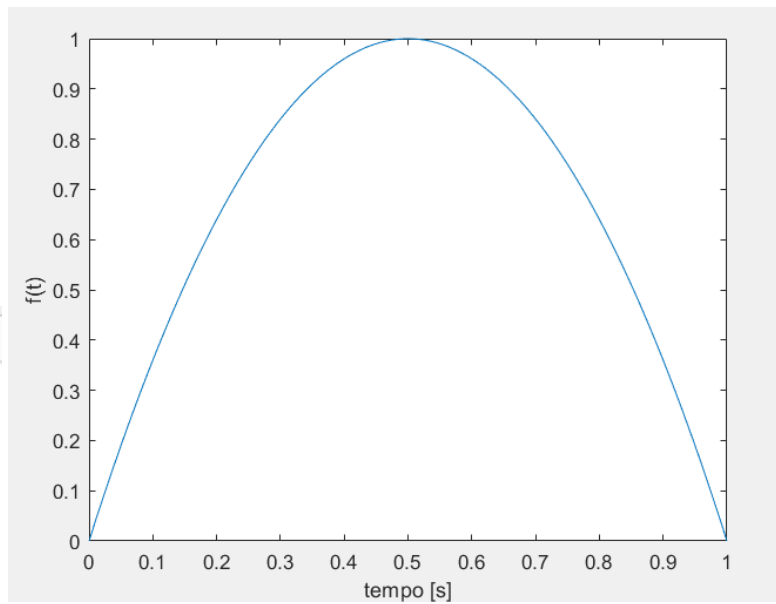


Figura 6: Resultado da Questão 6

Questão 7

```
1 %% 7
2
3 t = linspace(-1,5,500);
4 f = zeros(500);
5
6 for i=1:500
7     if t(i) > 0 && t(i) <= 1
8         f(i) = t(i)* 10;
9     elseif t(i) > 1 && t(i) <= 2
10        f(i) = 10;
11    elseif t(i) > 2 && t(i) < 3
12        f(i) = 10 - (10*(t(i)-2));
13    else
14        f(i) = 0;
15    end
16 end
17
18 plot(t,f);
```

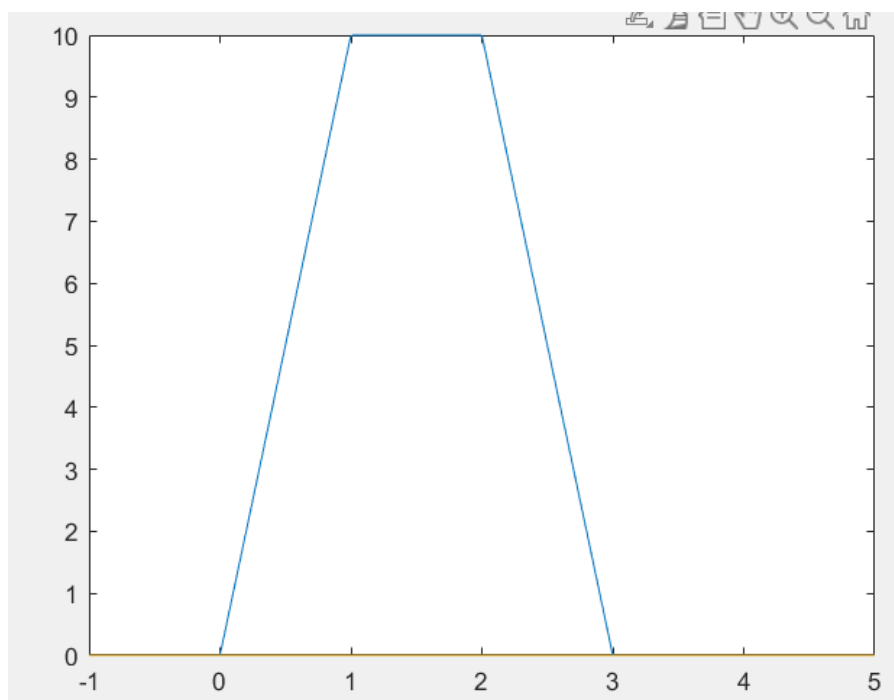


Figura 7: Resultados da Questão 7