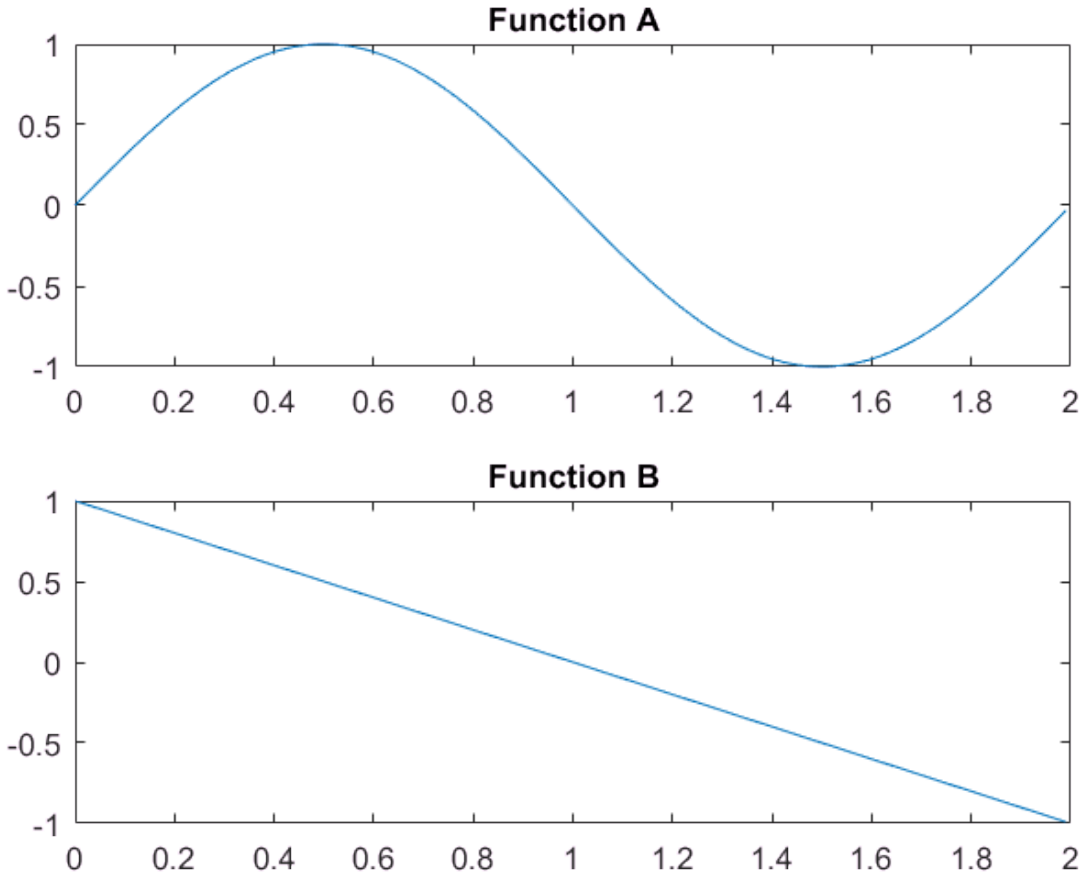
Расстояние между функциями

Красницкий Никита

```
clear all
close all
clc

Time = 2;           % Time of signals 2 sec
Fs   = 100;         % Sampling frequency 100Hz
dt   = 1/Fs;        % Time step
N    = Time/dt;     % Number of samples

t = 0:dt:Time-dt;   % Time reprosontation
```

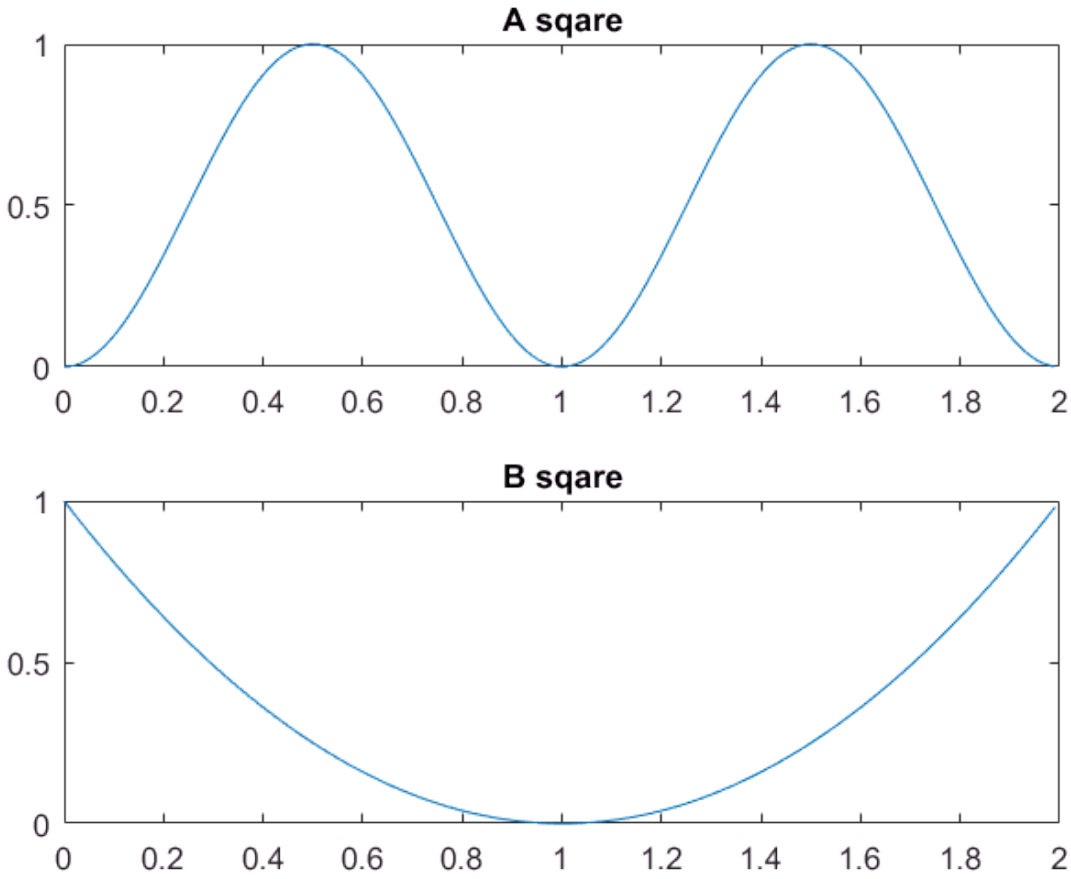
Создаю две функции

```
w0 = 2*pi/Time;
A  = sin(w0*t);
B  = 1 - t;

figure
subplot(2,1,1);
plot(t, A);
title('Function A');
subplot(2,1,2);
plot(t, B);
title('Function B');
```



Квадрат функций

```
SqA = A.*A;
SqB = B.*B;

figure
subplot(2,1,1);
plot(t, SqA);
title('A sqare');
subplot(2,1,2);
plot(t, SqB);
title('B sqare')
```

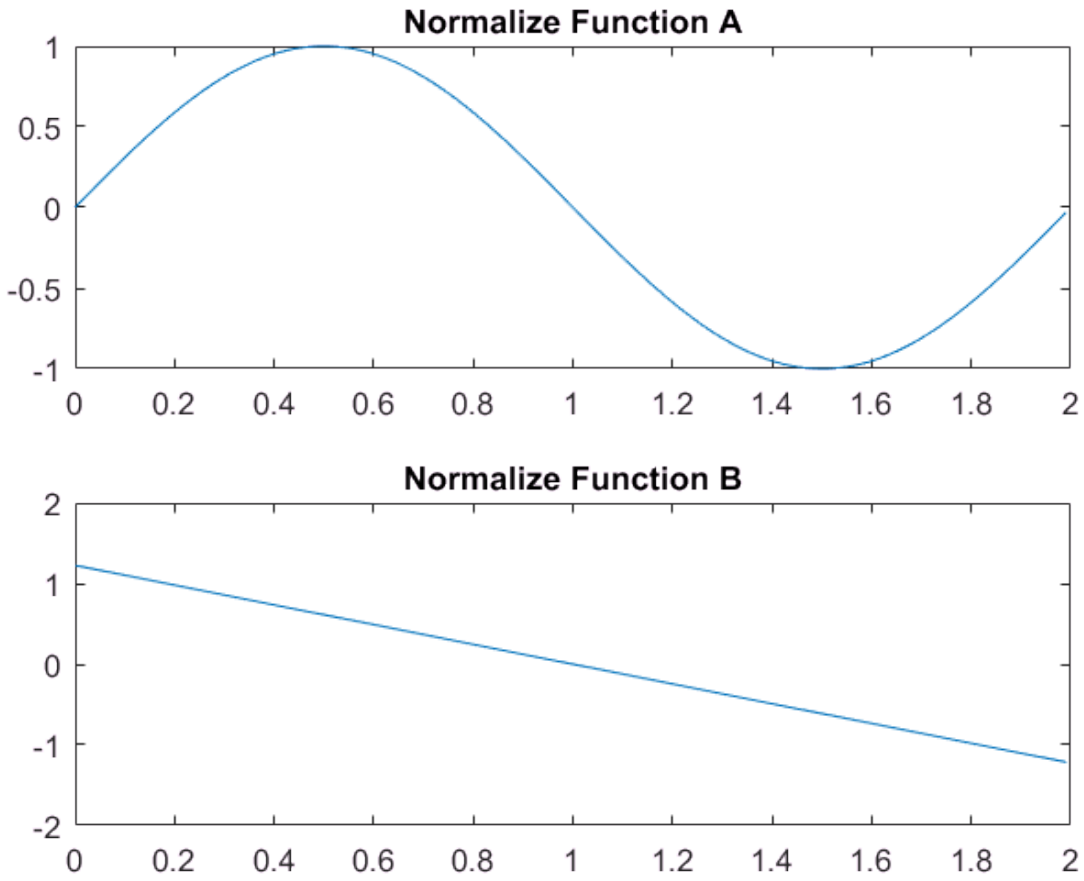


Норма функций. Подобие интеграла.

```
NormA = sqrt(sum(SqA * dt));
NormB = sqrt(sum(SqB * dt));
```

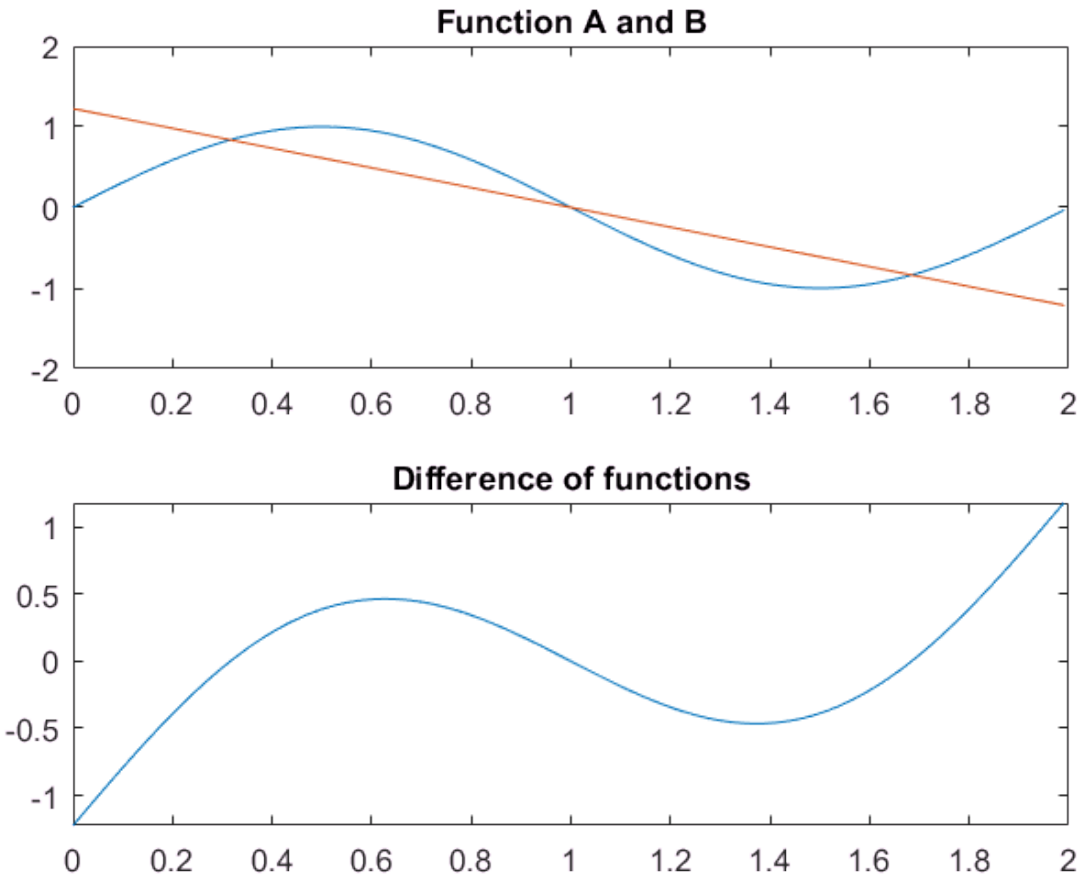
Преобразование функций к нормированному виду

```
A = A/NormA;
B = B/NormB;

figure
subplot(2,1,1);
plot(t, A);
title('Normalize Function A');
subplot(2,1,2);
plot(t, B);
title('Normalize Function B');
```



Общий вид функций и графическое изображение разницы функций

```
FunDif = A - B;

figure
subplot(2,1,1);
plot(t, A);
hold on
plot(t, B);
hold off
title('Function A and B');
subplot(2,1,2);
plot(t, FunDif);
title('Difference of functions');
ylim([min(FunDif) max(FunDif)]);
```



Расстояние между функциями

```
FunDistance = sum(FunDif.*FunDif * dt);
disp('Distance between functions is ');
```

```
Distance between functions is
```

```
disp(FunDistance);
```

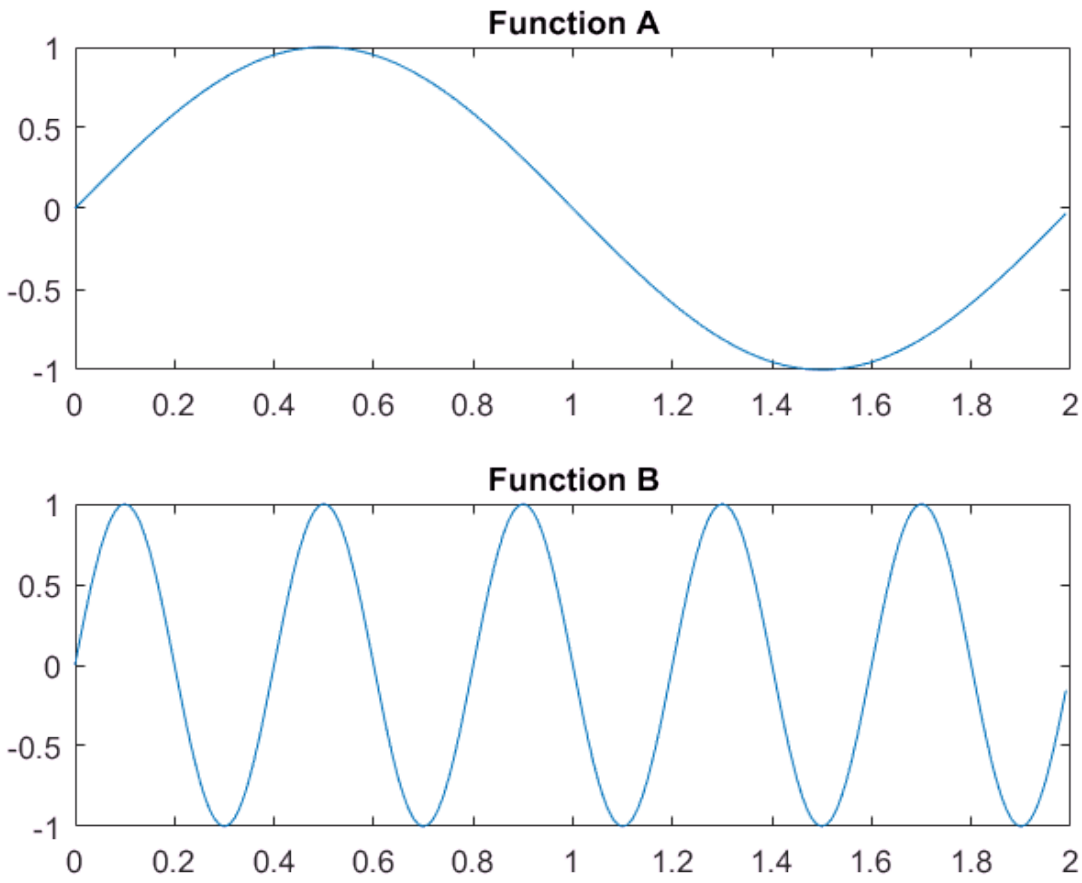
```
    0.4408
```

Пример ортогональных функций

```
clear all
close all
clc

Time = 2;           % Time of signals 2 sec
Fs   = 100;         % Sampling frequency 100Hz
dt   = 1/Fs;        % Time step
N    = Time/dt;     % Number of samples

t = 0:dt:Time-dt;   % Time reprosontation
```

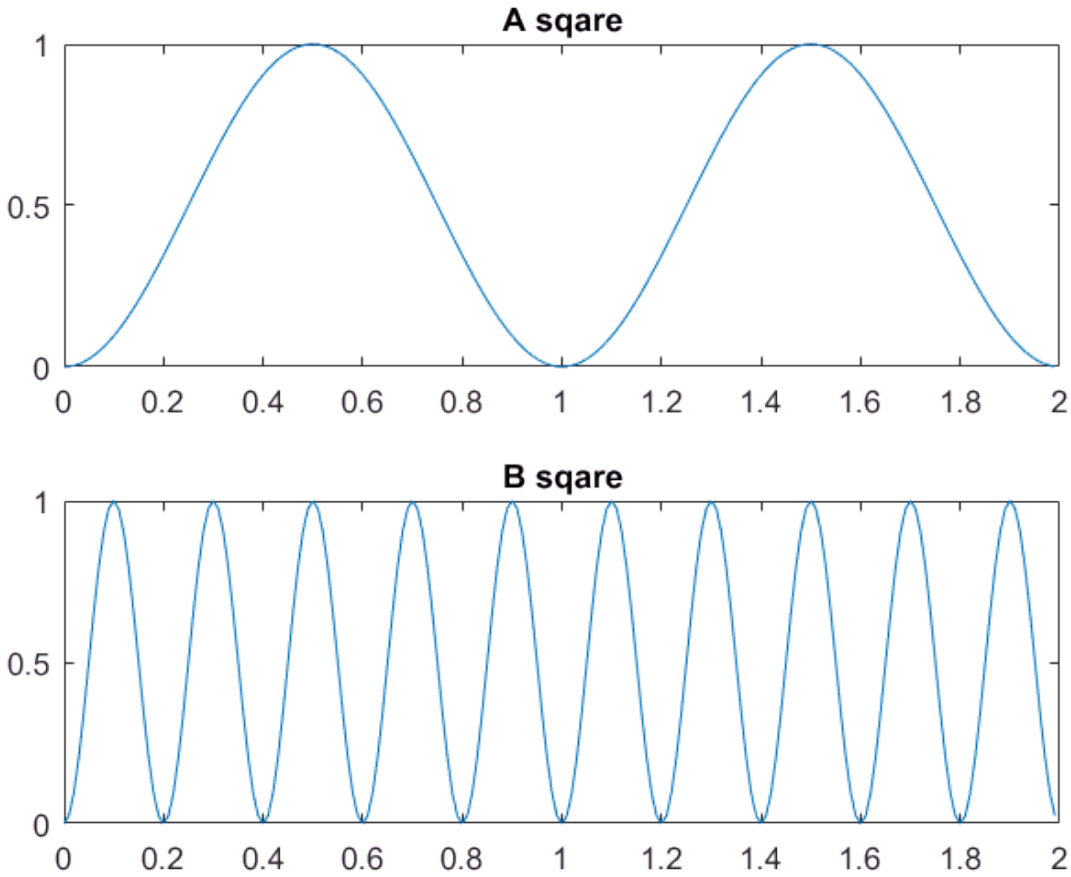
Создаю две функции

```
w0 = 2*pi/Time;
A  = sin(w0*t);
w1 = 5 * w0;
B  = sin(w1*t);

figure
subplot(2,1,1);
plot(t, A);
title('Function A');
subplot(2,1,2);
plot(t, B);
title('Function B');
```



Квадрат функций

```
SqA = A.*A;
SqB = B.*B;

figure
subplot(2,1,1);
plot(t, SqA);
title('A sqare');
subplot(2,1,2);
plot(t, SqB);
title('B sqare')
```

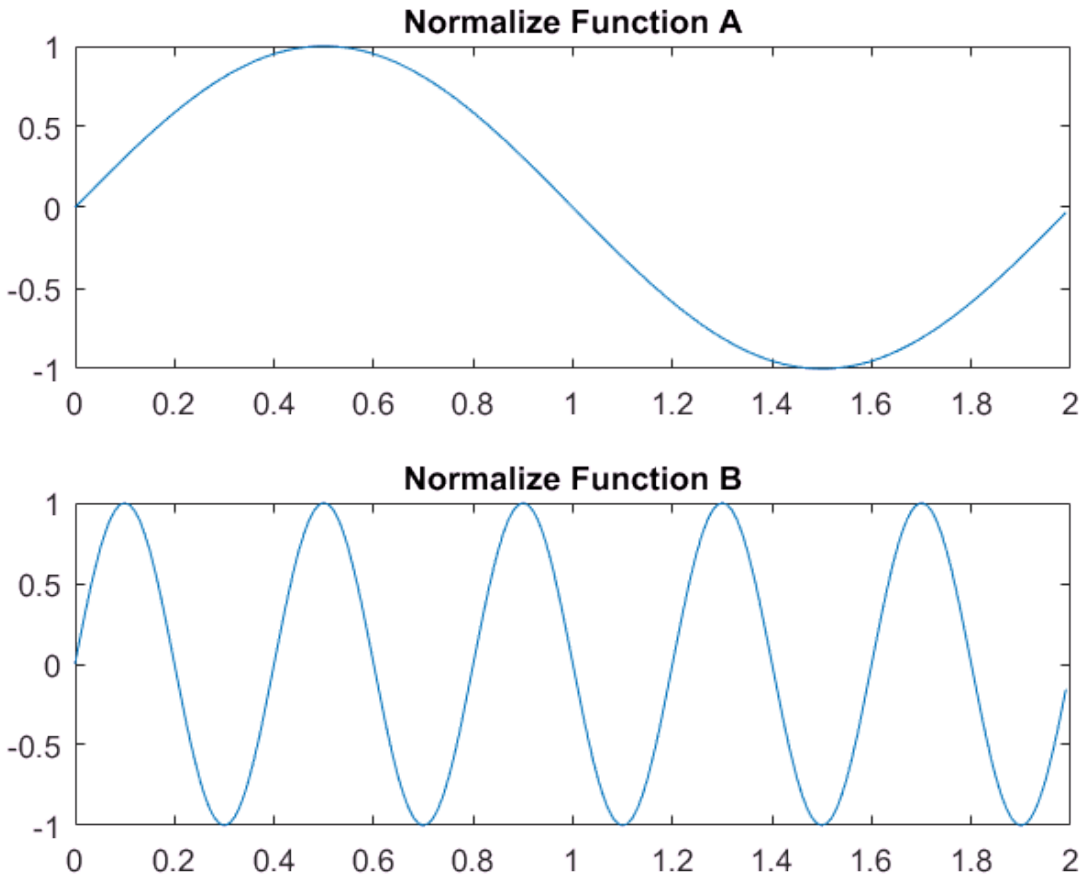


Норма функций. Подобие интеграла.

```
NormA = sqrt(sum(SqA * dt));
NormB = sqrt(sum(SqB * dt));
```

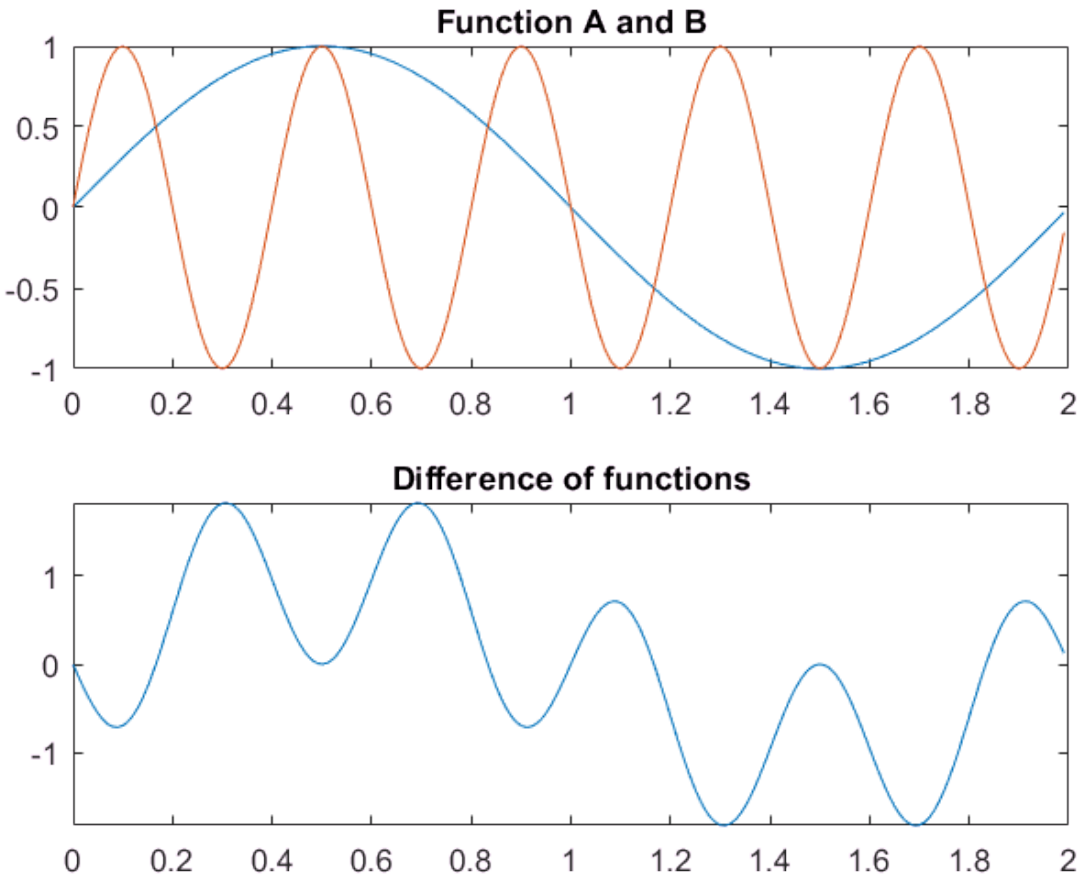
Преобразование функций к нормированному виду

```
A = A/NormA;
B = B/NormB;

figure
subplot(2,1,1);
plot(t, A);
title('Normalize Function A');
subplot(2,1,2);
plot(t, B);
title('Normalize Function B');
```



Общий вид функций и графическое изображение разницы функций

```
FunDif = A - B;

figure
subplot(2,1,1);
plot(t, A);
hold on
plot(t, B);
hold off
title('Function A and B');
subplot(2,1,2);
plot(t, FunDif);
title('Difference of functions');
ylim([min(FunDif) max(FunDif)]);
```



Расстояние между функциями

```
FunDistance = sum(FunDif.*FunDif * dt);
disp('Distance between functions is ');
```

```
 Distance between functions is
```

```
disp(FunDistance);
```

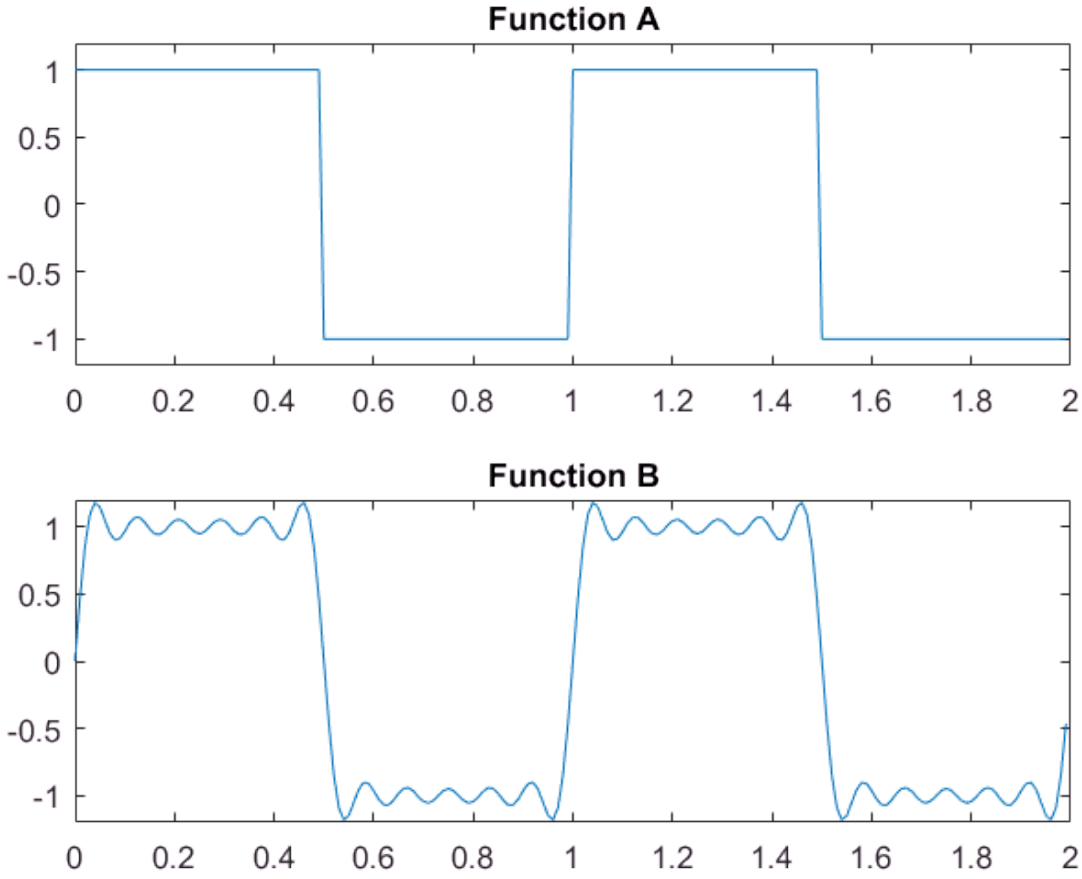
```
    2.0000
```

Пример схожих функций

```
clear all
close all
clc

Time = 2;           % Time of signals 2 sec
Fs   = 100;         % Sampling frequency 100Hz
dt   = 1/Fs;        % Time step
N    = Time/dt;     % Number of samples

t = 0:dt:Time-dt;   % Time reprosontation
```

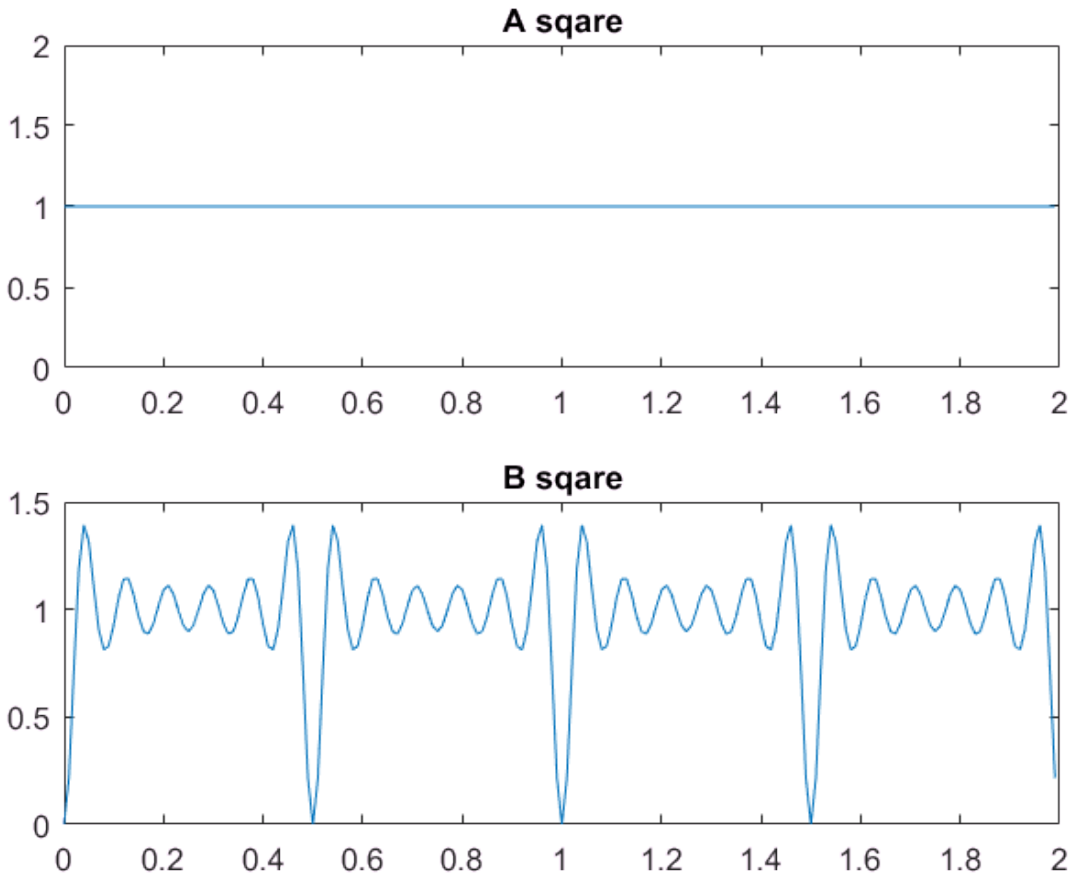
Создаю две функции

```
Period = N/2;
Hp     = Period/2;  % Half Period

A(1:Hp)      =  1;               % Fill half peroid with ones
A(Hp+1:2*Hp) = -1;               % Fill half period with minus ones
A            = repmat(A, 1, 2);  % Make 2 rows of that vector
A            = reshape(A, 1, N); % Combine it to one row vector
                                 % So we fill 2 periods of function by copy

w0       = 2*pi / (Period*dt);   % Define base frequency
Am       = 1;                    % Define an Amplitude
Harmonic = [1 3 5 7 9 11];       % Define Harmonics that will be used
                                 % Calculate Function like Fourier Series
B  =  (1./Harmonic) * (Am*4/pi)*sin(w0*Harmonic'*t);


figure
subplot(2,1,1);
plot(t, A);
title('Function A');
ylim([-1.2 1.2]);
subplot(2,1,2);
plot(t, B);
title('Function B');
ylim([-1.2 1.2]);
```



Квадрат функций

```
SqA = A.*A;
SqB = B.*B;

figure
subplot(2,1,1);
plot(t, SqA);
title('A sqare');
subplot(2,1,2);
plot(t, SqB);
title('B sqare');
```



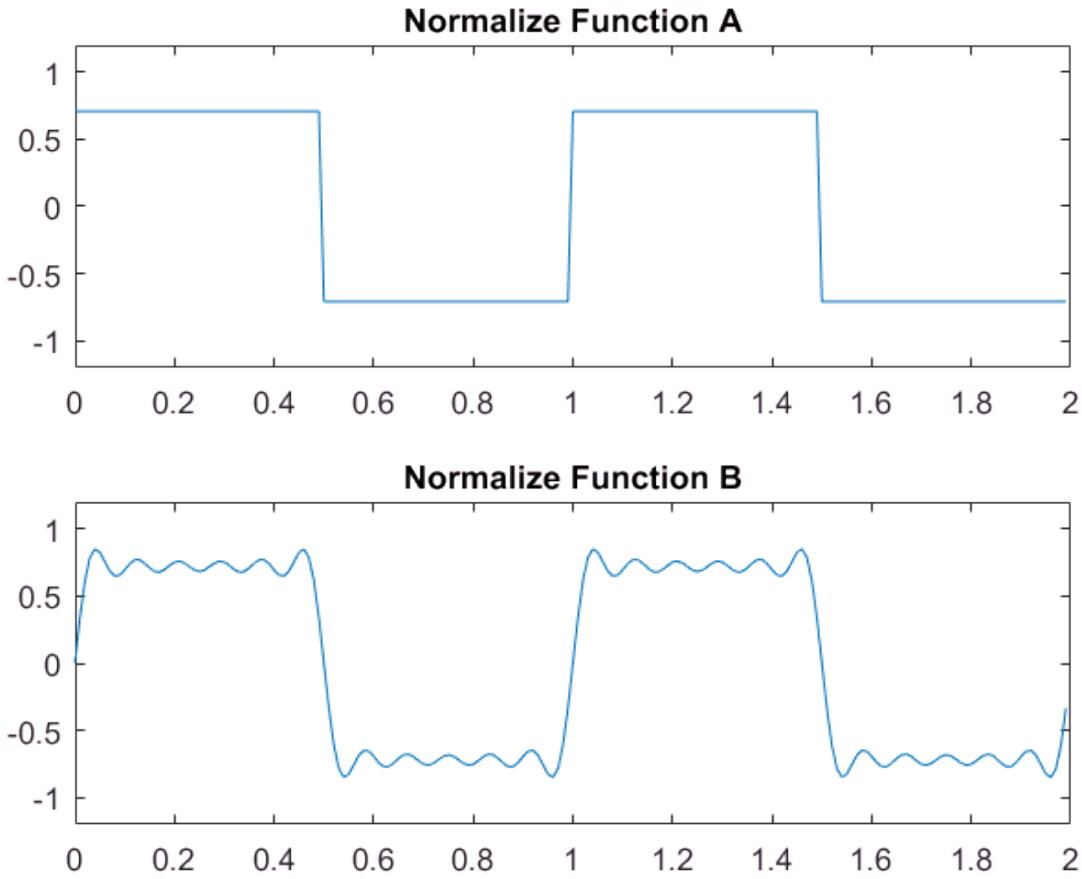
Норма функций. Подобие интеграла.

```
NormA = sqrt(sum(SqA * dt));
NormB = sqrt(sum(SqB * dt));
```

Преобразование функций к нормированному виду

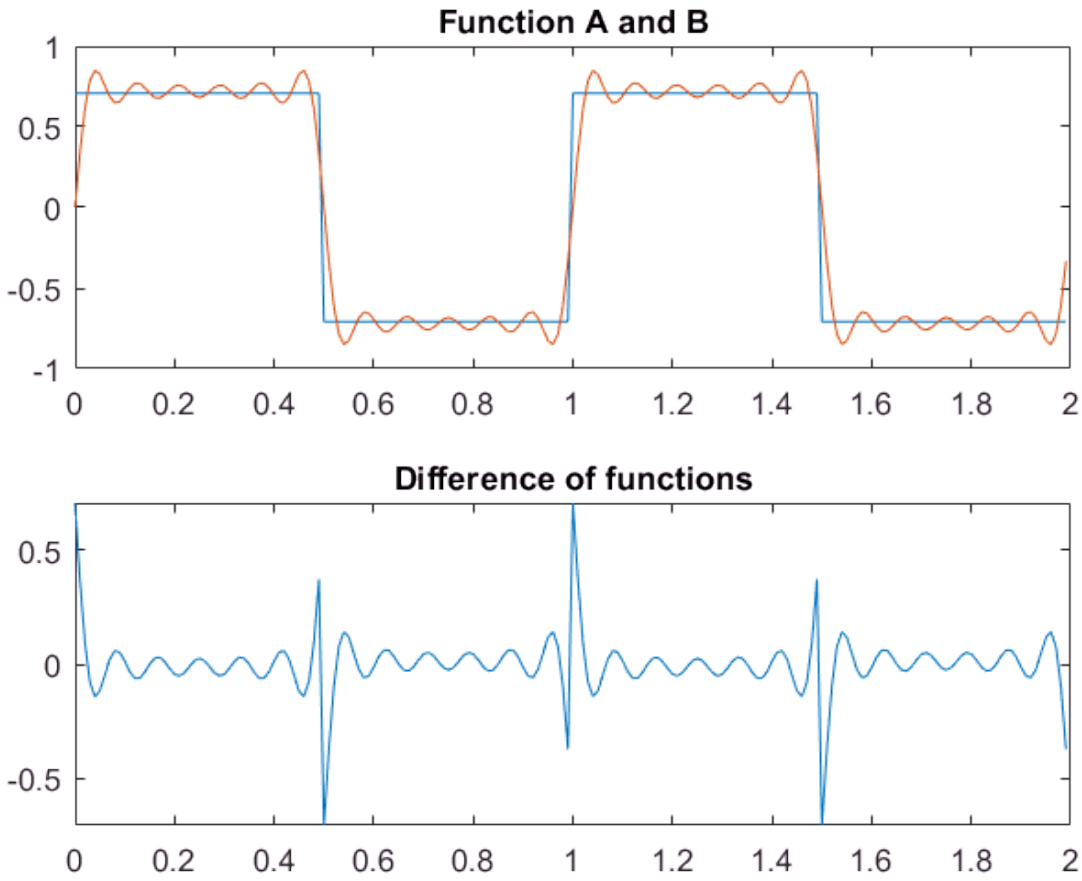
```
A = A/NormA;
B = B/NormB;

figure
subplot(2,1,1);
plot(t, A);
```

```
title('Normalize Function A');
ylim([-1.2 1.2]);
subplot(2,1,2);
plot(t, B);
title('Normalize Function B');
ylim([-1.2 1.2]);
```



Общий вид функций и графическое изображение разницы функций

```
FunDif = A - B;

figure
subplot(2,1,1);
plot(t, A);
hold on
plot(t, B);
hold off
title('Function A and B');
subplot(2,1,2);
plot(t, FunDif);
title('Difference of functions');
ylim([min(FunDif) max(FunDif)]);
```



Расстояние между функциями

```
FunDistance = sum(FunDif.*FunDif * dt);
disp('Distance between functions is ');
```

```
Distance between functions is
```

```
disp(FunDistance);
```

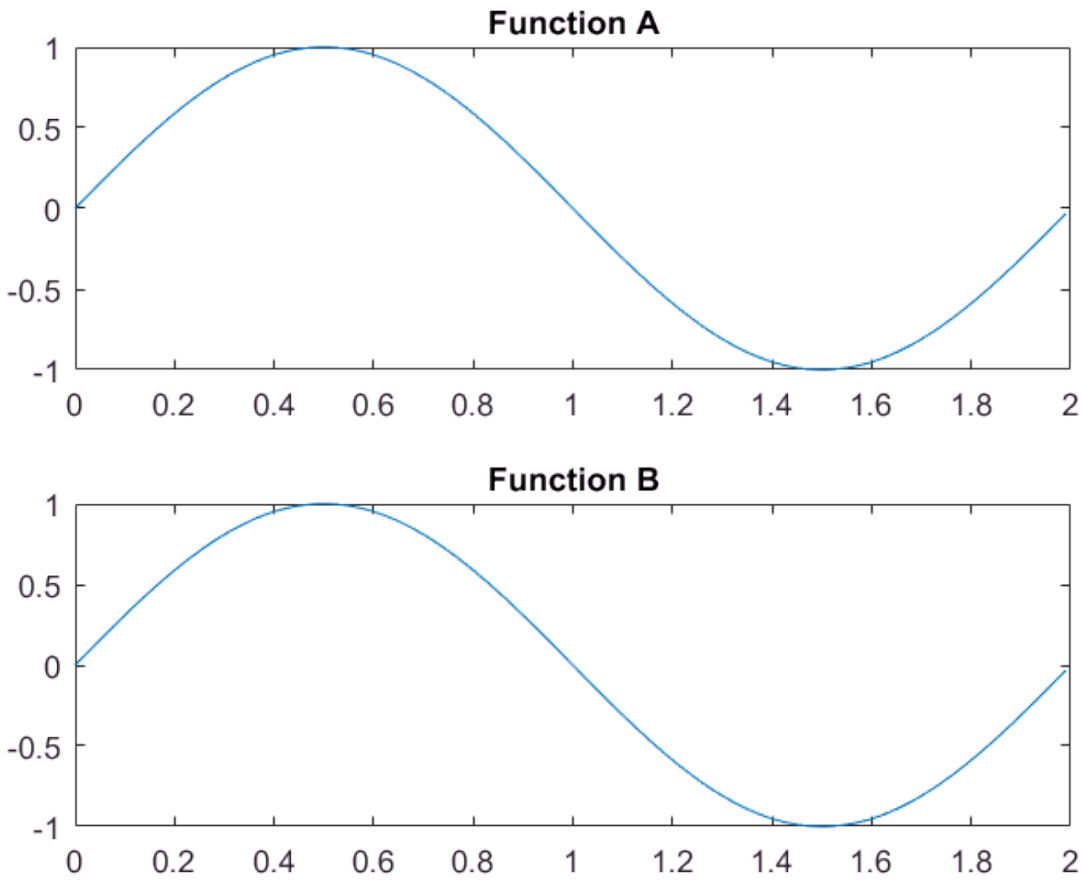
```
    0.0373
```

Пример для копии функции

```
clear all
close all
clc

Time = 2;           % Time of signals 2 sec
Fs   = 100;         % Sampling frequency 100Hz
dt   = 1/Fs;        % Time step
N    = Time/dt;     % Number of samples

t = 0:dt:Time-dt;   % Time reprosontation
```

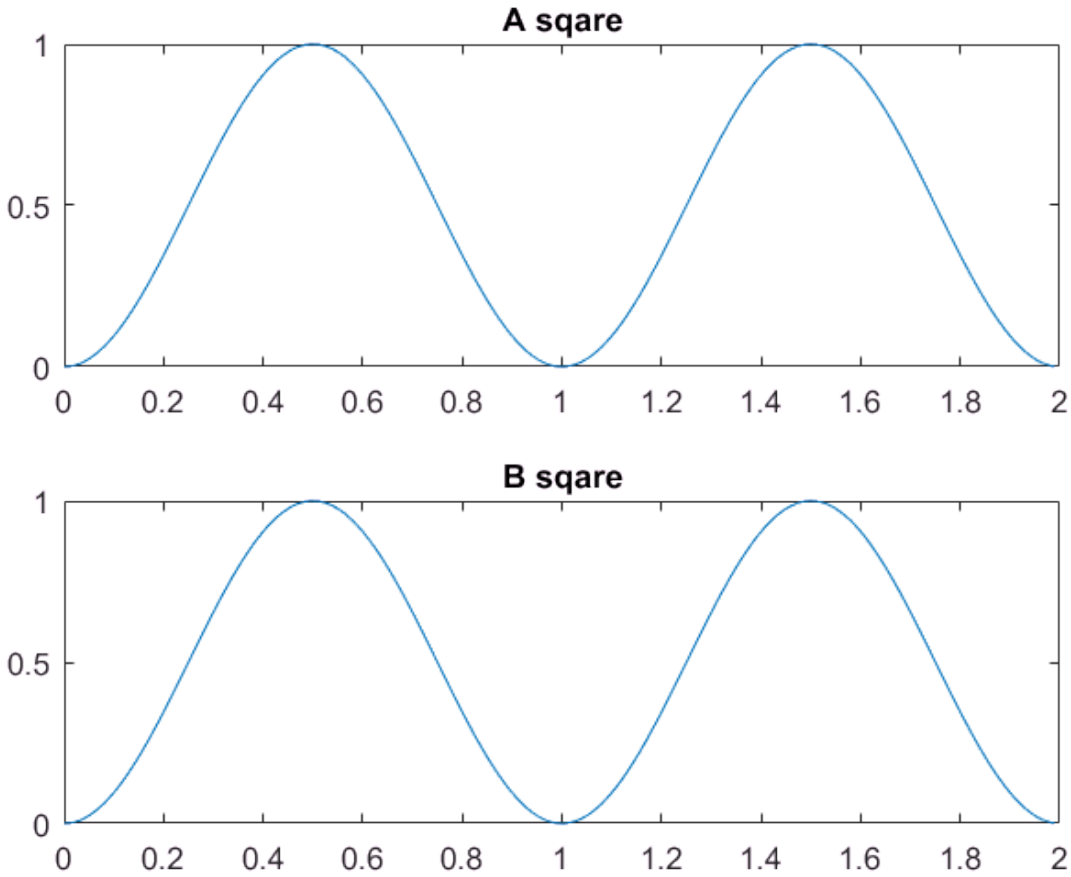
Создаю две функции

```
w0 = 2*pi/Time;
A  = sin(w0*t);

B  = A;

figure
subplot(2,1,1);
plot(t, A);
title('Function A');
subplot(2,1,2);
plot(t, B);
title('Function B');
```



Квадрат функций

```
SqA = A.*A;
SqB = B.*B;

figure
subplot(2,1,1);
plot(t, SqA);
title('A sqare');
subplot(2,1,2);
plot(t, SqB);
title('B sqare')
```

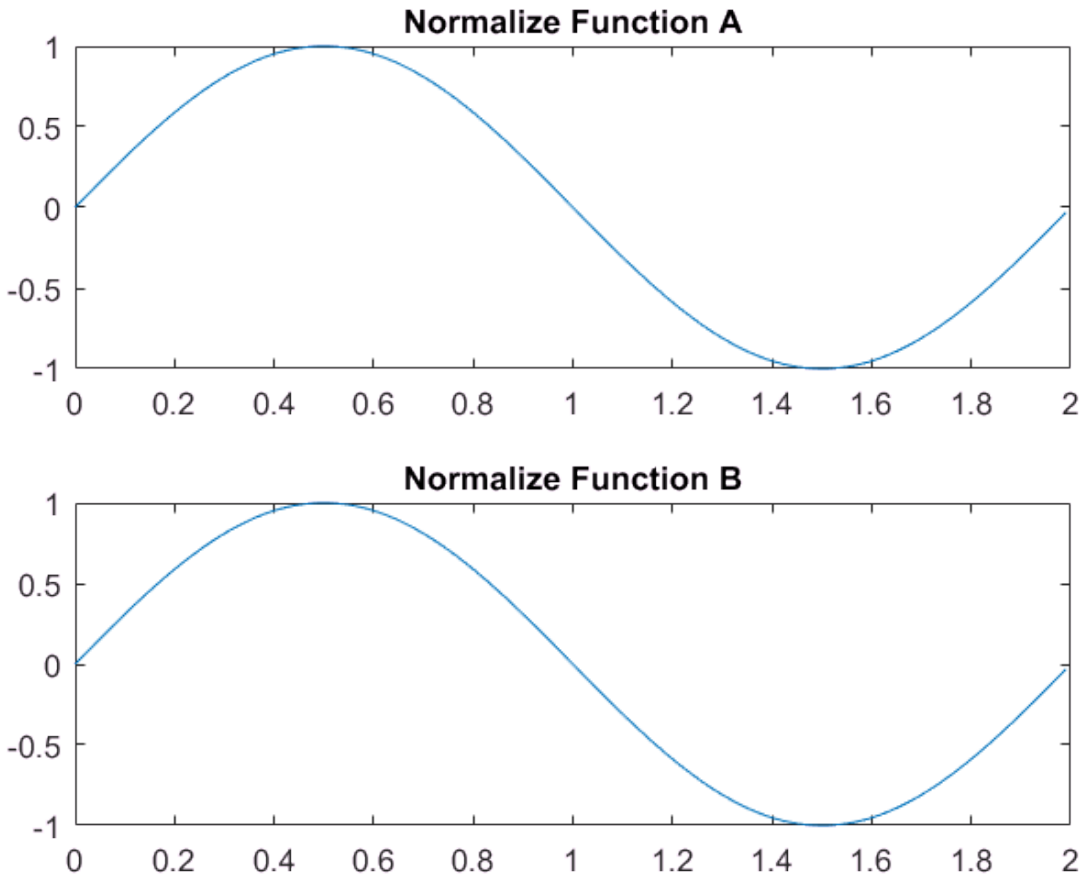


Норма функций. Подобие интеграла.

```
NormA = sqrt(sum(SqA * dt));
NormB = sqrt(sum(SqB * dt));
```

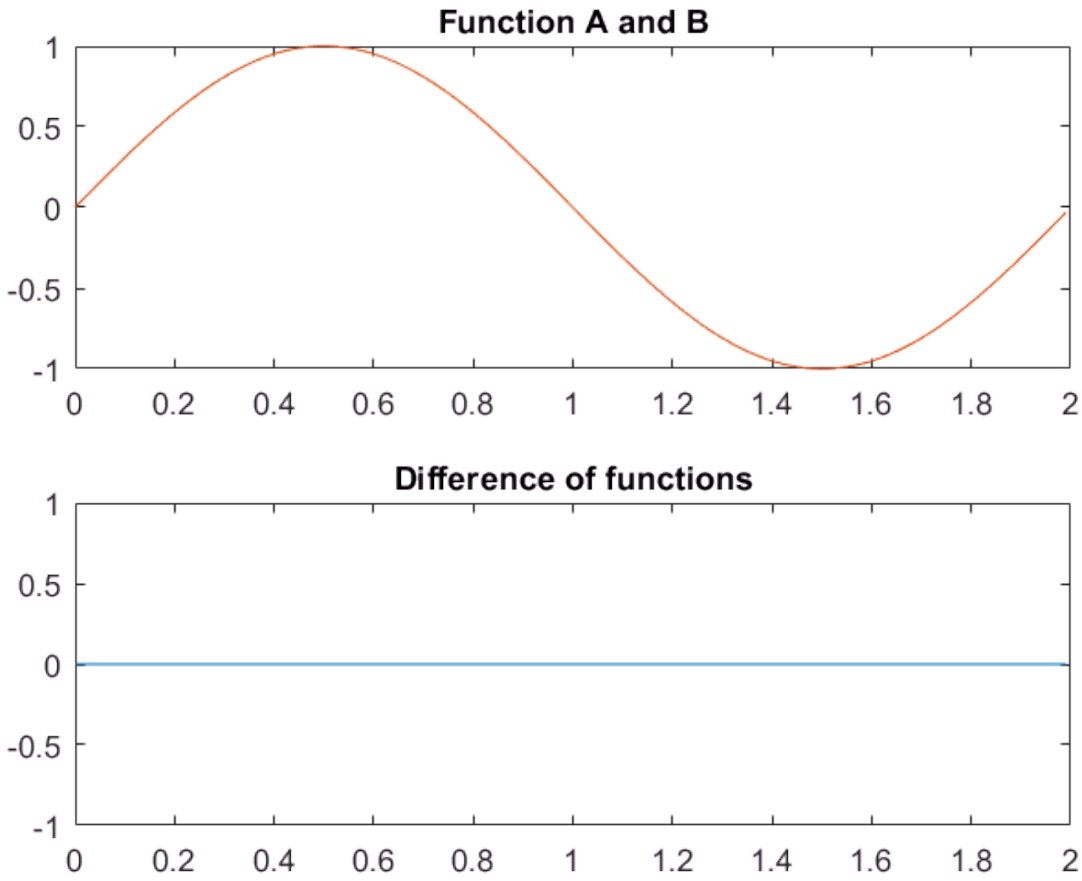
Преобразование функций к нормированному виду

```
A = A/NormA;
B = B/NormB;

figure
subplot(2,1,1);
plot(t, A);
title('Normalize Function A');
subplot(2,1,2);
plot(t, B);
title('Normalize Function B');
```



Общий вид функций и графическое изображение разницы функций

```
FunDif = A - B;

figure
subplot(2,1,1);
plot(t, A);
hold on
plot(t, B);
hold off
title('Function A and B');
subplot(2,1,2);
plot(t, FunDif);
title('Difference of functions');
```



Расстояние между функциями

```
FunDistance = sum(FunDif.*FunDif * dt);
disp('Distance between functions is ');
```

```
Distance between functions is
```

```
disp(FunDistance);
```

```
     0
```