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1、用 Matlab 命令函数分别绘出抽样信号、矩形脉冲信号、周期矩形脉冲信号、三角波脉冲信号、三角波周期信号的波形，理解其中参数的意义。

1）抽样信号：

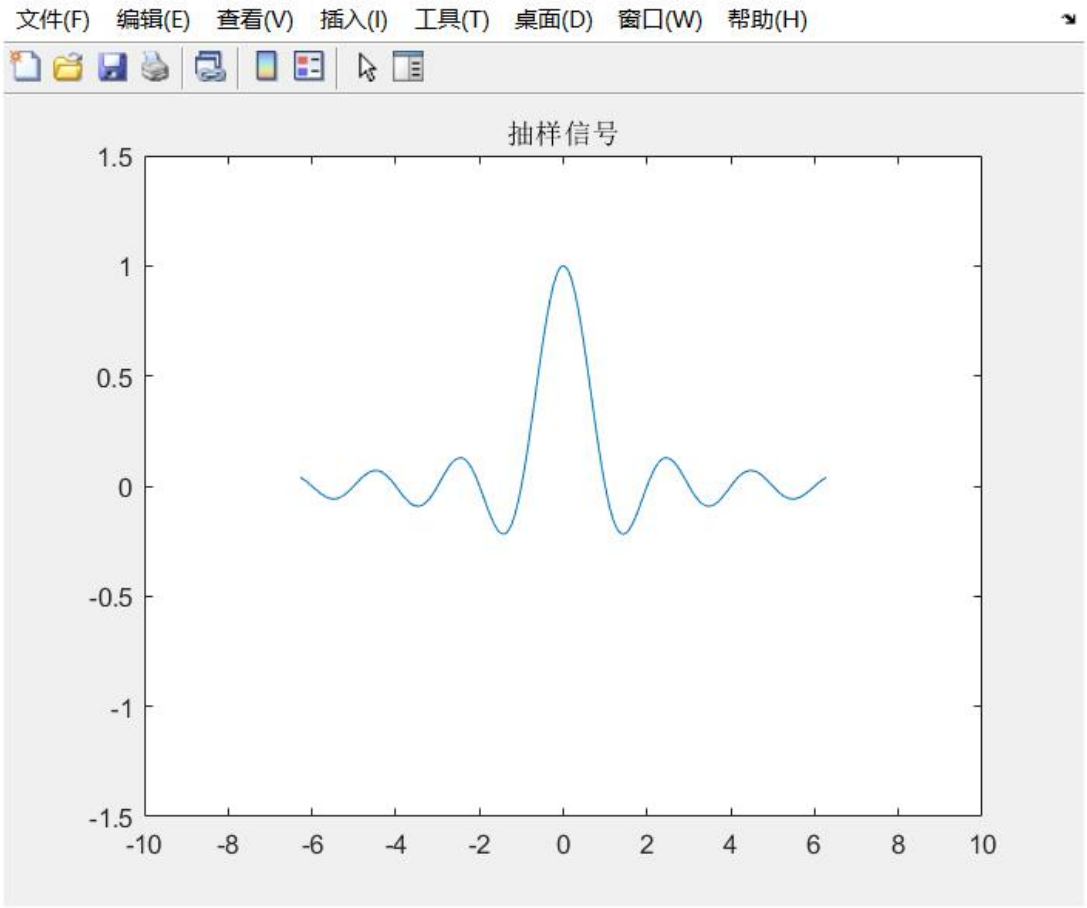
源码：

```
t = -2*pi:0.01:2*pi;

f_sinc = sinc(t);

plot(t,f_sinc);
title('抽样信号');
axis([-10,10,-1.5,1.5]);
```

各参数意义：

函数	参数
plot(t,f_sinc)	t 为自变量，f_sinc 为因变量
axis(a,b,c,d)	a,b 自变量区间 c,d 因变量区间

运行结果：



2）矩形脉冲信号：

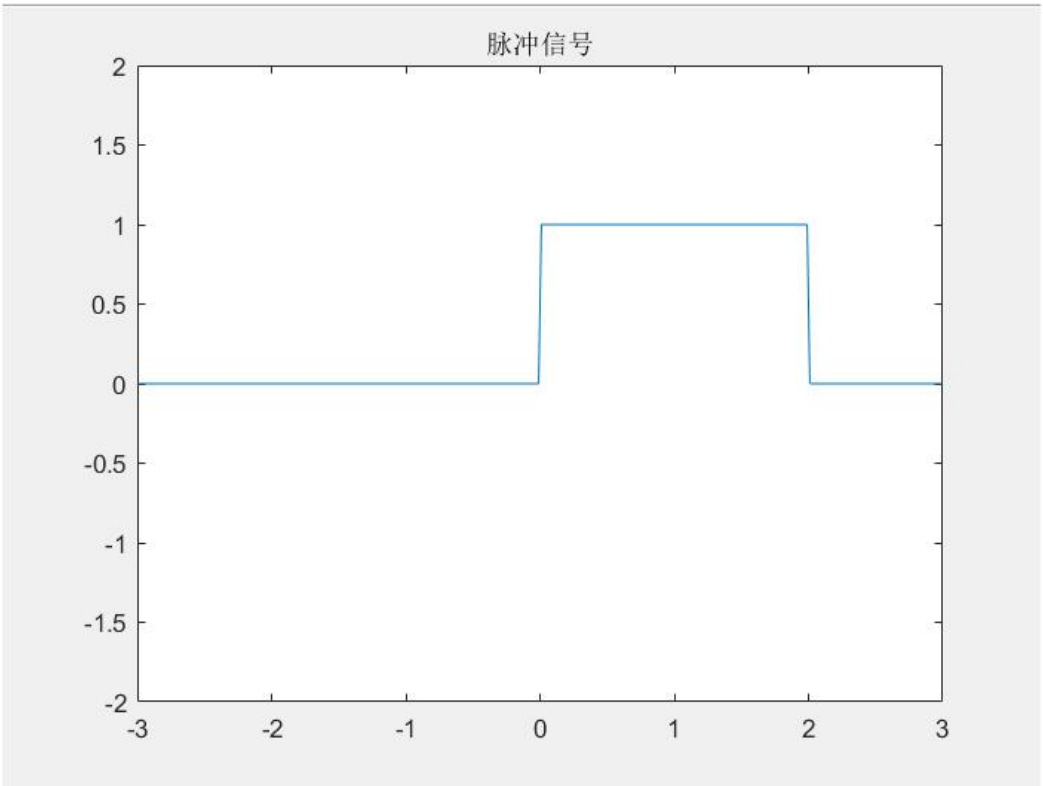
源码：

```
t = -5:0.01:5;
f_sign = sign(t);

f_u = 1/2*f_sign + 1/2;

f_sign2 = sign(t-2);

f_u2 = 1/2*f_sign2 + 1/2;

f_wave = f_u - f_u2;

plot(t,f_wave);

axis([-3,3,-2,2]);
title('脉冲信号');
```

各参数意义：

函数	参数
plot(t,f_sinc)	t 为自变量，f_sinc 为因变量
axis(a,b,c,d)	a,b 自变量区间 c,d 因变量区间

运行结果：



3) 周期脉冲信号：

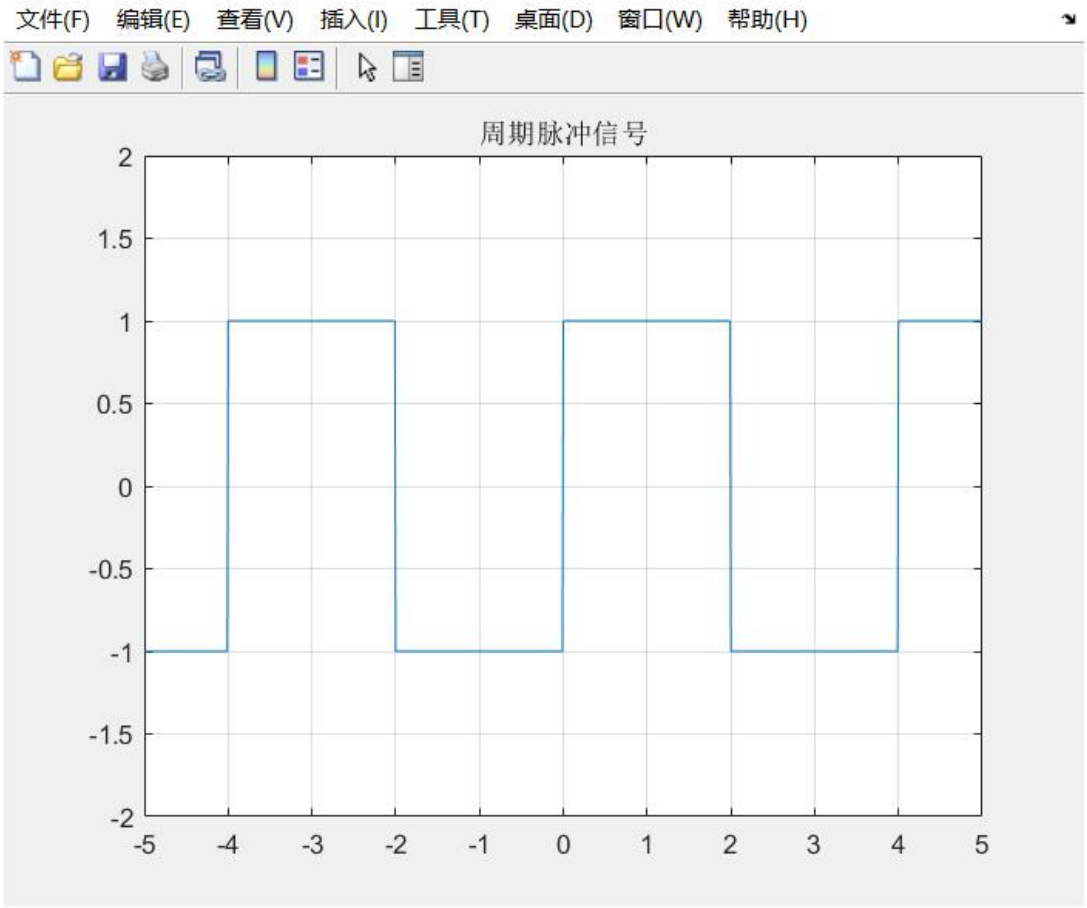
源码：

```
t = -5:0.01:5;
f = square(0.5*pi*t,50);

plot(t,f);

axis([-5,5,-2,2]);


title('周期脉冲信号');
grid on;
```

各参数意义：

函数	参数
sqare(a,b)	a 为角频率，b 为占空比
grid on	显示网格线

运行结果：



4）三角波信号：

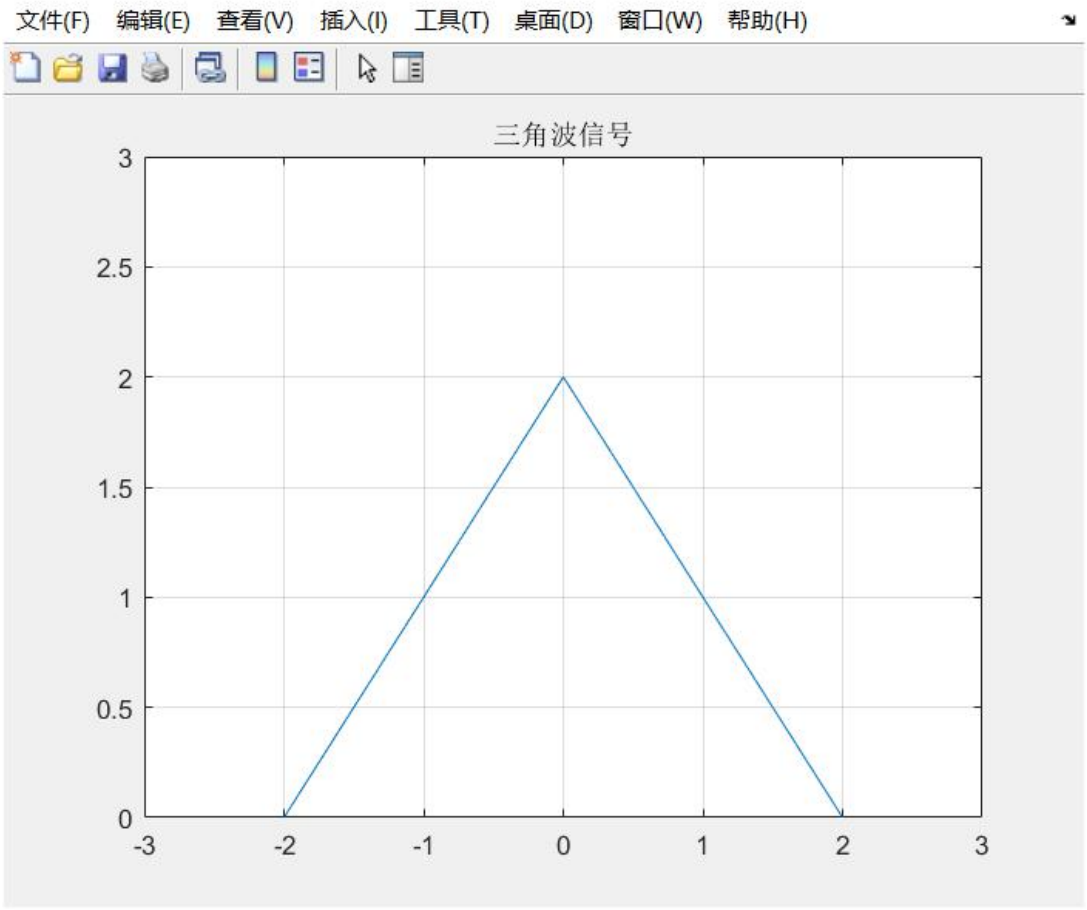
源码：

```
t = -2:0.01:2;
f_u1 = 0.5*sign(t) + 0.5;
f_u2 = 0.5*sign(-1*t)+0.5;
y = f_u2.*(t+2)+f_u1.*(-1*t+2);

plot(t,y);

axis([-3,3,0,3]);
title('三角波信号 ');
grid on;
```

各参数意义：

函数	参数
plot(t,f_sinc)	t 为自变量，f_sinc 为因变量
grid on	显示网格线

运行结果：



5）抽样信号：

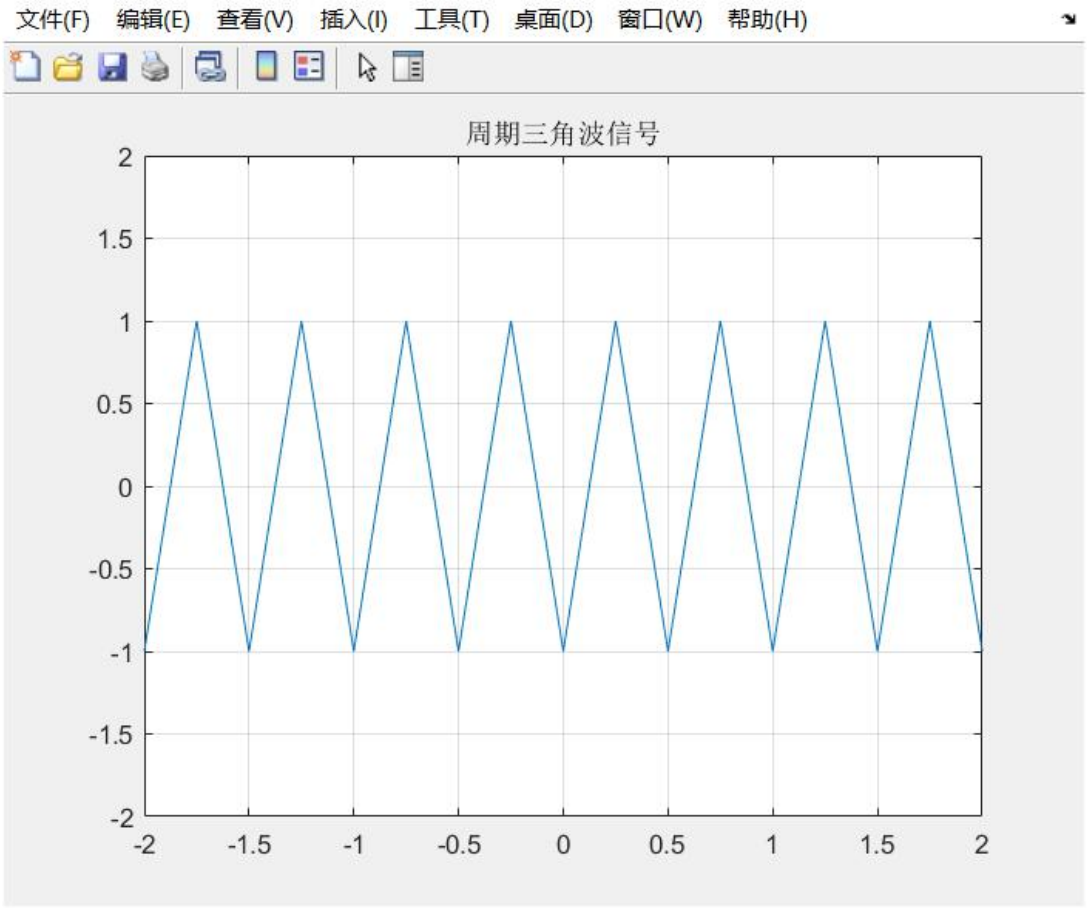
源码：

```
t = -2:0.01:2;
f = sawtooth(4*pi*t,0.5);

plot(t,f);
axis([-2,2,-2,2]);
title('周期三角波');
grid on;
```

各参数意义：

函数	参数
plot(t,f_sinc)	t 为自变量，f_sinc 为因变量
sawtooth(a*t,x)	生成周期为 2pi/a，峰值出现在 x（0~1，0.5 为中央）的三角波

运行结果：



2、分别用 MATLAB 的数字运算和符号运算功能，绘出下列连续时间信号的波形。

(1) $f(t) = (2 - e^{-2t})u(t)$ (2) $f(t) = \cos(\frac{\pi t}{2})[u(t) - u(t-4)]$

(3) $f(t) = e^{t}\cos(t)\,u(t)$ (4) $f(t) = \frac{2}{3}t\,u(t+2)$

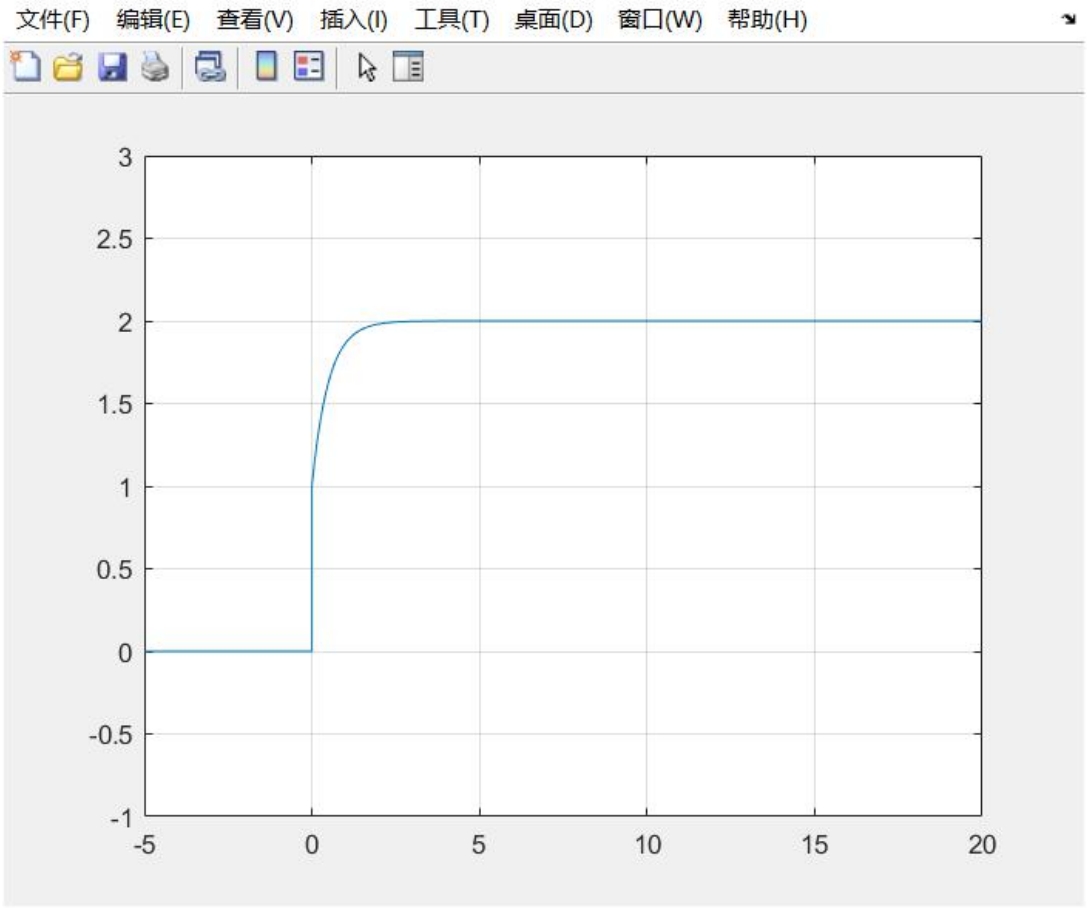
1) $f(t) = (2 - e^{-2t})u(t)$

法一：符号法

源码：

```
t = sym('t');
f = (2-exp(-2*t))*heaviside(t);
fplot(f,[-5,20]);
axis([-5,20,-1,3]);
grid on;
```

运行结果：

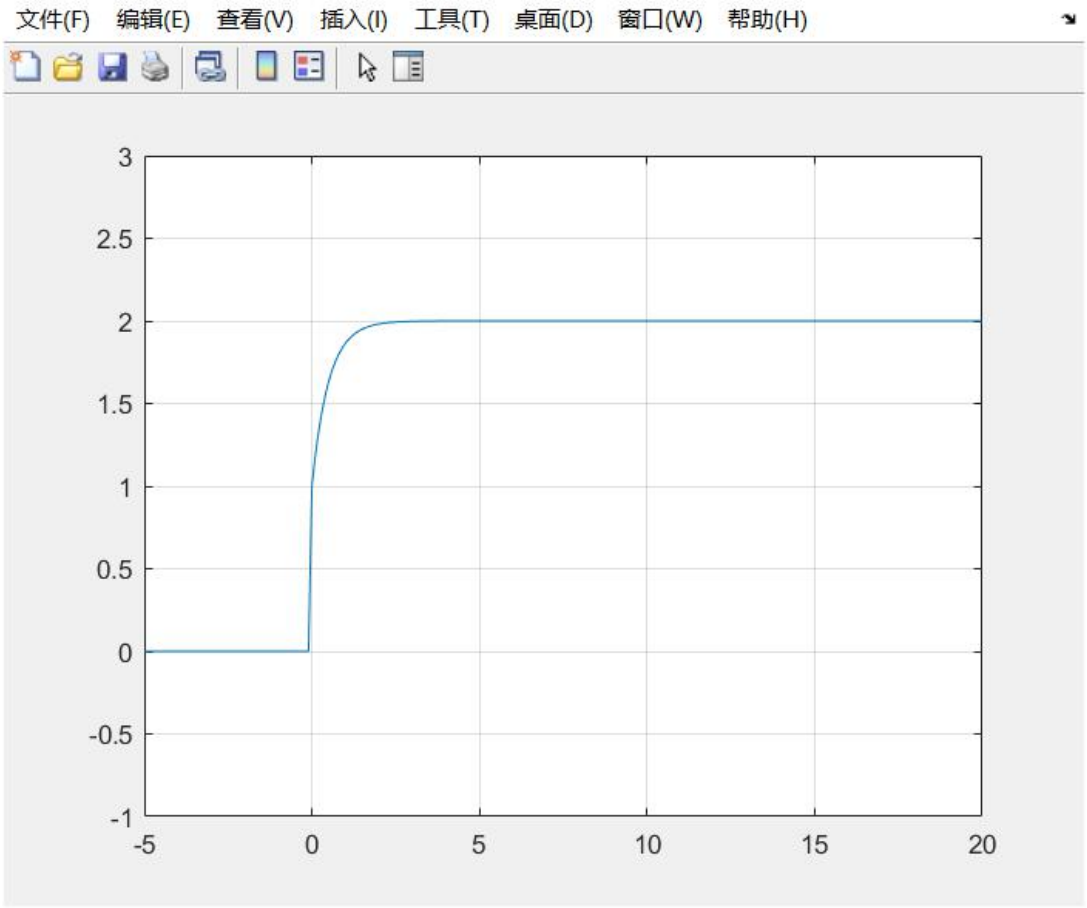


法二：数值法

源码：

```
t = -5:0.1:20;
f = (2-exp(-2*t)).*stepfun(t,0);
plot(t,f);
axis([-5,20,-1,3]);
grid on;
```

运行结果：



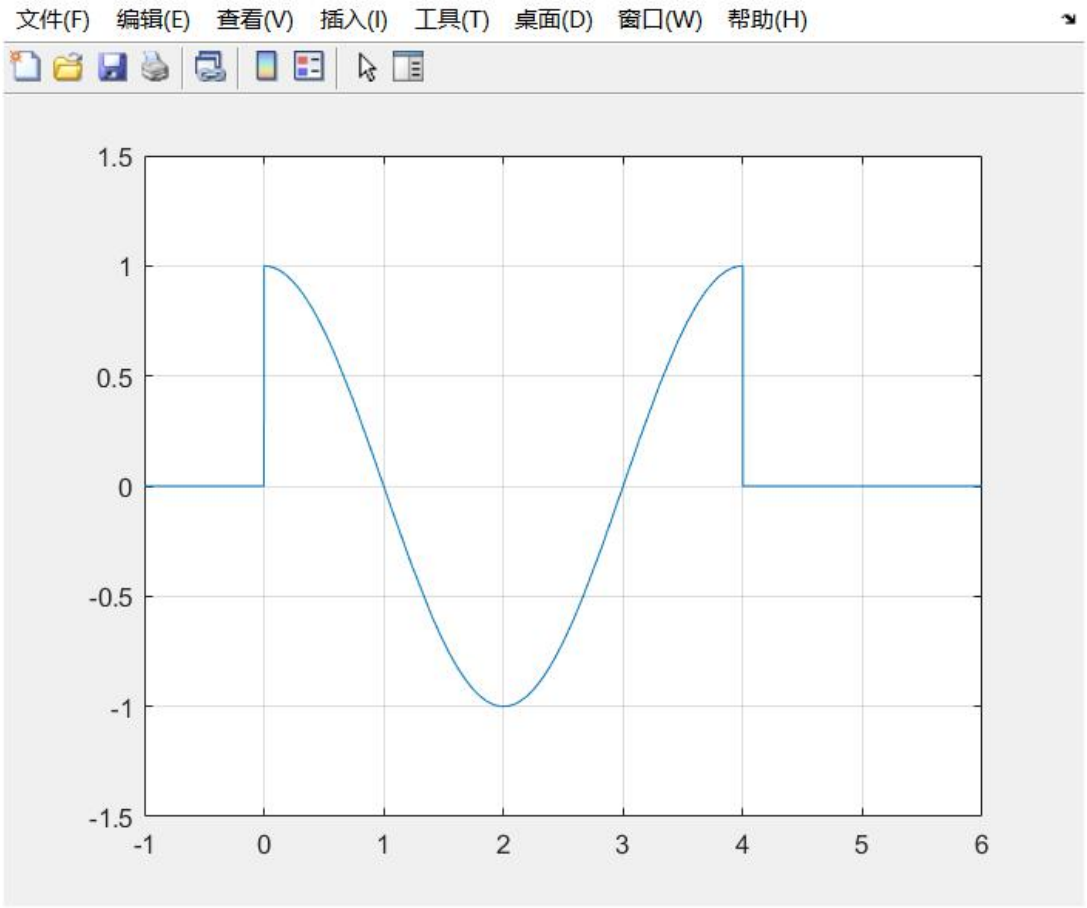
2) $f(t) = \cos(\frac{\pi t}{2})[u(t) - u(t-4)]$

法一：符号法

源码：

```
t = sym('t');
f = cos(0.5*pi*t)*(heaviside(t)-heaviside(t-4));
fplot(f,[-1,6]);
axis([-1,6,-1.5,1.5]);
grid on;
```

运行结果：

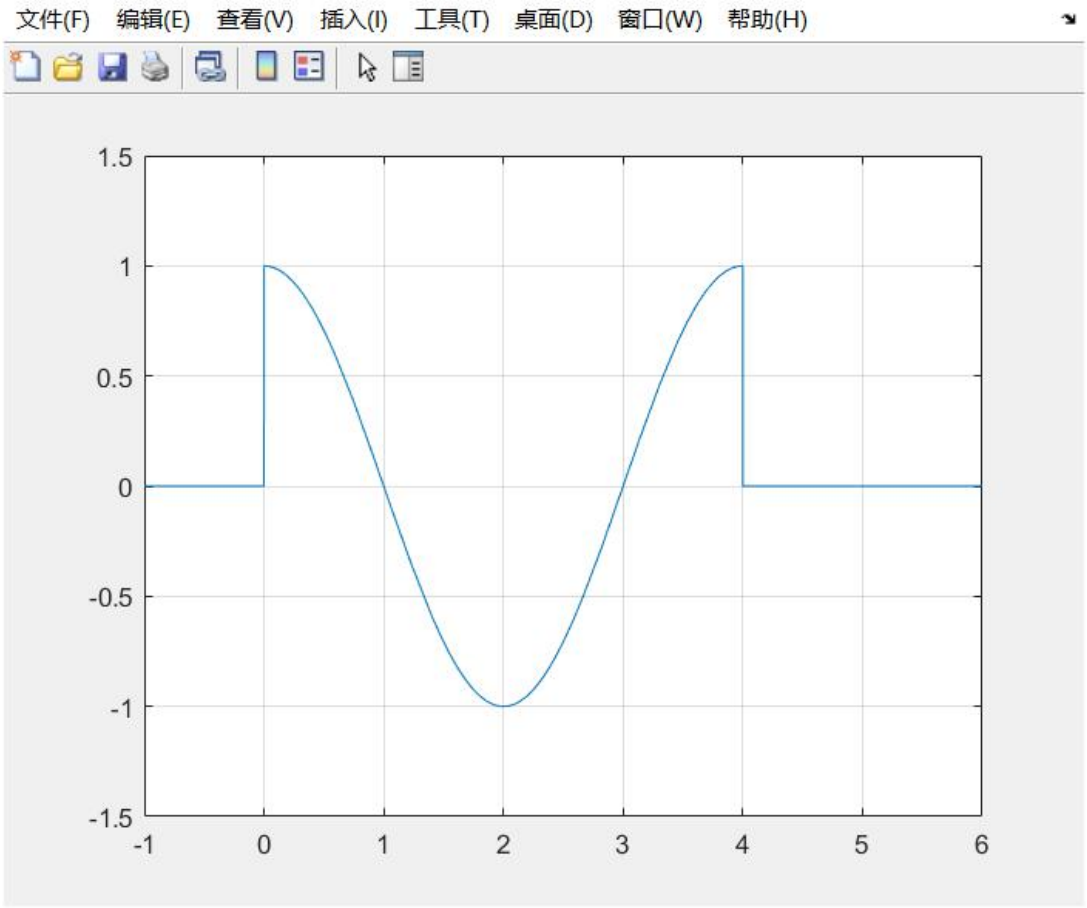


法二：数值法

源码：

```
t = -1:0.1:6;
f = cos(0.5*pi*t).*(stepfun(t,0)-stepfun(t,4));
plot(t,f);
axis([-1,6,-1.5,1.5]);
grid on;
```

运行结果：



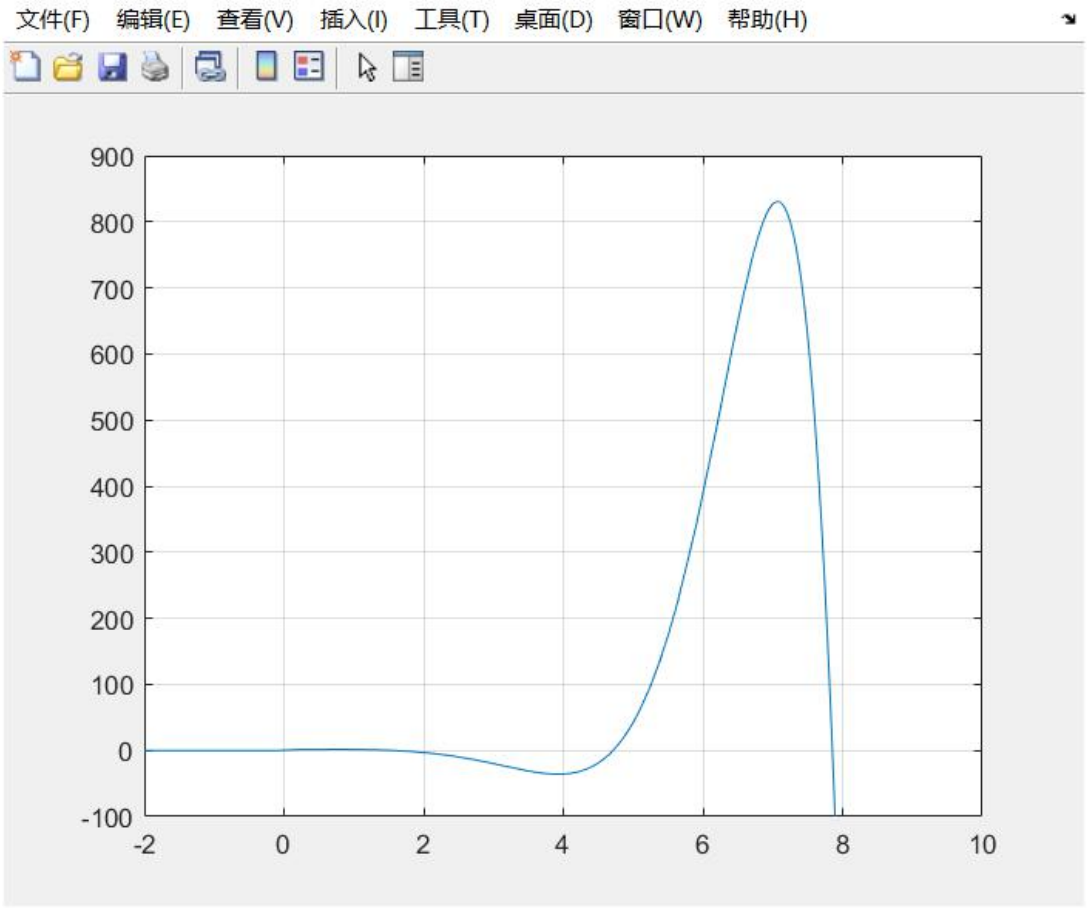
3) $f(t) = e^t \cos(t)\, u(t)$

法一：符号法

源码：

```
t = sym('t');
f = exp(t)*cos(t)*heaviside(t);
fplot(f,[-2,10]);
axis([-2,10,-100,900]);
grid on;
```

运行结果：

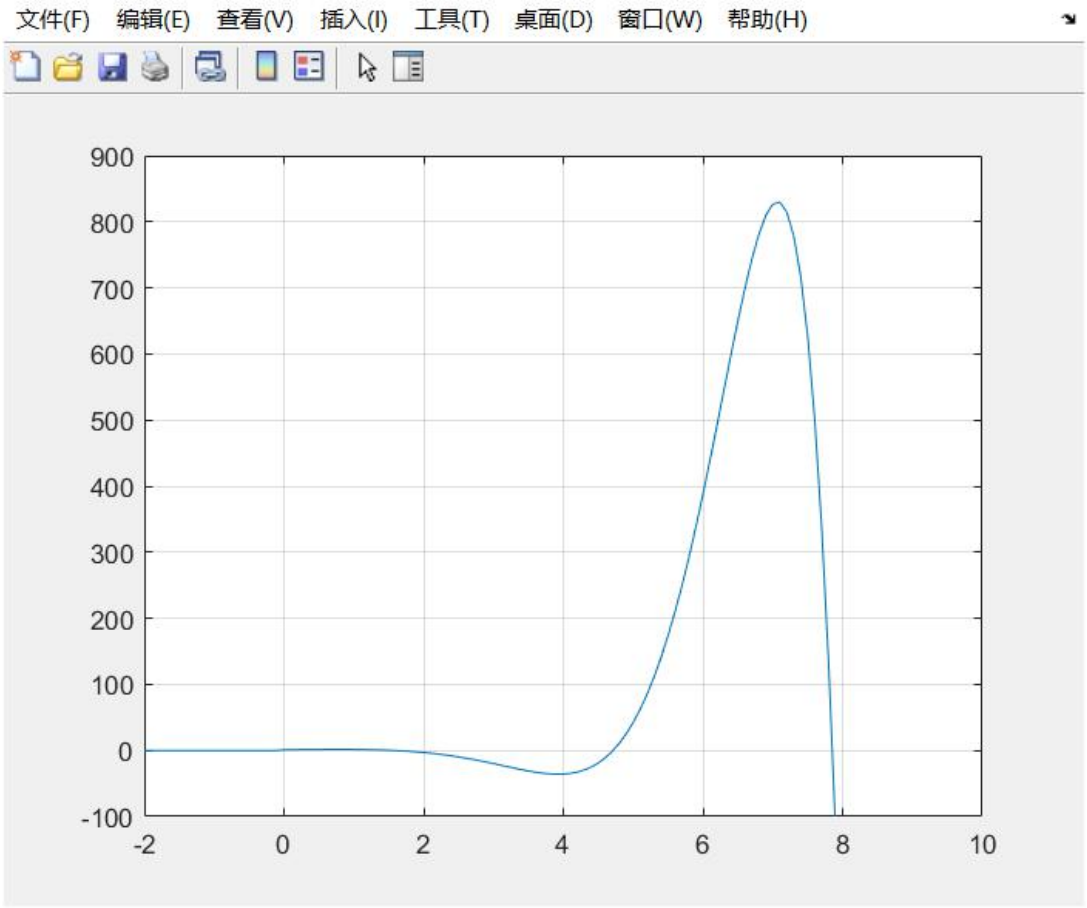


法二：数值法

源码：

```
t = -2:0.1:10;
f = exp(t).*cos(t).*stepfun(t,0);
plot(t,f);
axis([-2,10,-100,900]);
grid on;
```

运行结果：



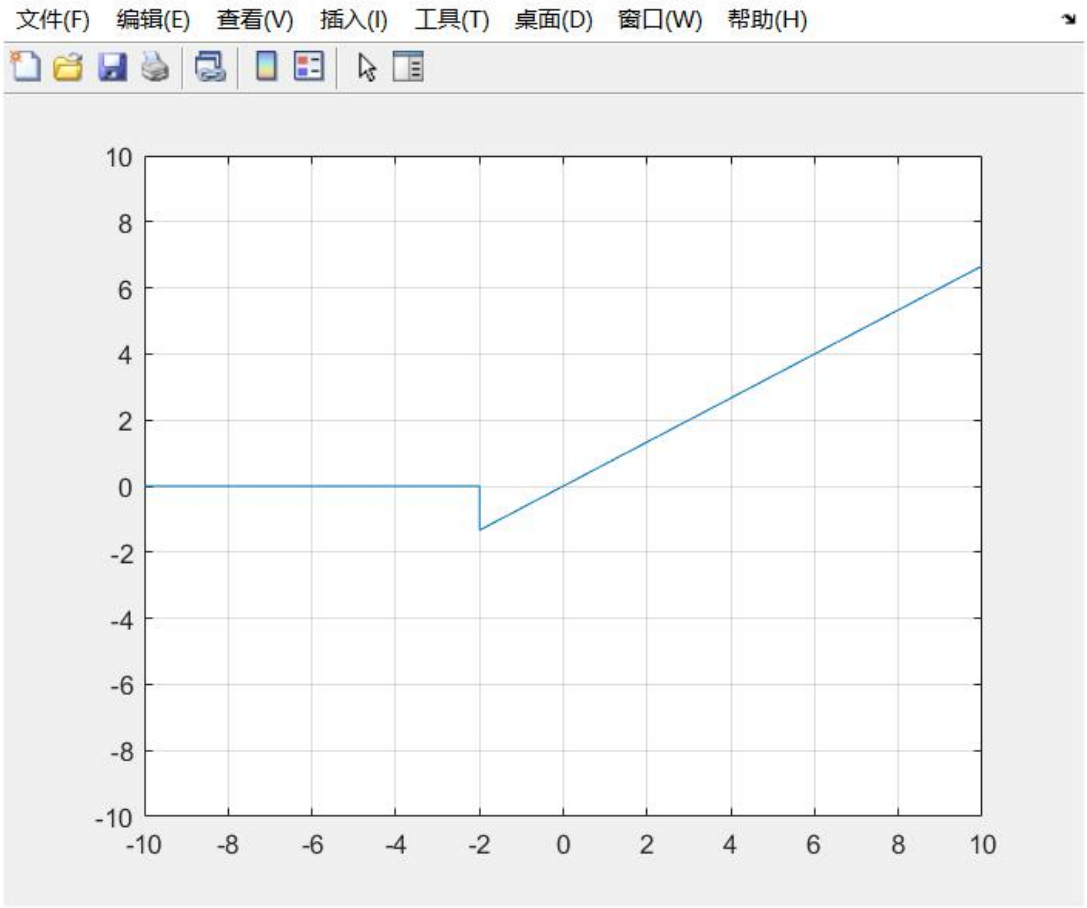
4) $f(t)=\frac{2}{3}tu(t+2)$

法一：符号法

源码：

```
t = sym('t');
f = (2/3)*t*heaviside(t+2);
fplot(f,[-10,10]);
axis([-10,10,-10,10]);
grid on;
```

运行结果：

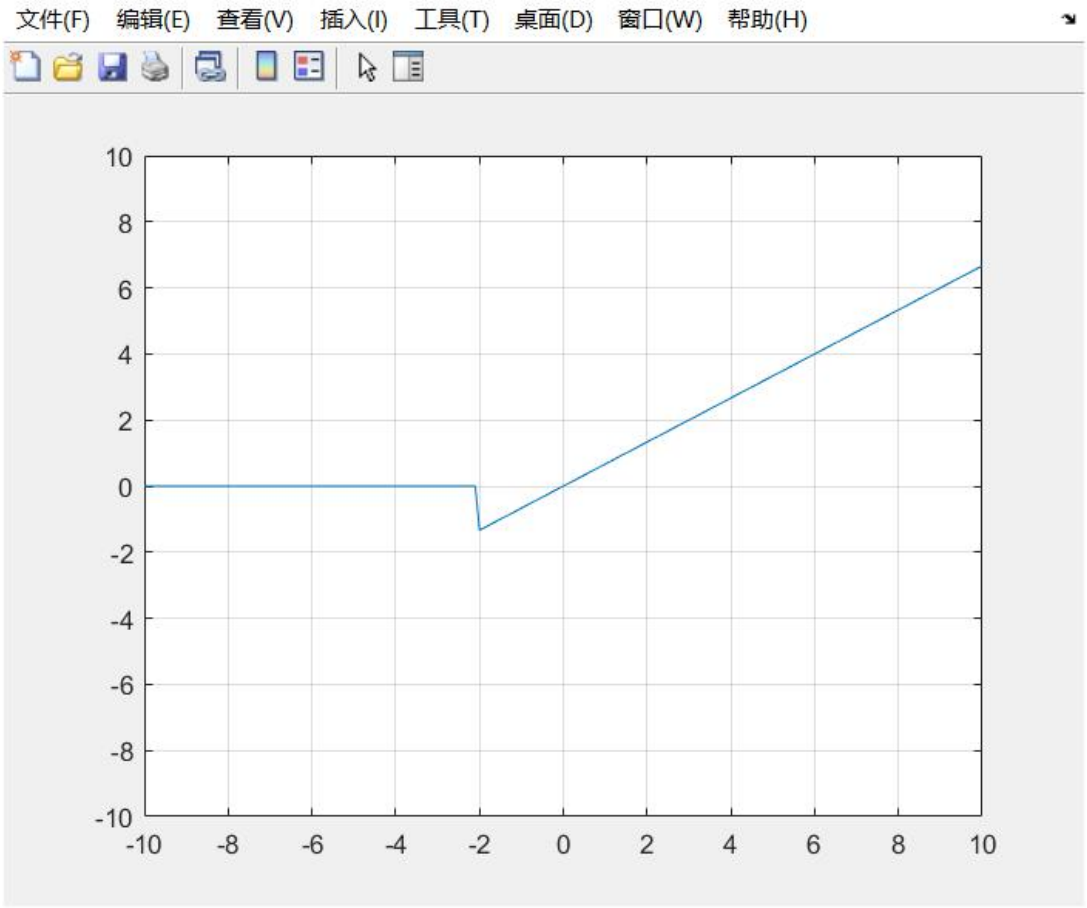


法二：数值法

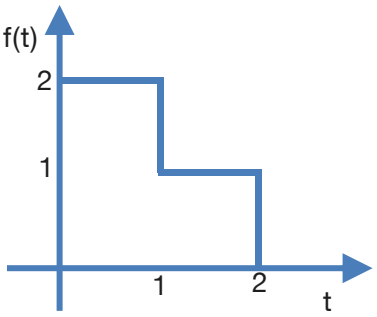
源码：

```
t = -10:0.1:10;
f = (2/3)*t.*stepfun(t,-2);
plot(t,f);
axis([-10,10,-10,10]);
grid on;
```

运行结果：



3、已知信号 *f*(*t*)的波形如右图所示，绘出满足下列要求的信号波形。



(1) *f*(−t)

(*2*) *f*(*t* − *2*)

(3) *f*(*at*) (其中 a 的值分别取 0.5 和 2)

(*4*) *f*(*0.5t* + *1*)

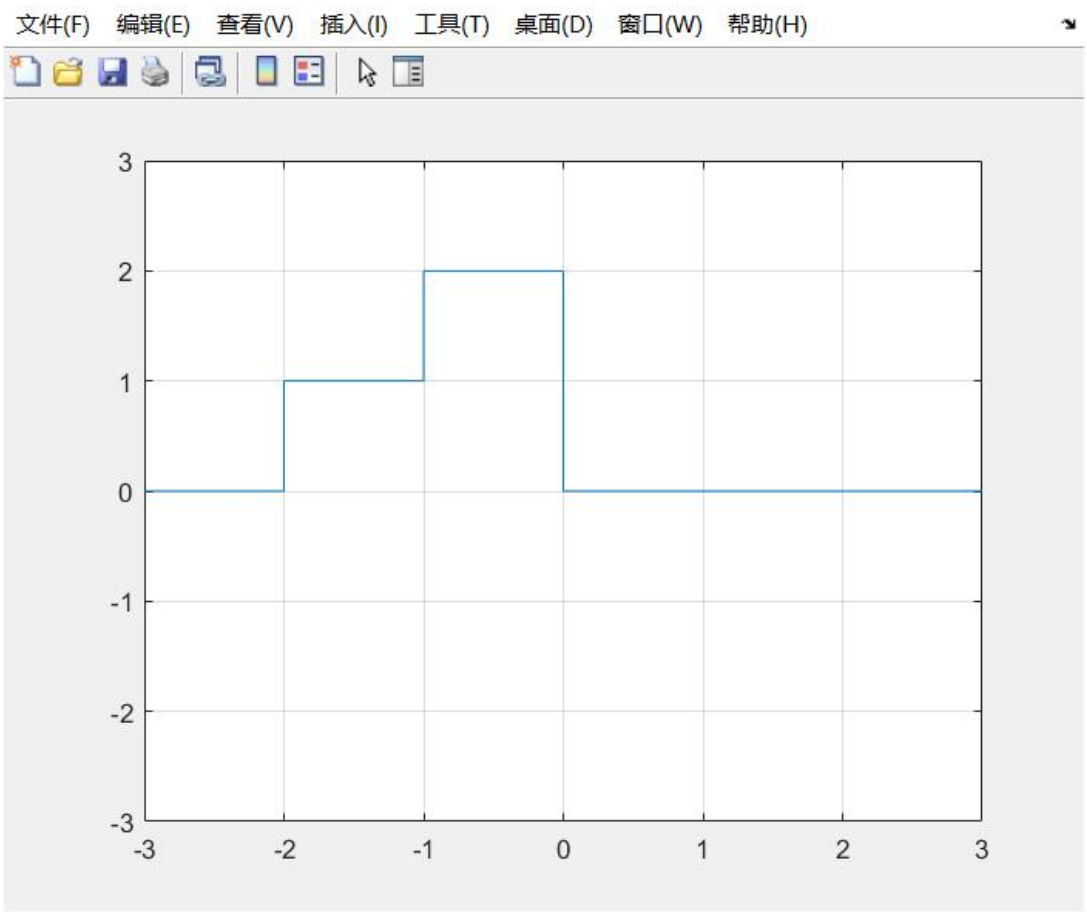
1) ***f*(−t)**

源码：

```
t = sym('t');
ft =
2*heaviside(-t)-1*heaviside(-t-1)-1*heaviside(-t-2);
```

```
fplot(ft,[-3,3]);
axis([-3,3,-3,3]);
grid on;
```

运行结果

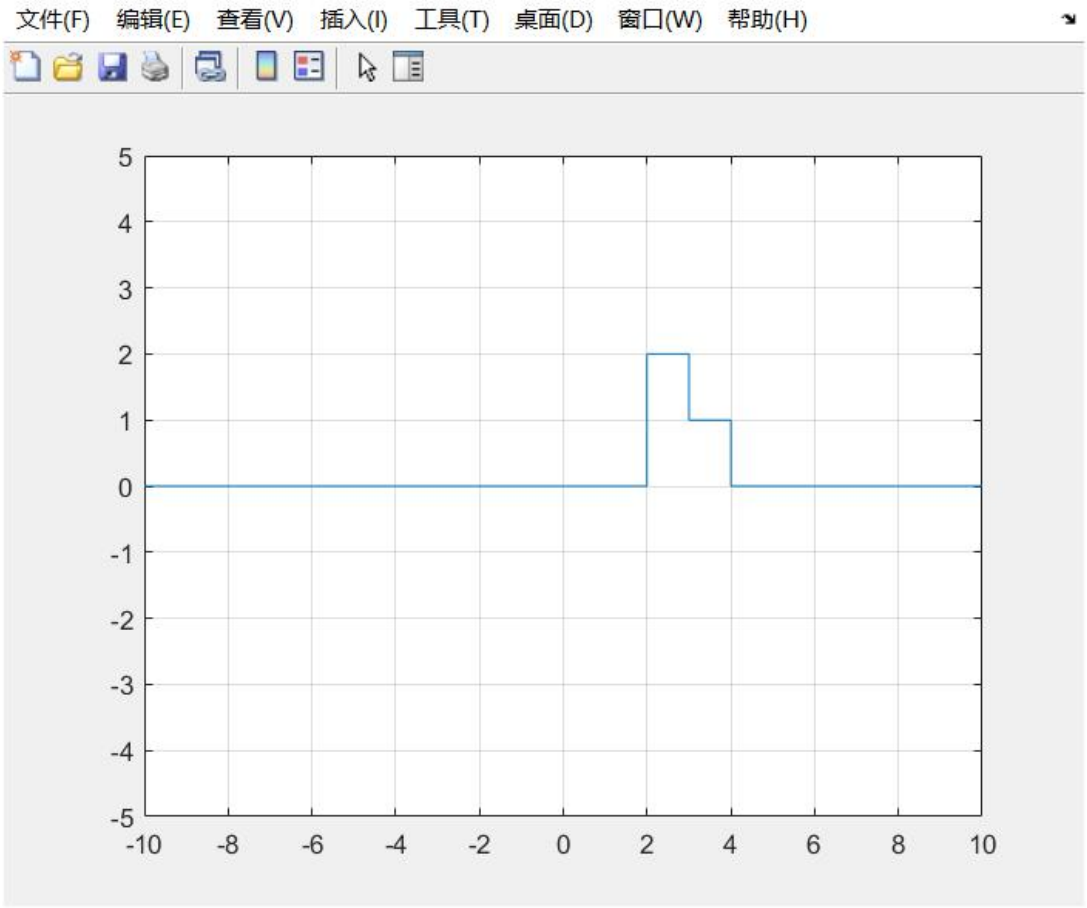


2) $f(t-2)$

源码：

```
t = sym('t');
ft =
2*heaviside(t-2)-1*heaviside(t-1-2)-1*heaviside(t-2-2
);
fplot(ft,[-10,10]);
axis([-10,10,-5,5]);
grid on;
```

运行结果



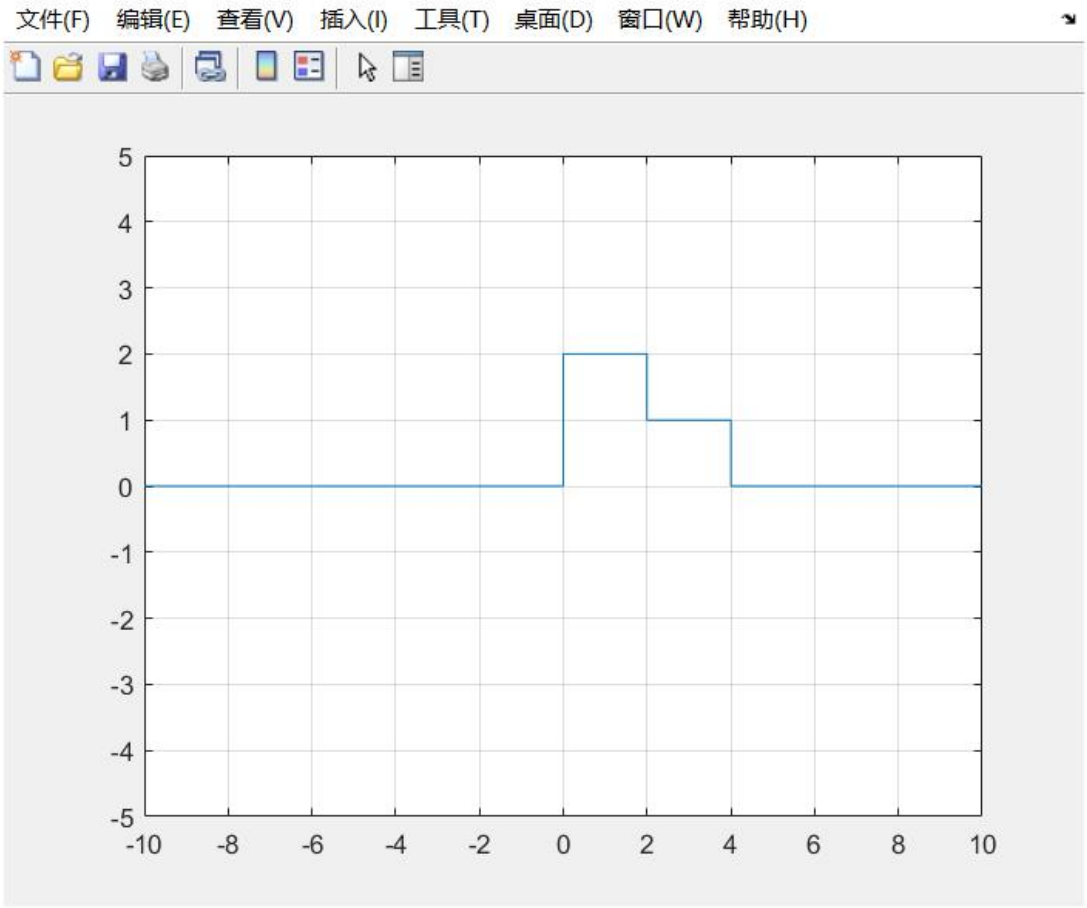
(3) *f*(*at*) (其中 a 的值分别取 0.5 和 2)

a = 0.5

源码：

```
t = sym('t');
a = 0.5;
ft =
2*heaviside(a*t)-1*heaviside(a*t-1)-1*heaviside(a*t-2
);
fplot(ft,[-10,10]);
axis([-10,10,-5,5]);
grid on;
```

运行结果

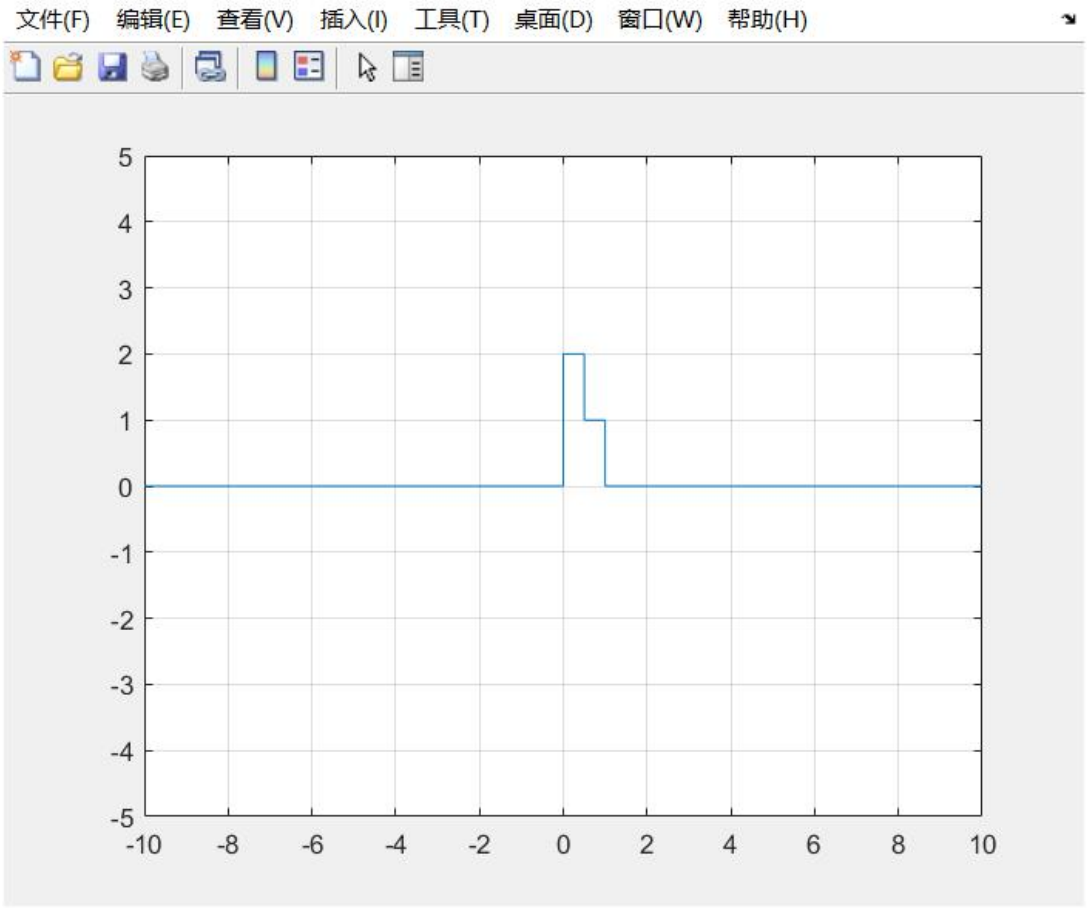


a=2

源码：

```
t = sym('t');
a = 2;
ft =
2*heaviside(a*t)-1*heaviside(a*t-1)-1*heaviside(a*t-2
);
fplot(ft,[-10,10]);
axis([-10,10,-5,5]);
grid on;
```

运行结果

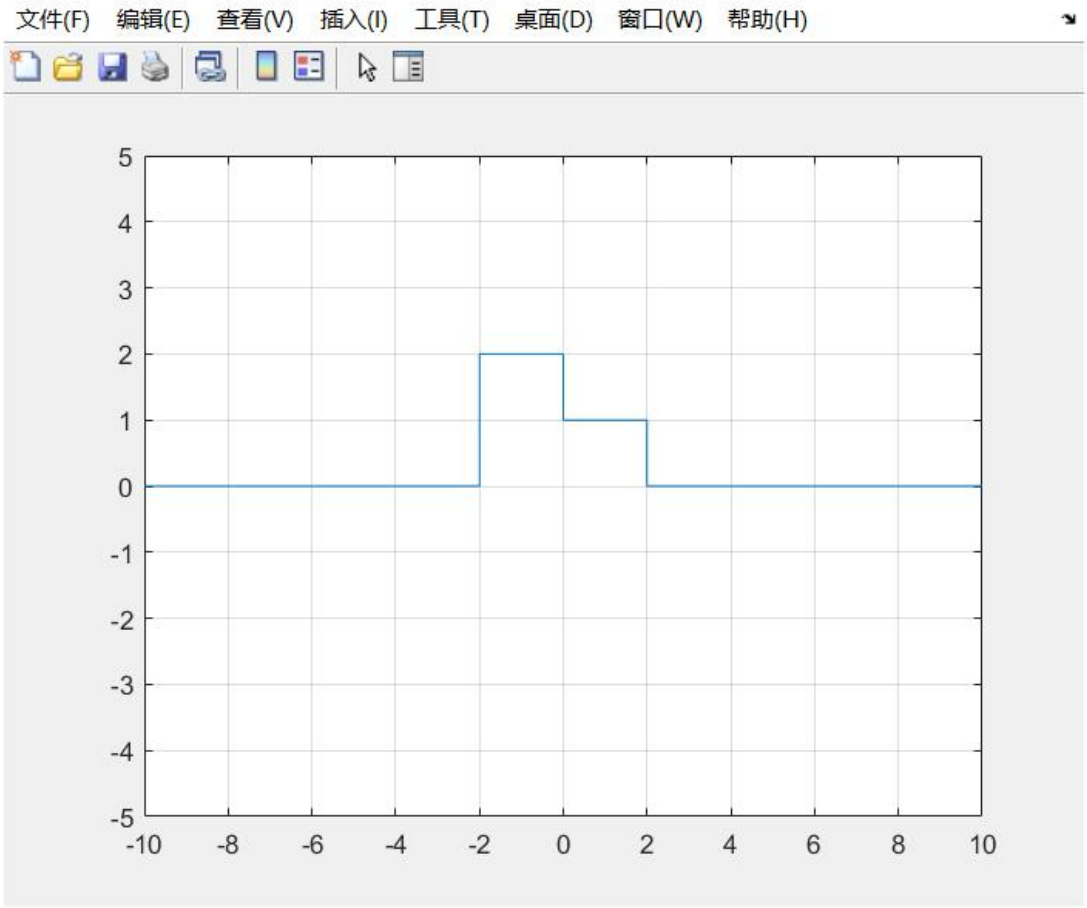


(4) $f(0.5t+1)$

源码：

```
t = sym('t');
a = 0.5;
ft =
2*heaviside(a*t+1)-1*heaviside(a*t+1-1)-1*heaviside(a
*t+1-2);
fplot(ft,[-10,10]);
axis([-10,10,-5,5]);
grid on;
```

运行结果



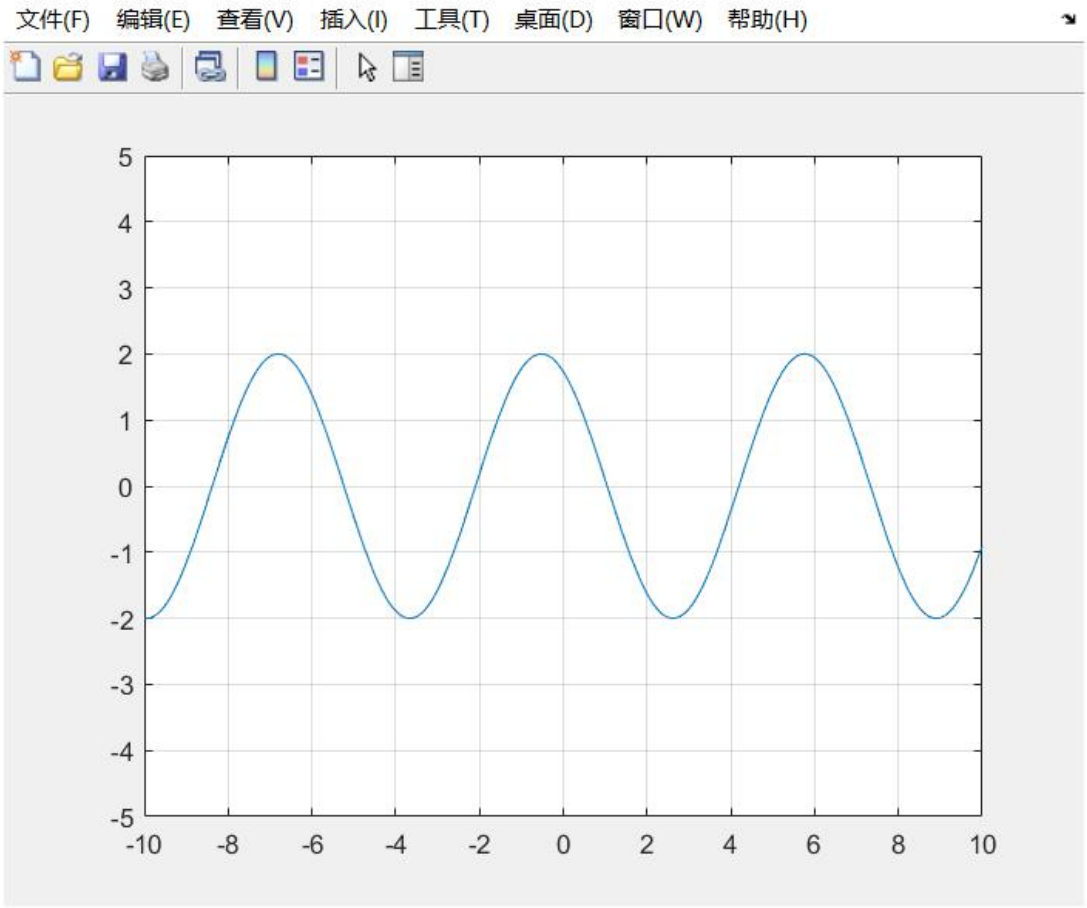
4、利用 Matlab 画出复信号 $f(t) = 2e^{j(t+\frac{\pi}{4})}$的实部、虚部、模和辅角。

实部:

源码:

```
t = sym('t');
ft = real(2*exp(1i*(t+pi/6)));
fplot(ft,[-10,10]);
axis([-10,10,-5,5]);
grid on;
```

运行结果

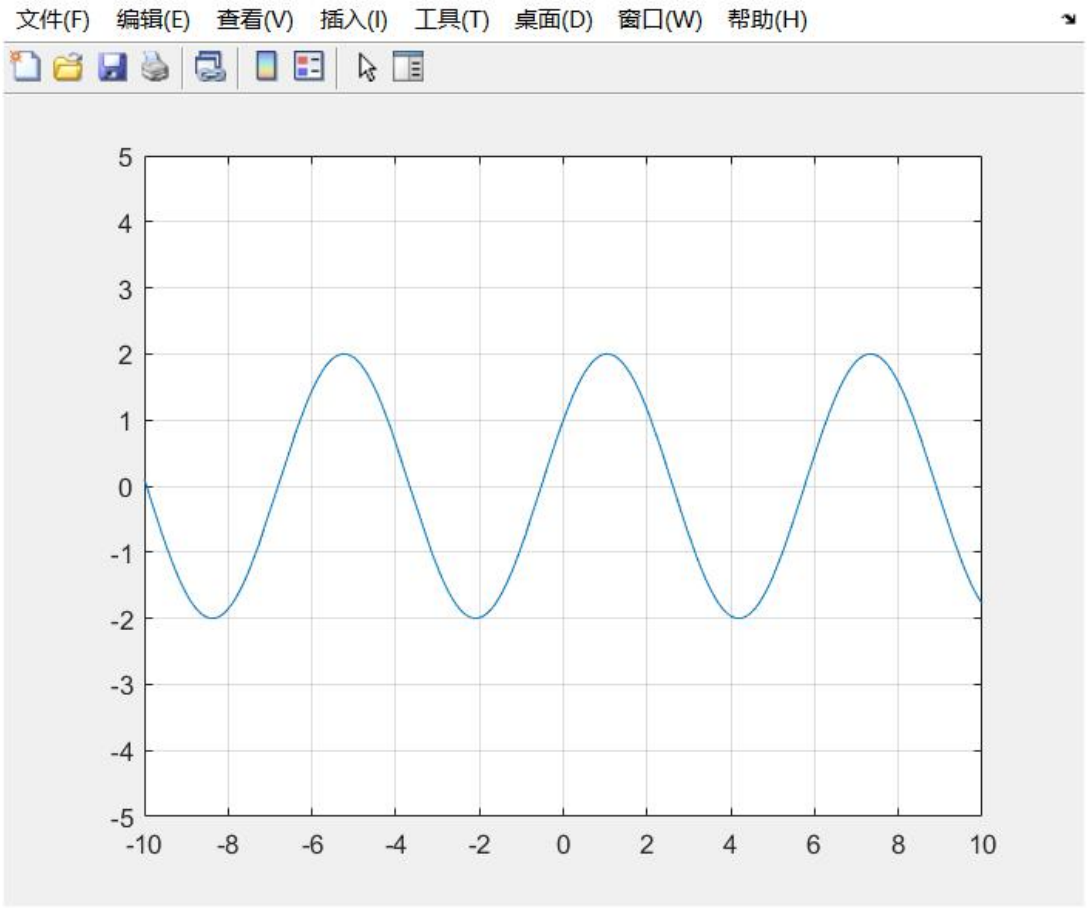


虚部:

源码:

```
t = sym('t');
ft = imag(2*exp(1i*(t+pi/6)));
fplot(ft,[-10,10]);
axis([-10,10,-5,5]);
grid on;
```

运行结果

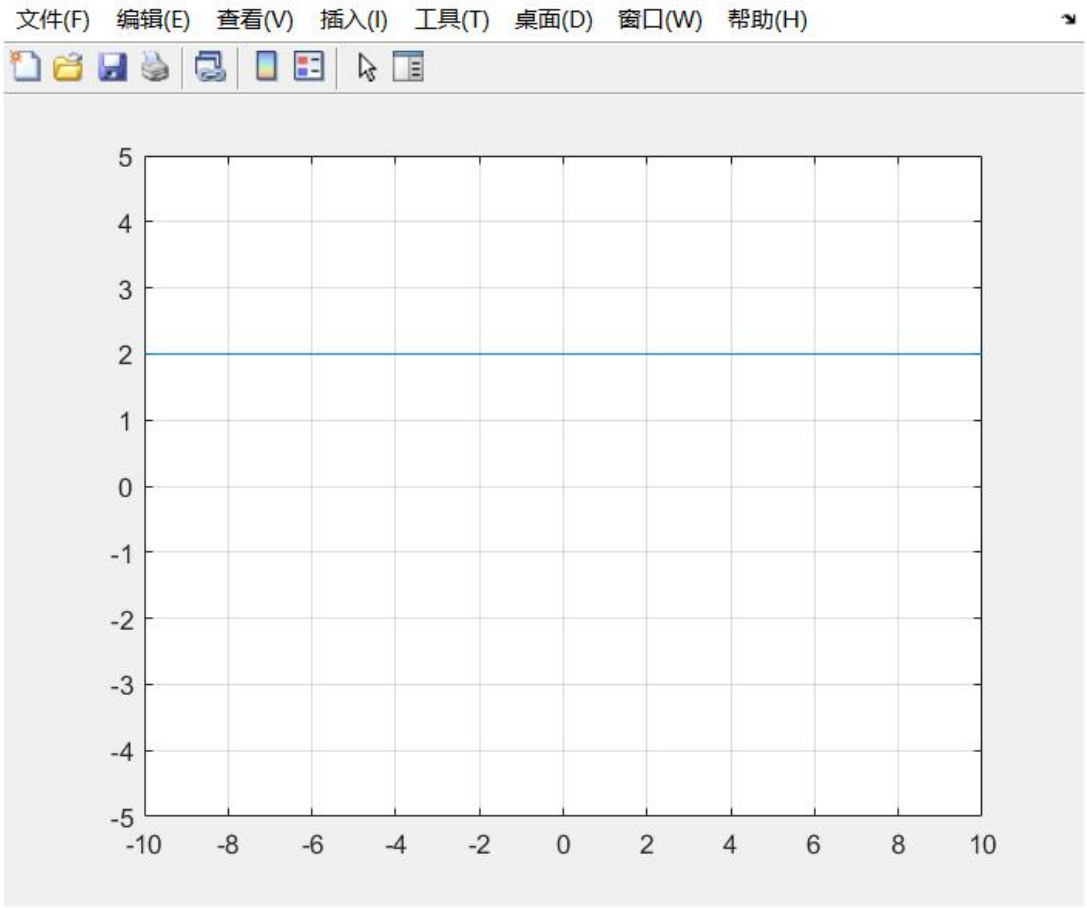


模：

源码：

```
t = sym('t');
ft = abs(2*exp(1i*(t+pi/6)));
fplot(ft,[-10,10]);
axis([-10,10,-5,5]);
grid on;
```

运行结果

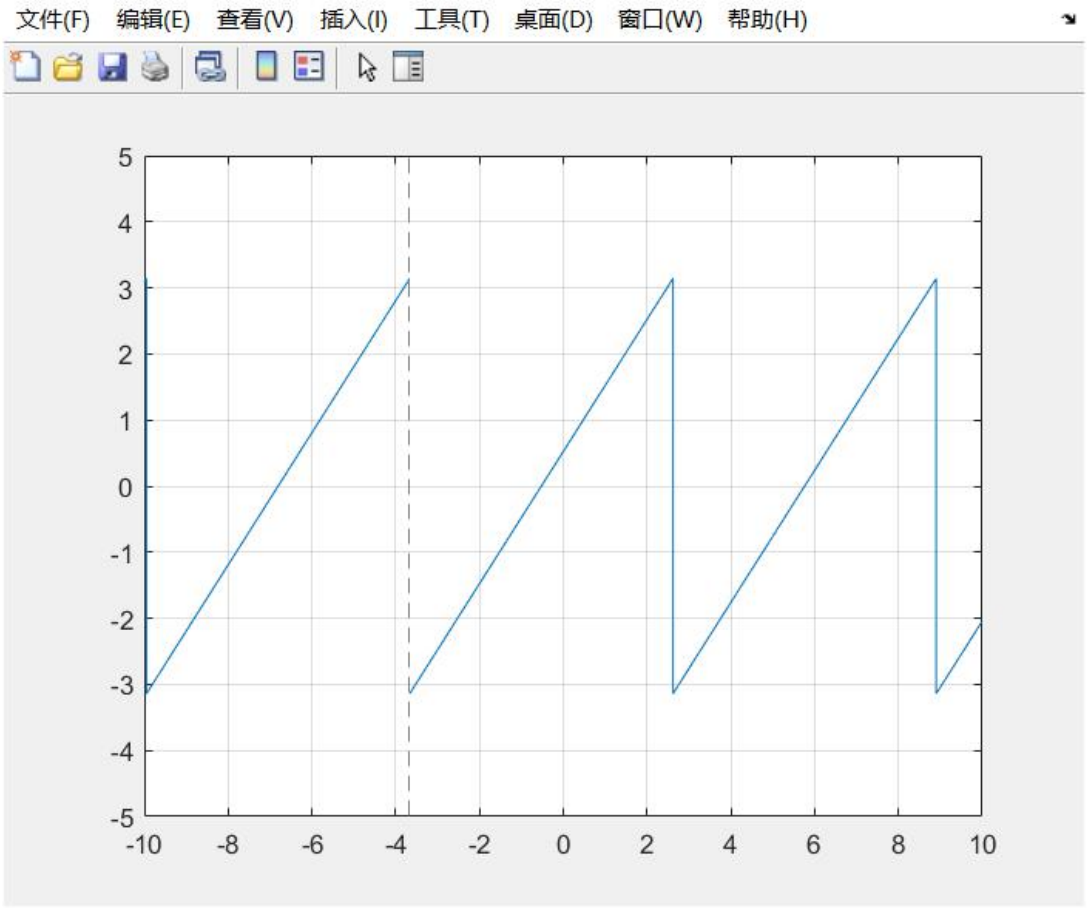


辐角：

源码：

```
t = sym('t');
ft = angle(2*exp(1i*(t+pi/6)));
fplot(ft,[-10,10]);
axis([-10,10,-5,5]);
grid on;
```

运行结果


文件(F) 编辑(E) 查看(V) 插入(I) 工具(T) 桌面(D) 窗口(W) 帮助(H)
5
4
3
2
1
0
-1
-2
-3
-4
-5
-10
-8
-6
-4
-2
0
2
4
6
8
10