Matlab 5^{th} Homework week 7

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1 Limit

1.1 Description

$$lim_{x\to a}\frac{sinx-sina}{x-a}$$
$$lim_{x\to\infty}(\frac{2x+3}{2x+1})^{x+1}$$
$$lim_{x\to a^+}\frac{\sqrt{x}-\sqrt{a}+\sqrt{x-a}}{\sqrt{x^2-a^2}}$$
$$lim_{x\to a^-}\frac{\sqrt{x}-\sqrt{a}+\sqrt{x-a}}{\sqrt{x^2-a^2}}$$
$$lim_{x\to 0}\frac{tan(2x)}{tan(5x)}$$

1.2 Analysis

Solve the problem by useing *limit* function.
Limit(f,variable,value,'left' or 'right').

1.3 Codes and Result

Question 1

```
syms x a;
f=(sin(x)-sin(a))/(x-a);
limit(f,x,a)
```

Result

ans=cos(a)

Question 2

```
syms x;
f=((2*x+3)/(2*x+1))^(x+1);
```

```
limit(f,x,inf)
```

Result

ans=exp(1)

Question 3

```
syms x a;
f=(sqrt(x)-sqrt(a)+sqrt(x-a))/sqrt(x^2-a^2);
limit(f,x,a,'right')
```

Result

$ans = \frac{1}{\sqrt{2a}}$

Question 5

```
syms x a;
f=(sqrt(x)-sqrt(a)+sqrt(x-a))/sqrt(x^2-a^2);
limit(f,x,a,'left')
```

Result

$ans = \frac{i}{\sqrt{-2a}}$

Question 4

```
syms x;
f=tan(2*x)/tan(5*x);
limit(f,x,0)
```

Result

ans =2/5

2 Differential

2.1 Description

f=t sin(x)

$$solve \quad \frac{df}{dx}, \frac{df}{dt}, \frac{d^2f}{dxdt}$$

$$f = x^{y^z}$$

$$solve \quad \frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}, \frac{\partial f}{\partial z}$$

2.2 Anaylsis

use function *diff* to get Differential number.
diff(f,variable x,steps n).

2.3 Code and Result

Question 1

```
syms t x;
f=t*sin(x);
diff(f,x)
diff(f,t)
diff(diff(f,x),t)
```

Result

ans=x*cos(x)
ans=sin(x)
ans=cos(x)

Question 2

```
syms x y z;
f=x^(y^z);
diff(f,x)
diff(f,y)
diff(f,z)
```

Result

ans =x(y - 1)*y

ans =x(y)*y(z - 1)*z*log(x)

ans =x(y)*y *log(x)*log(y)

3 Solve INT

3.1 Description

$$I = \int_0^{2\pi} d\alpha \int_0^{\frac{pi}{4}} d\theta \int_0^{2acos\theta} r^2(1+cos\theta)sin\theta dr$$

$$I = \int_{-\infty}^{+\infty} \frac{1}{1+x^2} dx$$

3.2 Anaylsis

Use function int(f,x,a,b)

3.3 Code and Result

Question 1

```
syms u theta r a;
f=r^2*(1+cos(u))*sin(theta);
int(int(int(f,r,0,2*a*cos(theta)),theta,0,pi/4),u,0,2*pi)
```

Result

ans=pi*a^3

Question 2

```
clear all;
syms x;
f=1/(1+x^2);
int(f,x,-inf,inf)
```

Result

ans=pi

4 Equations

4.1 Description

$$\begin{cases} x(x+y+z)=a \\ y(x+y+z)=b \\ z(x+y+z)=c \end{cases}$$

When a=16,b=12,c=18,solve x,y,z.

4.2 Anaylsis

In MATLAB, the solve() function can solve Equations,which automatically give the Results of the syms.

4.3 Code and Result

```
1   syms x y z;
2   a=16;
3   b=12;
4   c=18;
5   equ1=x*(x+y+z)-a;
6   equ2=y*(x+y+z)-b;
7   equ3=z*(x+y+z)-c;
8   s=solve(equ1,equ2,equ3,x,y,z);
9   s.x
10  s.y
11  s.z
```

Result

$$\begin{cases} x1=-(8*46^{1/2})/23 \\ y1=-(6*46^{1/2})/23 \\ z1=-(9*46^{1/2})/23 \end{cases}$$

$$\begin{cases} x1 = (8 * 46^{1/2})/23 \\ y1 = (6 * 46^{1/2})/23 \\ z1 = (9 * 46^{1/2})/23 \end{cases}$$

5 Non-Homogenous Differential Equation

5.1 Description

$$\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = xe^{2x}$$

To find the general solution of the non-homogenous differential equation of the second-order constant coefficient.

5.2 Anaylsis

use function *dsolve* to get the solution of the non-homogenous differential equation.

5.3 Code and Result

```
clear all;
syms x y;
dsolve('D2y-5*Dy+6*y-x*exp(2*x)')
```

Result

ans=(x*exp(2*x))/6 + C1*exp(2*t) + C2*exp(3*t)

6 Non-Homogenous Differential Equation with the initial condition

6.1 Description

$$\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = xe^{2x}$$

To find the general solution of the non-homogenous differential equation of the second-order constant coefficient.

6.2 Anaylsis

$$\frac{d^2s}{dt^2} + 2\frac{ds}{dt} + s = 0, s|_{t=0} = 4, s^{'}|_{t=0} = -2$$

use function *dsolve* to get the solution of the non-homogenous differential equation.

Don't forget the initial condition equations.

6.3 Code and Result

```
clear all;
syms s t;
eq1='D2s+2*Ds+s';
eq2='s(0)=4';
eq3='Ds(0)=-2';
dsolve(eq1,eq2,eq3)
```

Result

ans =4*exp(-t) + 2*t*exp(-t)

7 Laplace Transform

7.1 Description

Solve Laplace transform of $f(t) = Ae^{at}$, and inverse Laplace transform of $F(s) = \frac{s}{(s^2-1)^2}$.

7.2 Anaylsis

Use function laplace(f) and ilaplace(F) to solve the inverse transform.

7.3 Code and Result

Question 1

```
syms A a t;
f=A*exp(a*t);
laplace(f)
```

Result

ans=-A/(a - s)

Question 2

```
syms s;
F=s/(s^2-1);
ilaplace(F)
```

Result

ans =exp(-t)/2 + exp(t)/2

8 Syms&Number Plot

8.1 Discription

The following graphs are drawn using numeric and symbolic methods (both methods)

$$f(t) = 3 - e^{-t}(t > 0)$$
$$f(t) = 3e^{(} - 2t) + 5e^{-t}(t > 0)$$
$$f(t) = e^{-t}sin(2\pi t), 0 < t < 3$$
$$f(t) = \frac{sin(at)}{at} = Sa(at), a = 2$$

8.2 Anaylsis

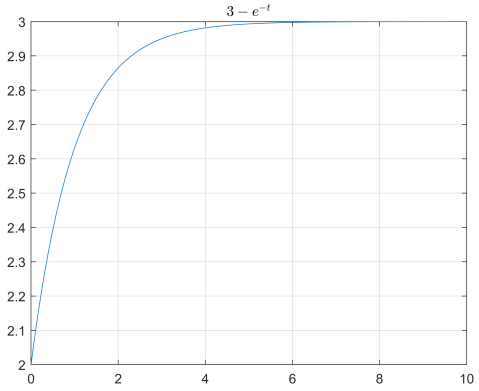
For syms **f**,use **ezplot(f)** to figure,for Numerical figure,use **plot(t,f)**.

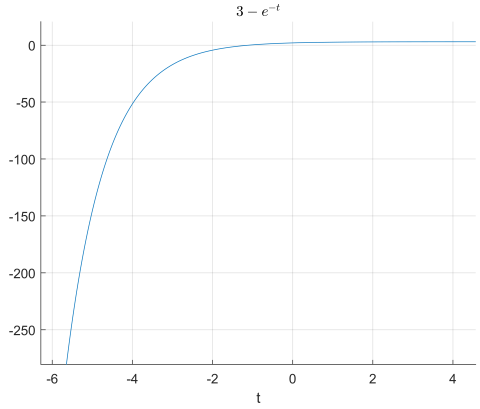
8.3 Code and Result

Question 1

```
t=0:0.01:10;
plot(t,3-exp(-t));
hold on;
grid on;
title('3-e^{-t}','Interpreter','Latex');
```

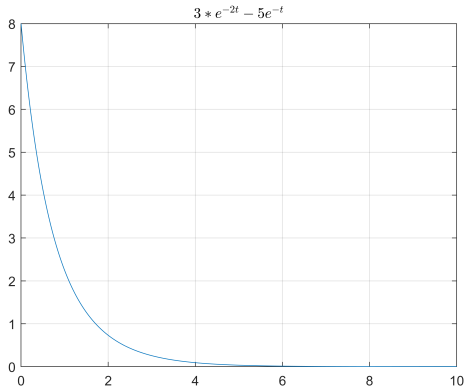
```
hold off;
figure(2)
grid on;
hold on;
t=sym('t');
f=sym(3-exp(-t))
ezplot(f);
title('3-e^{-t}','Interpreter','Latex');
```

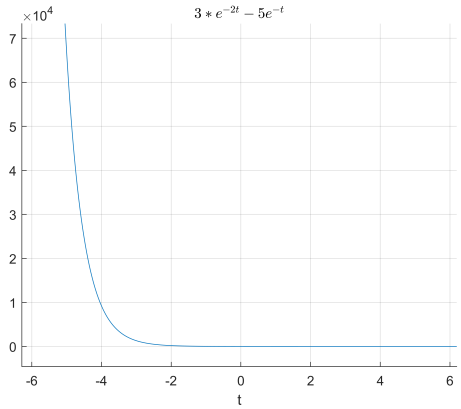




Question 2

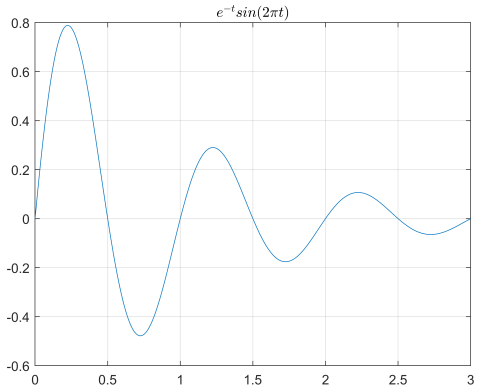
```
clear all;
t=0:0.01:3;
plot(t,3*exp(-2*t)+5*exp(-t));
hold on;
grid on;
title('3e-2*t+5e-t','Interpreter','Latex');
hold off;
figure(2)
grid on;
hold on;
t=sym('t');
f=sym(3*exp(-2*t)+5*exp(-t));
ezplot(f,[0,3]);
title('3e-2*t+5e-t','Interpreter','Latex');
```

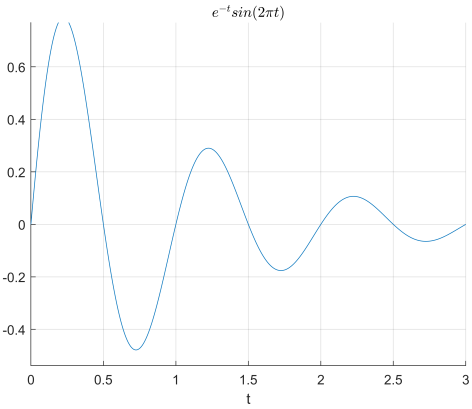




Question 3

```
clear all;
t=0:0.01:3;
plot(t,exp(-t).*sin(2*pi*t));
hold on;
grid on;
title('e^{-t}sin(2\pi t)','Interpreter','Latex');
hold off;
figure(2)
grid on;
hold on;
t=sym('t');
f=sym(exp(-t)*sin(2*pi*t));
ezplot(f,[0,3]);
title('e^{-t}sin(2\pi t)','Interpreter','Latex');
```





Question 4

```
clear all;
t=-7:0.01:7;
a=2
plot(t,sinc(a*t/pi));
hold on;
grid on;
title('Sa(at)','Interpreter','Latex');
hold off;
figure(2)
grid on;
hold on;
t=sym('t');
f=sym(sinc(a*t/pi));
ezplot(f);
title('Sa(at)','Interpreter','Latex');
```