作业4 符号计算

1. 做因式分解.

代码：

syms x;

f = x^4-5\*x^3+5\*x^2+5\*x-6;

factor(f)

输出：

2. 求矩阵的逆和特征值.

代码：

syms a;

A = [1 2;2 a];

iA = inv(A)

e = eig(A)

该矩阵的逆(iA)为，特征值(e)为。

3. 计算极限, ，, .

代码：

syms x y;

ans1 = limit((3^x+9^x)^(1/x),x,inf)

temp1 = limit(log(2\*x+exp(-y))/(sqrt(x^3+y^2)-1),x,0);

ans2 = limit(s1,y,0)

ans3 = limit(log(1+1/x)/acot(x),x,inf)

ans4 = limit((1-sqrt(1-x^2))/(exp(x)-cos(x)),x,inf)

输出：

ans1 = 9

ans2 = 0

ans3 = 1

ans4 = 0

4. 计算

代码：

syms k n x;

s1=symsum(k^2,k,1,n);

s2=symsum(k^(-2),k,1,inf);

s3=symsum(1/(2\*n+1)/(2\*x+1)^(2\*n+1),n,0,inf);

s1=simplify(s1)

s2=simplify(s2)

s3=simplify(s3)

输出：

s1 =

s2 =

s3 =

5. 求.

代码：

s=sin(x^2\*y\*z);

s=diff(s,x,2);

s=diff(s,y,1);

s=subs(s,{x,y,z},{1,1,3})

输出：

s =

6. (Taylor展开)求下列函数在的Taylor幂级数展开式(n=8):

输出：

syms x

f1 = exp(x);

f2 = log(1+x);

f3 = sin(x);

f4 = log(x+sqrt(1+x^2));

f5 = 1/(x^2-3\*x+2);

f = [f1 f2 f3 f4 f5];

for fi = f

taylor(fi, x, 'Order', 9, 'ExpansionPoint', 0)

end

输出：

ans =

ans =

ans =

ans =

ans =

7. 计算下列不定积分并用diff验证:

代码：

% 题7

function intf(f,symbol)

fi = int(f,symbol)

s = simplify(diff(fi));

if (f == s)

fprintf('经验证，运算结果正确。')

end

end

% 7.1

syms x;

f1 = exp(2\*x)\*(tan(x)+1)^2;

intf(f1,x);

% 7.2

syms y;

f2 = exp(2\*y)/(exp(y)+2);

intf(f2,y)

% 7.3

syms x a;

f3 = x^2/sqrt(a^2-x^2);

intf(f3,x)

% 7.4

syms x;

f4 = exp(x^(-2));

intf(f4,x)

% 7.5

syms x;

syms a b;

assume(a ~= b);

f5 = 1/x/(sqrt(log(x)+a)+sqrt(log(x)+b))

intf(f5,x)

输出：

fi =   
经验证，运算结果正确。

fi =

fi =

经验证，运算结果正确。

fi =

fi =

8. 计算积分.

代码：

syms x y;

f=(x-y)^3\*sin(x+2\*y);

Ix=simplify(int(f,y,-x,x))

输出：

Ix =

9. 用solve和vpasolve求解：

(1) ; (2) ; (3) ;

(4)

代码：

syms x;

f1 = x^2+x+1;

f2 = 3\*x^5-4\*x^3+2\*x-1;

f3 = 5\*x^23-6\*x^7+8\*x^6-5\*x^2;

syms a b;

f4\_1 = a-0.7\*sin(a)-0.2\*cos(b);

f4\_2 = b-0.7\*cos(a)+0.2\*sin(b);

ans1 = solve(f1)

ans1\_vpa = vpasolve(f1)

ans2 = solve(f2)

ans2\_vpa = vpasolve(f2)

ans3 = solve(f3)

ans3\_vpa = vpasolve(f3)

ans4=solve(f4\_1,f4\_2);

a = ans4.a, b = ans4.b

ans4\_vpa = vpasolve([f4\_1,f4\_2],[a,b]);

a = ans4\_vpa.a, b = ans4\_vpa.b

输出：

ans1 =

- (3^(1/2)\*1i)/2 - 1/2

(3^(1/2)\*1i)/2 - 1/2

ans1\_vpa =

- 0.5 - 0.86602540378443864676372317075294i

- 0.5 + 0.86602540378443864676372317075294i

ans2 =

1

root(z^4 + z^3 - z^2/3 - z/3 + 1/3, z, 1)

root(z^4 + z^3 - z^2/3 - z/3 + 1/3, z, 2)

root(z^4 + z^3 - z^2/3 - z/3 + 1/3, z, 3)

root(z^4 + z^3 - z^2/3 - z/3 + 1/3, z, 4)

ans2\_vpa =

1.0

- 0.94789546187456058989982247394741 + 0.38447007122004299382156325898354i

- 0.94789546187456058989982247394741 - 0.38447007122004299382156325898354i

0.44789546187456058989982247394741 + 0.34346118035803441068185315904729i

0.44789546187456058989982247394741 - 0.34346118035803441068185315904729i

ans3 =

0

0

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 1)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 2)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 3)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 4)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 5)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 6)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 7)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 8)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 9)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 10)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 11)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 12)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 13)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 14)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 15)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 16)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 17)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 18)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 19)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 20)

root(z^21 - (6\*z^5)/5 + (8\*z^4)/5 - 1, z, 21)

ans3\_vpa =

-1.0416311763589428374686584408263

-0.79274546861240926191924109664562

0

0

0.97677619398071757087862231043777

- 0.98594963701901959900484213184619 + 0.41057020403951865662802180945064i

- 0.98594963701901959900484213184619 - 0.41057020403951865662802180945064i

- 0.78209833143223447594582478257895 + 0.73762800311567240825832647446461i

- 0.78209833143223447594582478257895 - 0.73762800311567240825832647446461i

- 0.46094786023350981784523398271686 - 0.94584291018582793043183825065437i

- 0.46094786023350981784523398271686 + 0.94584291018582793043183825065437i

- 0.11502134522537942046330640127478 - 0.83395751612873404038333191900501i

- 0.11502134522537942046330640127478 + 0.83395751612873404038333191900501i

- 0.034470907009732943409050301800815 + 1.0150421408571649032393019800474i

- 0.034470907009732943409050301800815 - 1.0150421408571649032393019800474i

0.35164930123881630632696678974119 - 0.98778549068536472045647828253356i

0.35164930123881630632696678974119 + 0.98778549068536472045647828253356i

0.6614929533597689009181308956201 - 0.80640797130406975169374584454874i

0.6614929533597689009181308956201 + 0.80640797130406975169374584454874i

0.85537957344718312941157861309122 - 0.5362610924602192818188251618063i

0.85537957344718312941157861309122 + 0.5362610924602192818188251618063i

0.93876647836942518426621991528217 - 0.26823747234096561929304543964393i

0.93876647836942518426621991528217 + 0.26823747234096561929304543964393i

警告: Unable to solve symbolically. Returning a numeric solution using vpasolve.

a =

0.52652262191818418730769280519209

b =

0.50791971903684924497183722688768

a =

0.52652262191818418730769280519209

b =

0.50791971903684924497183722688768

10. 用dsolve求解：

(1)

(2)

(3)

(4)

(5)

代码：

% 10.1

syms y(x)

Dy = diff(y);

eqn = Dy == x + y;

cond = y(0) == 1;

S = dsolve(eqn, cond)

% 10.2

syms x(t) y(t)

eqn1 = diff(x, t) == -2\*x - 3\*y;

eqn2 = diff(y, t) == 2\*x + y;

eqns = [eqn1, eqn2];

cond1 = x(0) == -2.7;

cond2 = y(0) == 2.8;

conds = [cond1, cond2];

S = dsolve(eqns, conds)

% 10.3 (解不出)

syms y(t)

eqn = diff(y, t, t) - 0.01\*(diff(y, t))^2 + 2\*y == sin(t);

cond1 = y(0) == 1;

Dy = diff(y);

cond2 = Dy(0) == 0;

conds = [cond1, cond2];

S = dsolve(eqn, conds)

% 10.4

syms x(t)

eqn = 2\*diff(x, t, t) - 5\*diff(x, t) - 3\*x == 90\*exp(2\*t);

cond1 = x(0) == 2;

Dx = diff(x);

cond2 = Dx(0) == 1;

conds = [cond1, cond2];

S = dsolve(eqn, conds)

% 10.5

syms x(t)

eqn = diff(x, t, t) == -(2\*diff(x, t))/t + 2\*x/t^2 + (10\*cos(log(t)))/t^2;

cond1 = x(1) == 1;

cond2 = x(3) == 3;

conds = [cond1, cond2];

S = dsolve(eqn, conds)

输出：

S =

Sx =

Sy =

警告: Unable to find symbolic solution.

S = [ empty sym ]

S =

S =

11. 计算导数：, .

代码：

syms x;

y1 = (1 + sin(x))/(1 - cos(x));

y\_prime\_1 = diff(y1, x)

y2 = [asin(x), acos(x); atan(x), acot(x)];

y\_prime\_2 = diff(y2, x)

输出：

y\_prime\_1 =

y\_prime\_2 =

12. 计算下列定积分：

代码：

syms x;

f1 = x / (1 + cos(2\*x));

int(f1, 0, pi/4)

f2 = x \* (1 - x^4)^(3/2);

int(f2, 0, 1)

输出：

ans =

ans =