
SIT LAB 3

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Computational Mathematics in Symbolic Math

Variables, Expressions, Functions and Equations

```
pi/6 + pi/4
```

```
ans =
```

```
1.3090
```

```
sym(pi/6) + sym(pi/4)
```

```
ans =
```

```
(5*pi)/12
```

```
vpa(pi/6) + vpa(pi/4)
```

```
ans =
```

```
1.3089969389957471826927680763665
```

```
syms x y
```

```
log(x) + exp(y)
```

```
ans =
```

```
exp(y) + log(x)
```

```
y(x) = piecewise(x<0, -1, x>0, 1)
```

```
y(x) =
```

```
piecewise(x < 0, -1, 0 < x, 1)
```

```
syms f(x)
```

```
f(x)=x^4-2*x^3+6*x^2-2*x+10
```

```
f(-5)
```

```
f(x) =
```

```
x^4 - 2*x^3 + 6*x^2 - 2*x + 10
```

```
ans =
```

```
1045
```

```
syms y1 y2
```

```
y1= x+3;
```

```
y2= 3*x;
```

```
solve(y1==y2)
```

```
ans =
```

```
3/2
```

```
syms x
```

```
solve(x^4 == 1)
```

```
ans =
```

```
-1
```

```
1
```

```
-1i
```

```
1i
```

```
assume(x, 'real')
```

```
assumeAlso(x>0)
```

```
assumptions(x)
```

```
solve(x^4 == 1)
assume(x, 'clear')

ans =

[ in(x, 'real'), 0 < x]

ans =

1
```

Substitution and Solving

```
syms x xo
subs(x^2+1,x,xo-1)

ans =

(xo - 1)^2 + 1

syms a b c
subs(cos(a) + sin(b) - exp(2*c), [a b c], [pi/2 pi/4 -1])

ans =

2^(1/2)/2 - exp(-2)

solve(9*x^2 - 1 == 0)

ans =

-1/3
1/3

eqn=a*x^2 + b*x + c == 0;
sol = solve(eqn)
subs(sol,[a b c],[9 0 -1])

sol =

-(b + (b^2 - 4*a*c)^(1/2))/(2*a)
-(b - (b^2 - 4*a*c)^(1/2))/(2*a)
```

ans =

$-1/3$
 $1/3$

```
syms x f(x)
assume(x>0)
f(x) = 6*x^7-2*x^6+3*x^3-8;
fplot(f)
xlim([-10 10])
ylim([-1e3 1e3])
doubleSol = roots([-8 3 -2 6])
symsSol = solve(f)
vpaSol = vpasolve(f)
```

doubleSol =

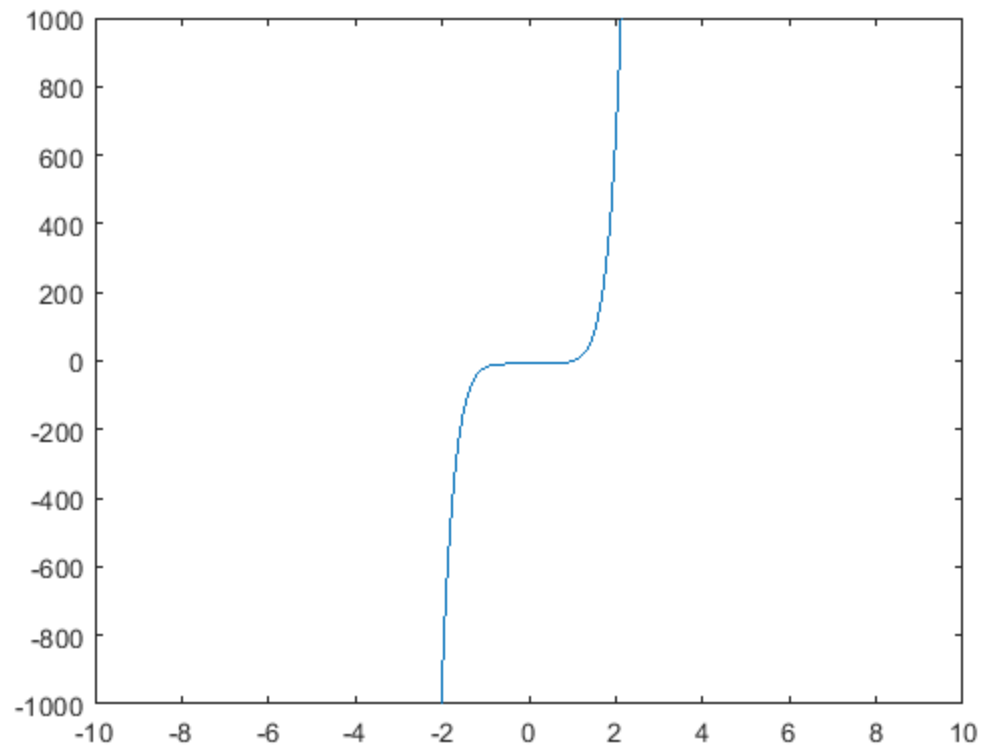
$0.9471 + 0.0000i$
 $-0.2861 + 0.8426i$
 $-0.2861 - 0.8426i$

symsSol =

$\text{root}(z^7 - z^6/3 + z^3/2 - 4/3, z, 5)$

vpaSol =

$1.0240240759053702941448316563337$
 $- 0.88080620051762149639205672298326 +$
 $0.50434058840127584376331806592405i$
 $- 0.88080620051762149639205672298326 -$
 $0.50434058840127584376331806592405i$
 $- 0.22974795226118163963098570610724 +$
 $0.96774615576744031073999010695171i$
 $- 0.22974795226118163963098570610724 -$
 $0.96774615576744031073999010695171i$
 $0.7652087814927846556172932675903 +$
 $0.83187331431049713218367239317121i$
 $0.7652087814927846556172932675903 -$
 $0.83187331431049713218367239317121i$



Simplification and Manipulation

```
simplify((x - 1)*(x + 1)*(x^2 + x + 1)*(x^2 + 1)*(x^2 - x + 1)*(x^4 -  
x^2 + 1))  
combine(2*sin(x)*cos(x) + (1- cos(2*x))/2 + cos(x)^2, 'sincos')
```

```
ans =
```

```
x^12 - 1
```

```
ans =
```

```
sin(2*x) + 1
```

```
syms x y  
factor(y^6-x^6)
```

```
ans =
```

```
[-1, x - y, x + y, x^2 + x*y + y^2, x^2 - x*y + y^2]
```

```
f(x) = (x^3 + 7);
```

```
expand(f(y-1))
```

```
ans =
```

```
y^3 - 3*y^2 + 3*y + 6
```

```
f(x) = sqrt(log(x));
```

```
g(x) = sqrt(1-x);
```

```
h = compose(g,f,x)
```

```
h(x) =
```

```
(1 - log(x)^(1/2))^(1/2)
```

Calculus(Differentiation,Integration,Limits, Series)

```
diff(sin(x))
```

```
diff(x^2+sin(2*x^4)+1,x)
```

```
int(exp(-x^2/2),x)
```

```
int(x*log(1+x),0,1)
```

```
ans =
```

```
cos(x)
```

```
ans =
```

```
2*x + 8*x^3*cos(2*x^4)
```

```
ans =
```

```
(2^(1/2)*pi^(1/2)*erf((2^(1/2)*x)/2))/2
```

```
ans =
```

```
1/4
```

```
syms x
```

```
T= taylor(sin(x)/x)
```

```
subs(T,x,0)
```

```
limit(tan(x),x,pi/2,'left')
```

```
limit(tan(x),x,pi/2,'right')
```

```
limit(tan(x),x,pi/2)
```

$T =$

$$x^4/120 - x^2/6 + 1$$

$ans =$

1

$ans =$

Inf

$ans =$

$-Inf$

$ans =$

NaN

Differential Equations

```
syms a b y(x)
dsolve(diff(y)==-a*y)
dsolve(diff(y)==-a*y,y(0)==b)
```

$ans =$

$$C4 \exp(-a x)$$

$ans =$

$$b \exp(-a x)$$

```
syms x(t) y(t)
z=dsolve(diff(x)==y,diff(y)==-x);
disp([z.x;z.y])
```

$$\begin{aligned} &C7 \cos(t) + C6 \sin(t) \\ &C6 \cos(t) - C7 \sin(t) \end{aligned}$$

Linear Algebra

```
syms a b c d
```

```
syms x1 x2
x=[x1;x2];
A=[a b;c d];
b=A*x
det(A)
lambda=eig(A)
```

$b =$

$$\begin{bmatrix} a*x1 + b*x2 \\ c*x1 + d*x2 \end{bmatrix}$$

$ans =$

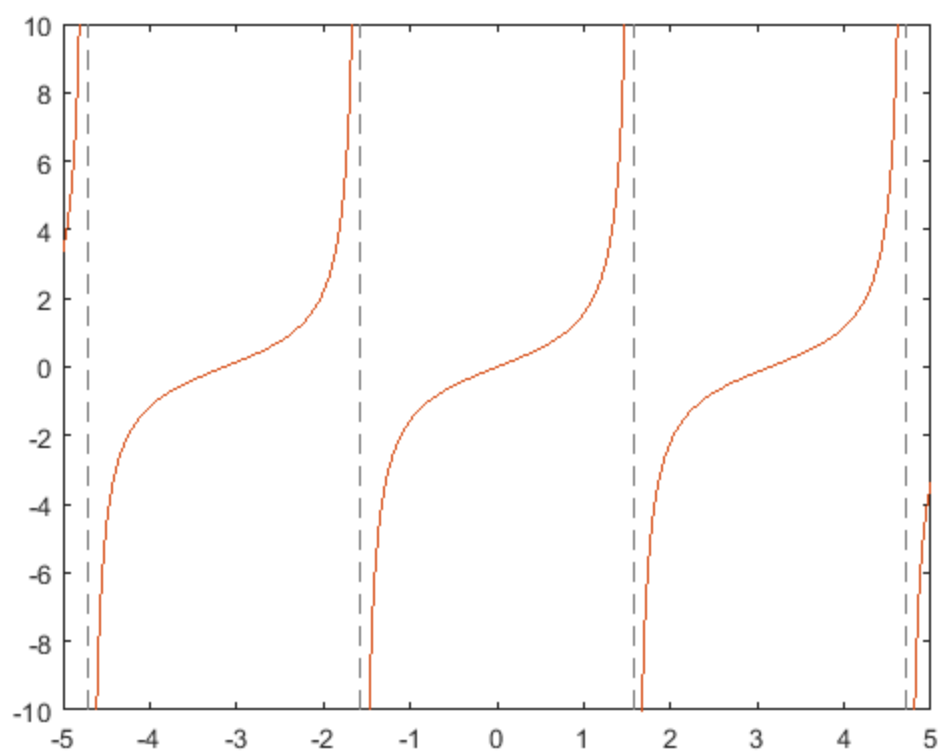
$$a*d - b*c$$

$lambda =$

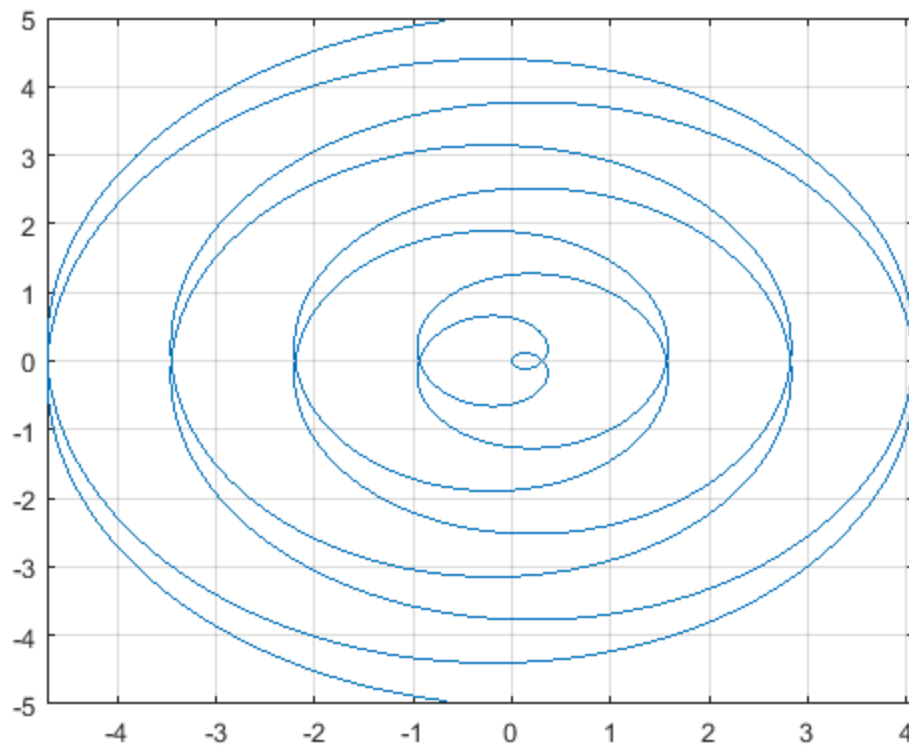
$$\begin{aligned} & a/2 + d/2 - (a^2 - 2*a*d + d^2 + 4*b*c)^{(1/2)}/2 \\ & a/2 + d/2 + (a^2 - 2*a*d + d^2 + 4*b*c)^{(1/2)}/2 \end{aligned}$$

Graphics

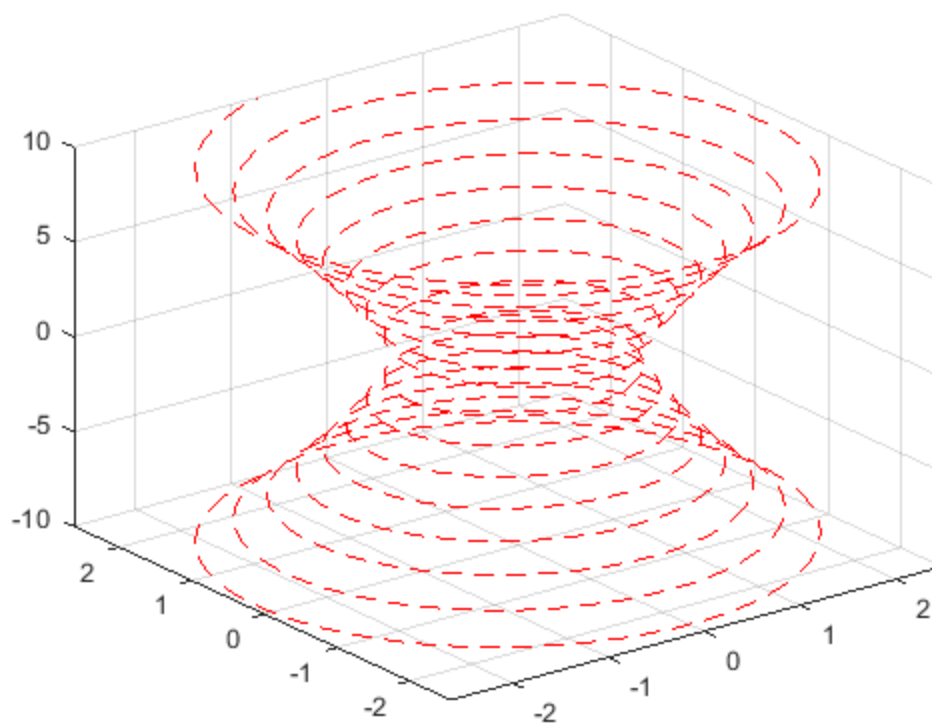
```
figure
fplot(tan(x))
```

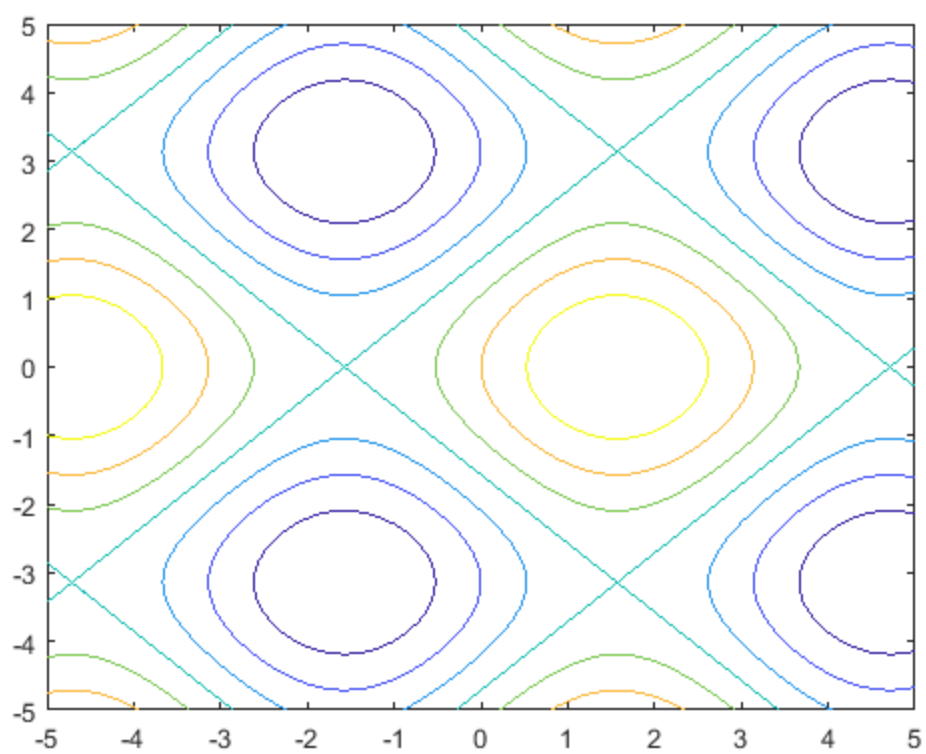
```
syms t
x=t*sin(5*t);
y=t*cos(5*t);
figure
fplot(x,y)
grid on
```



```
syms t
xt = exp(abs(t)/10).*sin(5*abs(t));
yt = exp(abs(t)/10).*cos(5*abs(t));
zt = t;
figure
h = fplot3(xt,yt,zt, [-10,10], '--r');
```



```
syms x y
fsurf(sin(x)+cos(y))
fcontour(sin(x)+cos(y))
```



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