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## Method of Variation Parameters

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clc
clear all
syms x r c1 c2
p1=input('Enter the coefficient of D2y ');
p2=input('Enter the coefficient of Dy');
p3=input('Enter the coefficient of y');
eq=p1*r^2+p2*r+p3;
r=solve(eq,'r');
p=real(r(1));
q=imag(r(1));
if q~=0
    y1=exp(p*x)*cos(q*x);
    y2=exp(p*x)*sin(abs(q)*x);
elseif r(1)==r(2)
    y1=exp(r(1)*x);
    y2=x*exp(r(1)*x);
else
    y1=exp(r(1)*x);
    y2=exp(r(2)*x);
end
y_h=c1*y1+c2*y2;
W=simplify(y1*diff(y2)-y2*diff(y1));
f=input('Enter the non homogenous part: ');
y_p=-y1*int(y2*f/W)+y2*int(y1*f/W);
y=simplify(y_h+y_p); %General solution
disp('The general solution is : ');
disp(y);
```

### Problem 1 :-

Enter the coefficient of D2y 1

Enter the coefficient of Dy 6

Enter the coefficient of y 9

Enter the non homogenous part:  $\exp(2*x)$

The general solution is :

$(\exp(-3*x)*(25*c1 + \exp(5*x) + 25*c2*x))/25$

### Problem 2 :-

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Enter the coefficient of  $D^2y$  1

Enter the coefficient of  $Dy$  0

Enter the coefficient of  $y$  1

Enter the non homogenous part:  $1/\sin(x)$

The general solution is :

$$c_1 \cos(x) + \log(\sin(x)) \sin(x) + c_2 \sin(x) - x \cos(x)$$

### Problem 3 :-

Enter the coefficient of  $D^2y$  1

Enter the coefficient of  $Dy$  0

Enter the coefficient of  $y$  1

Enter the non homogenous part:  $\tan(x)$

The general solution is :

$$c_1 \cos(x) + c_2 \sin(x) - 2 \operatorname{atanh}(\tan(x/2)) \cos(x)$$