ANSHIKA GAHLOT
MAT/19/59

ASSIGNMENT 1 (Chapter - 12)

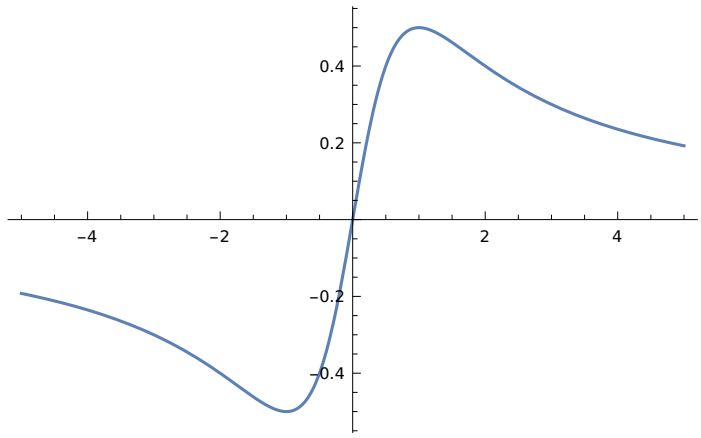
Ques1:

A) f(x)=x/1+x^2

In[1]:=
```
f[x_] := x / (1 + x ^ 2)
```

In[2]:=
```
Plot[f[x], {x, -5, 5}]
```

Out[2]=

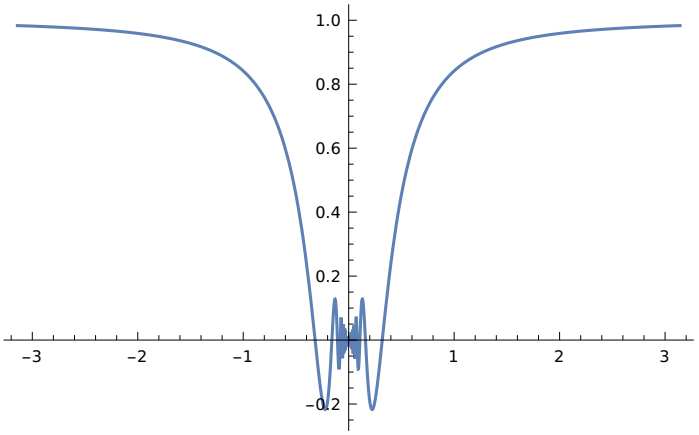


B) y=xsin(1/x)

In[1]:=
```
f[x_] := x Sin[1 / x]
```

In[3]:=
```
Plot[f[x], {x, -Pi, Pi}]
```

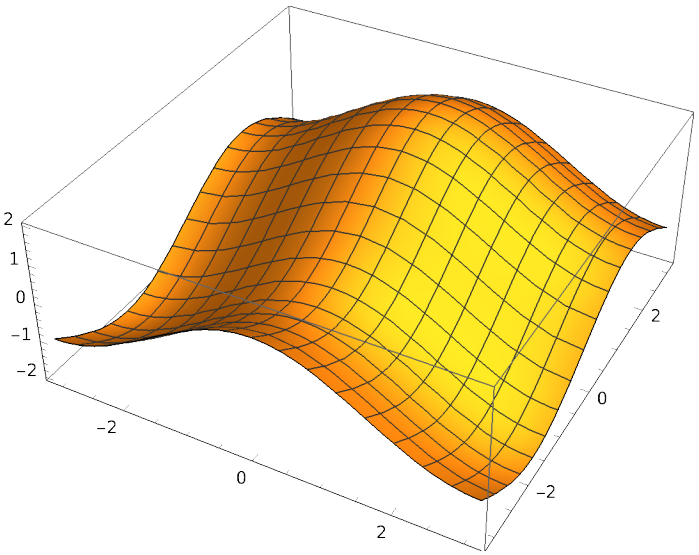
Out[3]=



C) g(x,y)=cos(x)+sin(y)

In[10]:=
```
Plot3D[{Cos[x] + Sin[y]}, {x, -Pi, Pi}, {y, -Pi, Pi}]
```

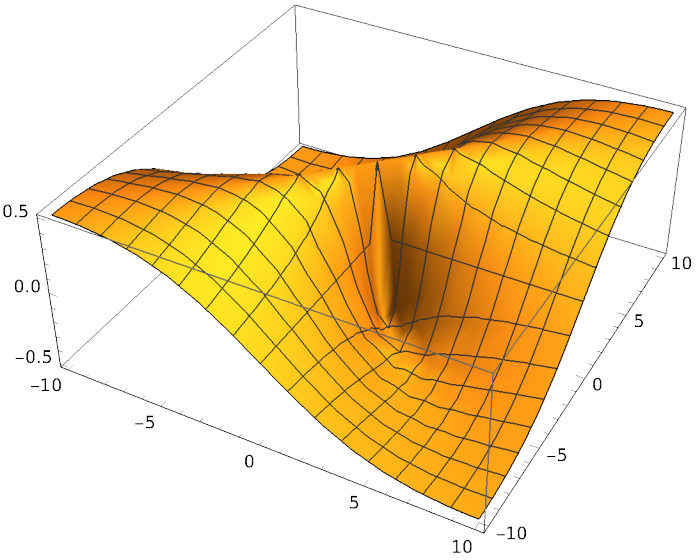
Out[10]=



D) z=xy/x^2+y^2

In[3]:=
```
Plot3D[{x y / (x ^ 2 + y ^ 2)}, {x, -10, 10}, {y, -10, 10}]
```

Out[3]=



Ques 2: f(x)=x/1+x^2

A) f'(x) and f''(x)

In[1]:=
```
f[x_] := x / (1 + x ^ 2)
```

In[3]:=
```
f'[x]
```

Out[3]=
$$-\frac{2\,x^2}{(1+x^2)^2}+\frac{1}{1+x^2}$$

In[4]:=
```
f''[x]
```

Out[4]=
$$\frac{8\,x^3}{(1+x^2)^3}-\frac{6\,x}{(1+x^2)^2}$$

B)f'(-1) and f'(0)

In[20]:=
```
f'[-1]
```

Out[20]=
```
0
```

In[22]:=
```
f''[0]
```

Out[22]=
```
0
```

C)f''(0) and f''(1)

In[23]:=
```
f''[0]
```

Out[23]= 0

In[24]:=
```
f''[1]
```

Out[24]= $-\frac{1}{2}$

Ques 3 :
A) 3,527,218,133,309,949,276,293

In[26]:=
```
FactorInteger [3 527 218 133 309 949 276 293 ]
```

Out[26]= {{15 013 , 2}, {25 013 , 3}}

B)4719453259301662 69

In[27]:=
```
FactorInteger [471 945 325 930 166 269 ]
```

Out[27]= {{4211 , 1}, {34 589 , 1}, {46 747 , 1}, {69 313 , 1}}

C)4719453259301662 81

In[28]:=
```
FactorInteger [471 945 325 930 166 281 ]
```

Out[28]= {{471 945 325 930 166 281 , 1}}

Ques4:
A) 3^6 mod 7

In[29]:=
```
Mod[3 ^ 6, 7]
```

Out[29]= 1

B)6^10 mod 11

In[30]:=
```
Mod[6 ^ 10, 11]
```

Out[30]= 1

C) 7^20 mod 21

In[31]:=
```
Mod[7 ^ 20, 21]
```

Out[31]= 7

D)7^22 mod 23

In[32]:=
```
Mod[7^22, 23]
```

Out[32]= 1

Ques8 :

In[48]:=
```
m = {{1, 1}, {1, 0}}
```

Out[48]= {{1, 1}, {1, 0}}

In[49]:=
```
g[n_] := MatrixPower[m, (n - 1)].m
```

In[50]:=
```
List[g[1], g[2], g[3], g[4], g[5], g[6], g[7], g[8], g[9], g[10]]
```

Out[50]= {{{1, 1}, {1, 0}}, {{2, 1}, {1, 1}}, {{3, 2}, {2, 1}}, {{5, 3}, {3, 2}}, {{8, 5}, {5, 3}}, {{13, 8}, {8, 5}}, {{21, 13}, {13, 8}}, {{34, 21}, {21, 13}}, {{55, 34}, {34, 21}}, {{89, 55}, {55, 34}}}

B)Fibonacci sequence

In[30]:=
```
f[0] = 1;
f[1] = 1;
f[n_] := f[n] = f[n - 2] + f[n - 1]
```

In[33]:=
```
f[100]
```

Out[33]= 573 147 844 013 817 084 101

Ques9:

A)x^2+x=1

In[26]:=
```
Solve[{x^2 + x == 1}, x]
```

Out[26]= $\left\{\left\{x \to \frac{1}{2}\left(-1-\sqrt{5}\right)\right\}, \left\{x \to \frac{1}{2}\left(-1+\sqrt{5}\right)\right\}\right\}$

B) x^2+x=-1

In[27]:=
```
Solve[{x^2 + x == -1}, x]
```

Out[27]= $\{\{x \to -(-1)^{1/3}\}, \{x \to (-1)^{2/3}\}\}$

C) 4x-3y=5
6x+2y=14

In[28]:=
```
Solve[{4 x - 3 y == 5, 6 x + 2 y == 14}, {x, y}]
```

Out[28]= {{x → 2, y → 1}}

D) -2x-2y+3z+t=8

-3x+0y-6z+t=-19
6x-8y+6z+5t=47
x+3y-3z-t=-9

In[29]:=
```
Solve[{-2 x - 2 y + 3 z + t == 8, -3 x + 0 y - 6 z + t == -19,
  6 x - 8 y + 6 z + 5 t == 47, x + 3 y - 3 z - t == -9}, {x, y, z, t}]
```

Out[29]=
```
{{x → 2, y → 1, z → 3, t → 5}}
```

Ques10:

In[9]:=
```
FindRoot[{250 Exp[1.0 r] + 300 Exp[0.75 r] + 350 Exp[0.5 r] + 400 Exp[0.25 r] == 1365}, {r, 0}]
```

Out[9]=
```
{r → 0.084104}
```

Ques 11:

In[18]:=
```
mysqrt[n_] := Module[{i = 1, g = 1}, While[i ≤ 20, g = (g + n / g) / 2; i = i + 1]; g]
```

In[21]:=
```
N[mysqrt[2]]
```

Out[21]=
```
1.41421
```

In[22]:=
```
N[mysqrt[10]]
```

Out[22]=
```
3.16228
```

Ques12:

A)

In[2]:=
```
collatz[n_] := Which[n == 1, collatz[n] = 0, EvenQ[n],
    collatz[n] = 1 + collatz[n / 2], OddQ[n], collatz[n] = 1 + collatz[3 * n + 1]];
```

In[29]:=
```
collatz[15]
```

Out[29]=
```
17
```

B)

In[3]:=
```
collatz[1]
```

Out[3]=
```
0
```

In[4]:=
```
collatz[2]
```

Out[4]=
```
1
```

In[5]:=
```
collatz[6]
```

Out[5]=
```
8
```

In[6]:=
```
collatz[21]
```

Out[6]= 7