Assignment-1

Chapter:12(Getting Started With Mathematica)

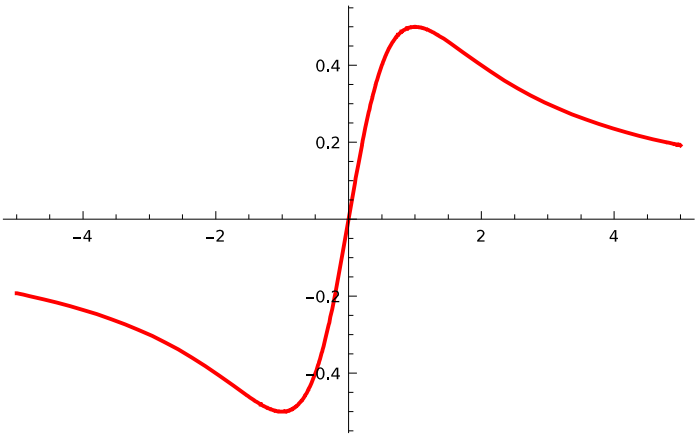
QUES1. Graph each of the following functions.

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

In[41]:=
```
f[x_] := x / (1 + x ^ 2)
```

In[42]:=
```
Plot[f[x], {x, -5, 5}, PlotStyle → {Red, Thick}]
```

Out[42]=

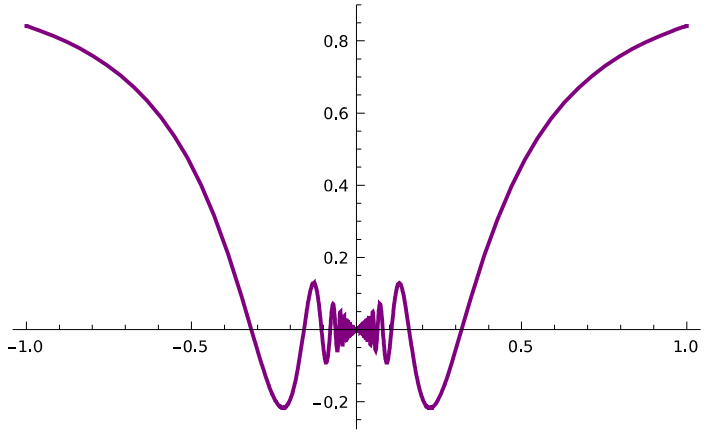


(b)y=xSin(1/x)

In[3]:=
```
g[x_] := x Sin[1 / x]
```

In[4]:=
```
Plot[g[x], {x, -1, 1}, PlotStyle → {Purple, Thick}]
```

Out[4]=

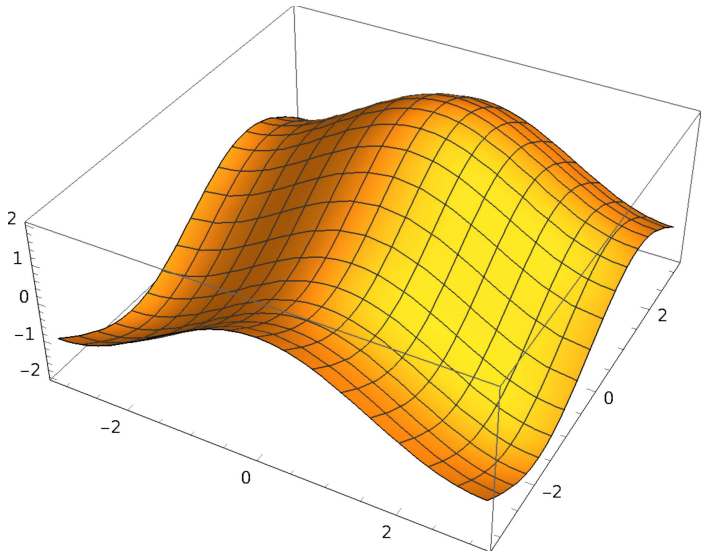


(c)g(x,y)=Cos(x)+Sin(y)

In[52]:=
```
g[x_, y_] := Cos[x] + Sin[y]
```

In[53]:=
```
Plot3D[g[x, y], {x, -Pi, Pi}, {y, -Pi, Pi}]
```

Out[53]=

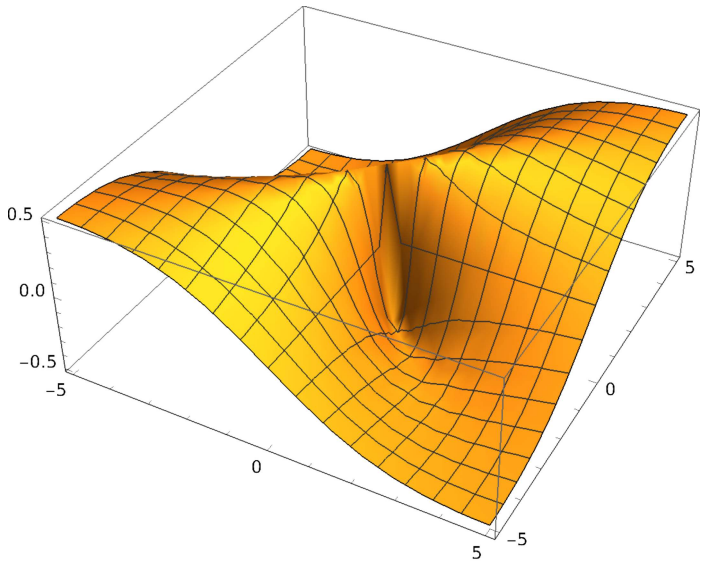


(d)z=xy/(x^2+y^2)

In[50]:=
```
f[x_, y_] := x y / (x ^ 2 + y ^ 2)
```

In[51]:=
```
Plot3D[f[x, y], {x, -5, 5}, {y, -5, 5}]
```

Out[51]=



QUES2. Let f(x)=x/1+x^2.

In[6]:=
```
f[x_] := x / (1 + x ^ 2)
```

a) Find f'(x) and f''(x)

In[7]:=
```
D[f[x], x]
```

Out[7]=
$$-\frac{2\,x^2}{(1+x^2)^2}+\frac{1}{1+x^2}$$

In[8]:=
```
D[%, {x, 2}]
```

Out[8]=
$$\frac{40\,x^2}{(1+x^2)^3}-\frac{6}{(1+x^2)^2}-2\,x^2\left(\frac{24\,x^2}{(1+x^2)^4}-\frac{4}{(1+x^2)^3}\right)$$

b) Find f'(-1) and f'(0)

In[46]:=
```
f'[-1]
```

Out[46]=
```
0
```

In[47]:=
```
f'[0]
```

Out[47]=
```
1
```

c) Find f"(0) and f"(1)

In[48]:=
```
f''[0]
```

Out[48]=
```
0
```

In[49]:=
```
f''[1]
```

Out[49]=
$$-\frac{1}{2}$$

QUES3. Find the prime factorization of each integer

a) 3,527,218,133,309,949,276,293.

In[2]:=
```
FactorInteger [3 527 218 133 309 949 276 293 ]
```

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

b) 471,945,325,930,166,269

In[4]:=
```
FactorInteger [471 945 325 930 166 269 ]
```

Out[4]=
```
{{4211 , 1}, {34 589 , 1}, {46 747 , 1}, {69 313 , 1}}
```

c) 471,945,325,930,166,281

In[5]:=
```
FactorInteger [471 945 325 930 166 281 ]
```

Out[5]=
```
{{471 945 325 930 166 281 , 1}}
```

QUES4. Compute each expression.Do you notice

a) 3^6 mod 7

In[30]:=
```
Mod[3 ^ 6, 7]
```

Out[30]=
```
1
```

b)6^10 mod 11

In[31]:=
```
Mod[6 ^ 10, 11]
```

Out[31]=
```
1
```

c)7^20 mod 21

In[32]:=
```
Mod[7^20, 21]
```
Out[32]= 7

d)7^22 mod 23

In[33]:=
```
Mod[7^22, 23]
```
Out[33]= 1

QUES8. Let M=[{1,1},{1,0}]

In[34]:=
```
M = {{1, 1}, {1, 0}}
```
Out[34]= {{1, 1}, {1, 0}}

a) Find M^2,M^3,.....,M^10.

In[35]:=
```
MatrixPower[M, 2]
```
Out[35]= {{2, 1}, {1, 1}}

In[36]:=
```
MatrixPower[M, 3]
```
Out[36]= {{3, 2}, {2, 1}}

In[37]:=
```
MatrixPower[M, 4]
```
Out[37]= {{5, 3}, {3, 2}}

In[38]:=
```
MatrixPower[M, 5]
```
Out[38]= {{8, 5}, {5, 3}}

In[39]:=
```
MatrixPower[M, 6]
```
Out[39]= {{13, 8}, {8, 5}}

In[40]:=
```
MatrixPower[M, 7]
```
Out[40]= {{21, 13}, {13, 8}}

In[41]:=
```
MatrixPower[M, 8]
```
Out[41]= {{34, 21}, {21, 13}}

In[42]:=
```
MatrixPower[M, 9]
```
Out[42]= {{55, 34}, {34, 21}}

In[43]:=
```
MatrixPower[M, 10]
```

Out[43]=
```
{{89, 55}, {55, 34}}
```

b) Find the 100th Fibonacci number.

In[44]:=
```
f[0] = 1;
```

In[45]:=
```
f[1] = 1;
```

In[46]:=
```
f[n_] := f[n] = f[n - 2] + f[n - 1]
```

In[47]:=
```
f[100]
```

Out[47]=
```
573 147 844 013 817 084 101
```

QUES9. Find the solutions to the following equations

a)Find x, if x^2+x=1

In[48]:=
```
Solve[x^2 + x == 1, x]
```

Out[48]=
$$\left\{\left\{x \to \frac{1}{2}\left(-1-\sqrt{5}\right)\right\}, \left\{x \to \frac{1}{2}\left(-1+\sqrt{5}\right)\right\}\right\}$$

b)Find x, if x^2+x=-1.

In[49]:=
```
Solve[x^2 + x == -1, x]
```

Out[49]=
$$\left\{\{x \to -(-1)^{1/3}\}, \{x \to (-1)^{2/3}\}\right\}$$

c)Find x and y.

4x-3y=5

6x+2y=14

In[50]:=
```
Solve[{4 x - 3 y == 5, 6 x + 2 y == 14}, {x, y}]
```

Out[50]=
```
{{x → 2, y → 1}}
```

d) Find x,y,z and t.

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

-3x+0y-6z+t=-19

6x-8y+6z+5t=47

x+3y-3z-t=-9

```
In[53]:= 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}]
Out[53]= {{t → 5, x → 2, y → 1, z → 3}}
```

QUES10. Solve this equation for r: 250e^1.0r+300e^0.75r+350e^0.5r+400e^0.25r = 1365

```
In[1]:= 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[1]= {r → 0.084104}
```

QUES11.

```
In[18]:= mysqrt[n_] := Module[{i = 1, g = 1}, While[i ≤ 20, g = (g + n / g) / 2; i = i + 1]; g]
In[19]:= N[mysqrt[2], 6]
Out[19]= 1.41421
In[21]:= N[Sqrt[2], 6]
Out[21]= 1.41421
In[22]:= N[mysqrt[3]]
Out[22]= 1.73205
```

QUES12.

```
In[23]:= Clear[collatz];
In[4]:= 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[5]:=
```
collatz[27]
```

Out[5]=
```
111
```