ASSIGNMENT - CH12

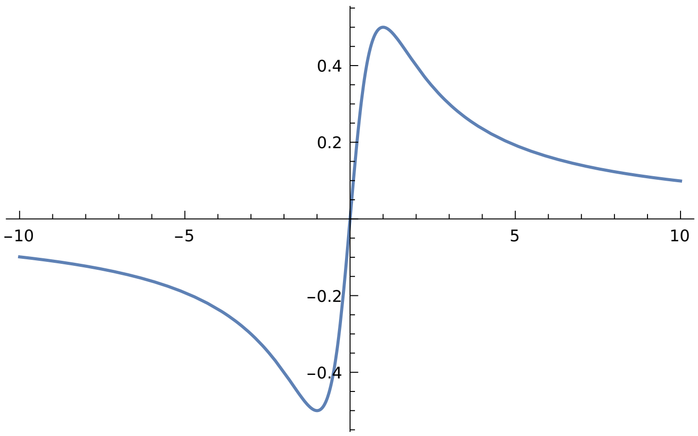
Q1) Graph each of the function. Experiment with different domains or viewpoints to display the best images.

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

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

In[3]:=
```
Plot[f[x], {x, -10, 10}]
```

Out[3]=

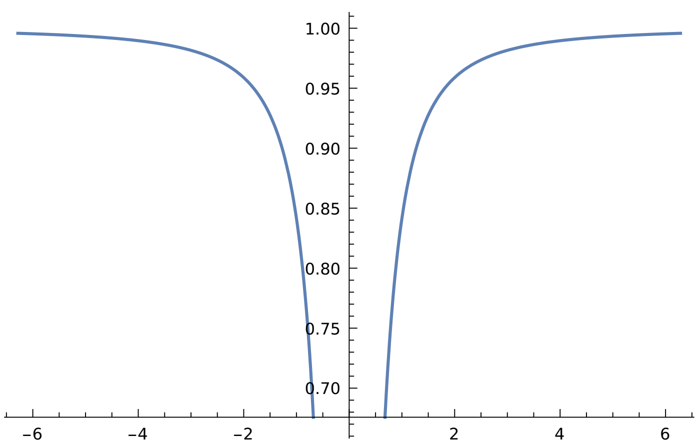


b) y = xSin(1/x)

In[4]:=
```
f[x_] := x * Sin[1 / x]
```

In[6]:=
```
Plot[f[x], {x, -2 Pi, 2 Pi}]
```

Out[6]=

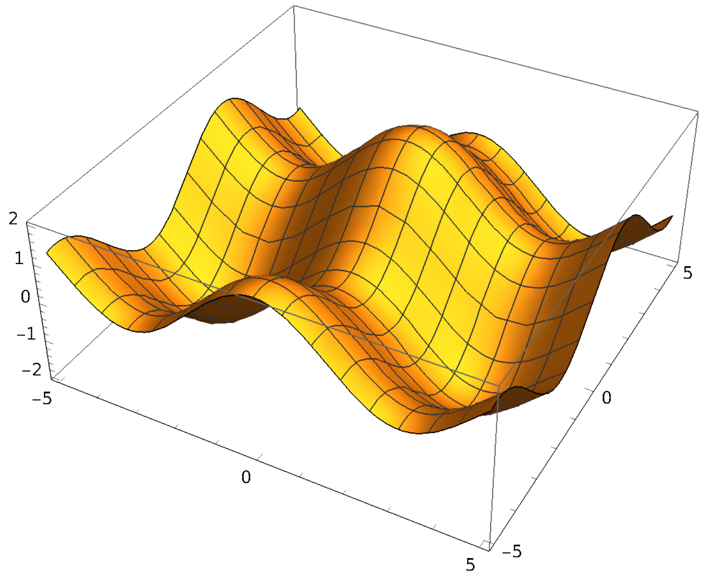


c) g(x,y)= cos x +sin y

In[1]:=
```
f[x_, y_] := Cos[x] + Sin[y]
```

In[4]:=
```
Plot3D[f[x, y], {x, -5, 5}, {y, -5, 5}]
```

Out[4]=

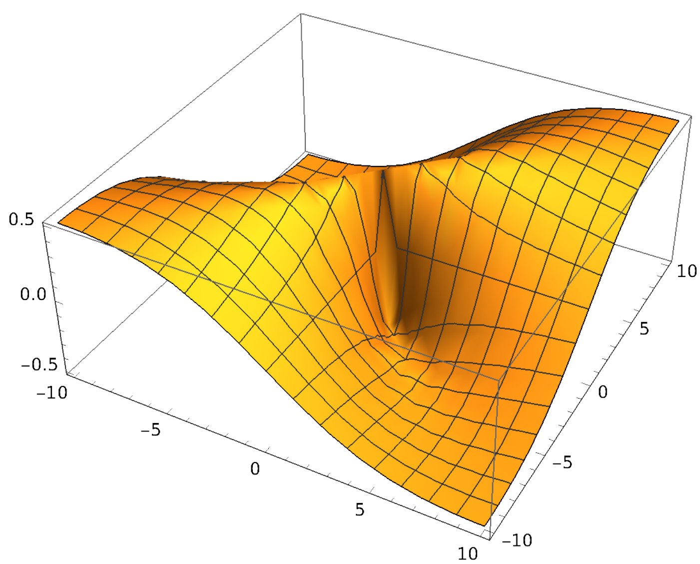


d) i(x,y)= xy/(x^2+y^2)

In[5]:=
```
i[x_, y_] := (x * y) / (x ^ 2 + y ^ 2)
```

In[8]:=
```
Plot3D[i[x, y], {x, -10, 10}, {y, -10, 10}]
```

Out[8]=



In[9]:=
```
ClearAll[f, g, h, i]
```

Q2) Let f(x)= x/1+x

In[50]:=
```
f[x_] := x / (1 + x ^ 2)
```

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

In[51]:=
```
D[f[x], x]
```

Out[51]= $-\frac{2\,x^2}{(1+x^2)^2}+\frac{1}{1+x^2}$

In[14]:=
```
D[%, x]
```

Out[14]= $\frac{8\,x^3}{(1+x^2)^3}-\frac{6\,x}{(1+x^2)^2}$

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

In[15]:=
```
D[f[x], x] /. x → (-1)
```

Out[15]= 0

In[16]:=
```
D[f[x], x] /. x → (0)
```

Out[16]= 1

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

In[57]:=
```
f''[0]
```

Out[57]= 0

In[56]:=
```
f''[1]
```

Out[56]= $-\frac{1}{2}$

Q3) 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[3]:=
```
FactorInteger [471 945 325 930 166 269 ]
```

Out[3]= {{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}}

Q4) Compute each expression . Do you notice any pattern ?

a) 3^6 mod 7

In[46]:=
```
Mod[3 ^ 6, 7]
```
Out[46]= 1

a)6^10 mod 11

In[47]:=
```
Mod[6 ^ 10, 11]
```
Out[47]= 1

a) 7^20 mod 21

In[48]:=
```
Mod[7 ^ 20, 21]
```
Out[48]= 7

a) 7^22 mod 23

In[49]:=
```
Mod[7 ^ 22, 23]
```
Out[49]= 1

Q8) Let M = [{1,1},{1,0}]

In[60]:=
```
M = {{1, 1}, {1, 0}}
```
Out[60]= {{1, 1}, {1, 0}}

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

In[61]:=
```
MatrixPower [M, 2]
```
Out[61]= {{2, 1}, {1, 1}}

In[62]:=
```
MatrixPower [M, 3]
```
Out[62]= {{3, 2}, {2, 1}}

In[63]:=
```
MatrixPower [M, 4]
```
Out[63]= {{5, 3}, {3, 2}}

In[64]:=
```
MatrixPower[M, 5]
```
Out[64]= {{8, 5}, {5, 3}}

In[65]:=
```
MatrixPower[M, 6]
```
Out[65]= {{13, 8}, {8, 5}}

In[66]:=
```
MatrixPower[M, 7]
```
Out[66]= {{21, 13}, {13, 8}}

In[67]:=
```
MatrixPower[M, 8]
```
Out[67]= {{34, 21}, {21, 13}}

In[68]:=
```
MatrixPower[M, 9]
```
Out[68]= {{55, 34}, {34, 21}}

In[69]:=
```
MatrixPower[M, 10]
```
Out[69]= {{89, 55}, {55, 34}}

b) Find the fibonacci number

In[70]:=
```
ClearAll[f]
```

In[71]:=
```
f[0] = 1
```
Out[71]= 1

In[72]:=
```
f[1] = 1
```
Out[72]= 1

In[73]:=
```
f[n_] := f[n] = f[n - 2] + f[n - 1]
```

In[74]:=
```
f[100]
```
Out[74]= 573 147 844 013 817 084 101

Q9) Find solutions to the following equations.

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

In[75]:=
```
Solve[x^2 + x == 1, x]
```
Out[75]= $\left\{\left\{x \to \frac{1}{2}\left(-1-\sqrt{5}\right)\right\}, \left\{x \to \frac{1}{2}\left(-1+\sqrt{5}\right)\right\}\right\}$

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

In[76]:=
```
Solve[x^2 + x == -1, x]
```
Out[76]=
$\{\{x \to -(-1)^{1/3}\}, \{x \to (-1)^{2/3}\}\}$

c) Find x and y .

4x-3y =5

6x+2y = 14

In[78]:=
```
Solve[{4 x - 3 y == 5, 6 x + 2 y == 14}, {x, y}]
```
Out[78]=
```
{{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+3-3z-t=-9

In[8]:=
```
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 - 3 z - t == -9}, {x, y, z, t}]
```
Out[8]=
```
{{x → 2, y → 1, z → 3, t → 5}}
```

Q10) Solve this equation in r:

250e^1.0r+300e^0.75r+350e^0.5r+400e^0.25r = 1365

In[1]:=
```
FindRoot[250 ⅇ^(1.0 r) + 300 ⅇ^(0.75 r) + 350 ⅇ^(0.5 r) + 400 ⅇ^(0.25 r) == 1365, {r, 0}]
```
Out[1]=
```
{r → 0.084104}
```

Q11)

In[2]:=
```
mysqrt[n_] := Module[{i = 1, g = 1}, While[i ≤ 20, g = (g + n / g) / 2; i = i + 1]; g]
```
In[3]:=
```
N[mysqrt[2], 6]
```
Out[3]=
```
1.41421
```
In[4]:=
```
N[mysqrt[3]]
```
Out[4]=
```
1.73205
```

Q12)

a)

In[5]:=
```
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]];
```

b)

In[6]:=
```
collatz[1]
```
Out[6]=
```
0
```

In[7]:=
```
collatz[2]
```
Out[7]=
```
1
```

In[8]:=
```
collatz[6]
```
Out[8]=
```
8
```

In[9]:=
```
collatz[27]
```
Out[9]=
```
111
```