Practical-1

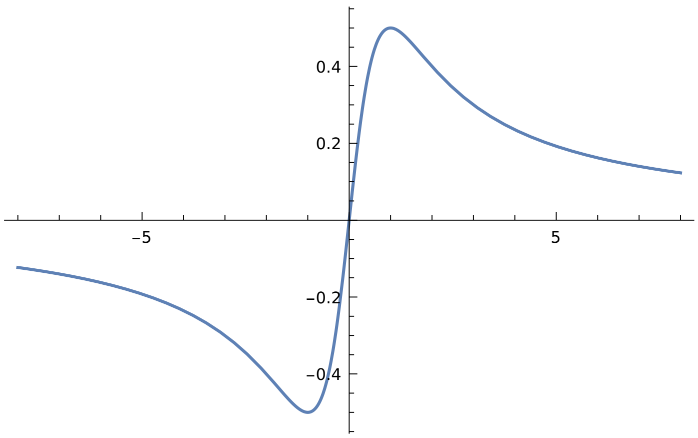
Ques1. Graph each of the functions.Experiment with different domains or viewpoints to display the best images.

(a)Ques 1. f[x]=x/(1+x^2)

In[76]:=
```
f[x_] := x / (1 + x ^ 2);
```

In[5]:=
```
Plot[f[x], {x, -8, 8}]
```

Out[5]=

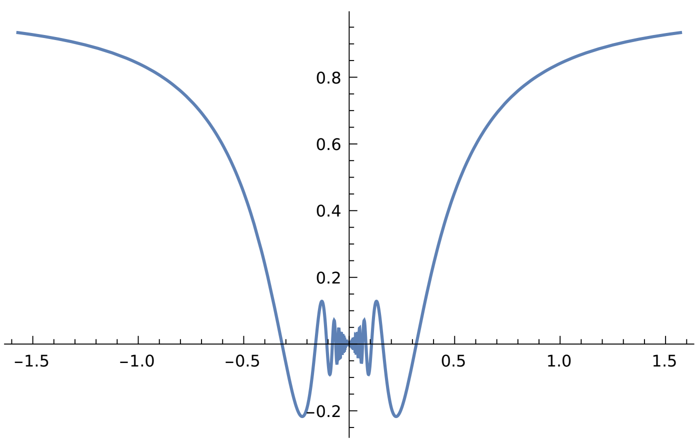


(b) y[x_]:=xSin[1/x]

In[8]:=
```
y[x_] := x * Sin[1 / x];
```

In[9]:=
```
Plot[y[x], {x, -Pi / 2, Pi / 2}]
```

Out[9]=

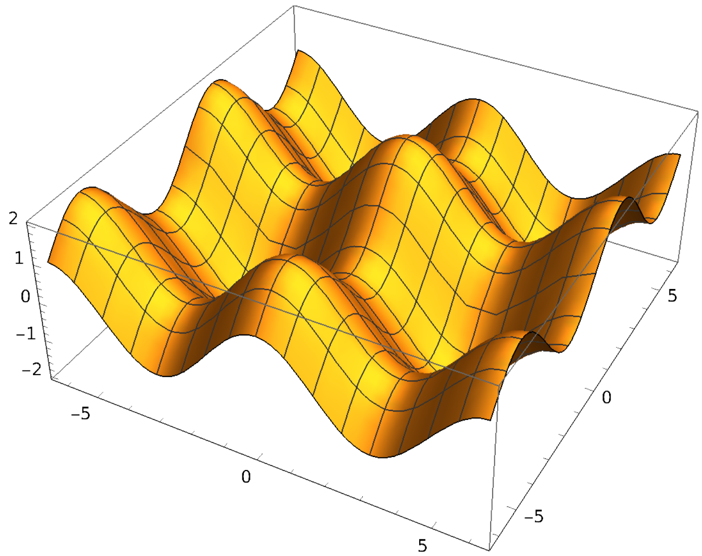


(c) g[x,y] = Cos[x] + Sin[y]

In[9]:=
```
g[x_, y_] := Cos[x] + Sin[y];
```

In[10]:=
```
Plot3D[g[x, y], {x, -2 Pi, 2 Pi}, {y, -2 Pi, 2 Pi}]
```

Out[10]=

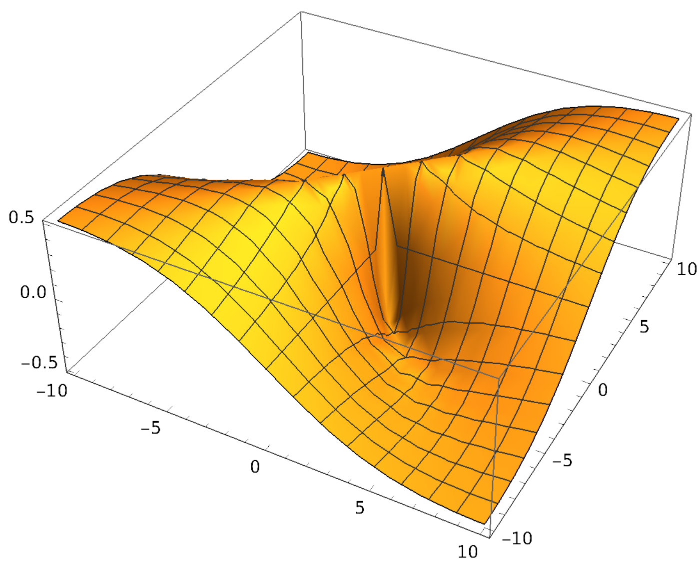


(d) z[x,y] = xy/(x^2+y^2)

In[54]:=
```
z[x_, y_] := x * y / (x ^ 2 + y ^ 2);
```

In[55]:=
```
Plot3D[x * y / (x ^ 2 + y ^ 2), {x, -10, 10}, {y, -10, 10}]
```

Out[55]=



Ques2. Define f[x] = x/(1+x^2) and find the following.

In[14]:=
```
f[x_] := x / (1 + x ^ 2);
```

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

In[15]:=
```
D[f[x], x]
```

Out[15]=

$$-\frac{2\,x^2}{\left(1+x^2\right)^2}+\frac{1}{1+x^2}$$

In[16]:=
```
D[f[x], x, x]
```
Out[16]=
$$\frac{8\,x^3}{\left(1+x^2\right)^3}-\frac{6\,x}{\left(1+x^2\right)^2}$$

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

In[17]:=
```
D[f[x], x] /. x → -1
```
Out[17]= 0

In[18]:=
```
D[f[x], x] /. x → 0
```
Out[18]= 1

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

In[19]:=
```
D[f[x], x, x] /. x → 0
```
Out[19]= 0

In[20]:=
```
D[f[x], x, x] /. x → 1
```
Out[20]= $-\frac{1}{2}$

In[21]:=
```
f''[1]
```
Out[21]= $-\frac{1}{2}$

Ques3.Find the prime factorization of each integer.

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

In[27]:=
```
FactorInteger[471 945 325 930 166 269]
```
Out[27]= {{4211 , 1}, {34 589 , 1}, {46 747 , 1}, {69 313 , 1}}

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

In[32]:=
```
FactorInteger[471 945 325 930 166 281]
```
Out[32]= {{471 945 325 930 166 281 , 1}}

Ques4. Compute each expression.Do you notice a pattern.

(a) 3^6 mod 7

In[37]:=
```
Mod[3^6, 7]
```
Out[37]= 1

(b) 6^10 mod 11

In[44]:=
```
Mod[6 ^ 10, 11]
```
Out[44]= 1

(c) 3^20 mod 21

In[42]:=
```
Mod[7 ^ 20, 21]
```
Out[42]= 7

(d) 7^22 mod 23

In[10]:=
```
Mod[7 ^ 22, 23]
```
Out[10]= 1

Yes, we observe a pattern.If 'a' and 'n' are any positive integers such that 'a' and 'n' are coprime to each other, then a^(n-1) mod n=1.

Ques8. (a)Write a matrix M and find M^2,M^3,......,M^10.

In[4]:=
```
m = {{1, 1}, {1, 0}}
```
Out[4]= {{1, 1}, {1, 0}}

In[5]:=
```
Table[MatrixPower[m, n], {n, 2, 10}]
```
Out[5]= {{{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) Find the 100th Fibonacci number.

In[3]:=
```
Fibonacci[100]
```
Out[3]= 354 224 848 179 261 915 075

In[68]:=
```
ClearAll[f, y, g, z, x, y]
```

Ques9. Solve the solution of the system of equations.

(a) Find x

In[69]:=
```
Solve[x ^ 2 + x == 1, x]
```
Out[69]= $\left\{\left\{x \to \frac{1}{2}\left(-1-\sqrt{5}\right)\right\}, \left\{x \to \frac{1}{2}\left(-1+\sqrt{5}\right)\right\}\right\}$

(b)Find x

In[70]:=
```
Solve[x ^ 2 + x == -1, x]
```
Out[70]= $\left\{\left\{x \to -(-1)^{1/3}\right\}, \left\{x \to (-1)^{2/3}\right\}\right\}$

(c)Find x and y

In[71]:=
```
Solve[4 x - 3 y == 5 && 6 x + 2 y == 14, {x, y}]
```
Out[71]= {{x → 2, y → 1}}

(d)Find x,y,z and t

In[7]:=
```
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[7]=
```
{{x → 2, y → 1, z → 3, t → 5}}
```

In[22]:=
```
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[22]=
```
{{x → 2, y → 1, z → 3, t → 5}}
```

Ques10. Find the numerical solution.

In[11]:=
```
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[11]=
```
{r → 0.084104}
```

Ques11.

In[11]:=
```
mysqrt[n_] := Module[{i = 1, g = 1}, While[i ≤ 20, g = (g + n / g) / 2; i = 1 + i]; g]
```

In[12]:=
```
N[mysqrt[2], 6]
```
Out[12]=
```
1.41421
```

In[13]:=
```
N[Sqrt[2], 6]
```
Out[13]=
```
1.41421
```

In[14]:=
```
N[mysqrt[3]]
```
Out[14]=
```
1.73205
```

Ques12 .

In[26]:=
```
Clear[collatz];
```

In[27]:=
```
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[1]
```
Out[29]=
```
0
```

In[30]:=
```
collatz[2]
```
Out[30]=
```
1
```

In[31]:=
```
collatz[6]
```
Out[31]=
```
8
```

In[32]:=
```
collatz[27]
```
Out[32]=
```
111
```