PRACTICAL NO.1

JYOTI MAT/19/80

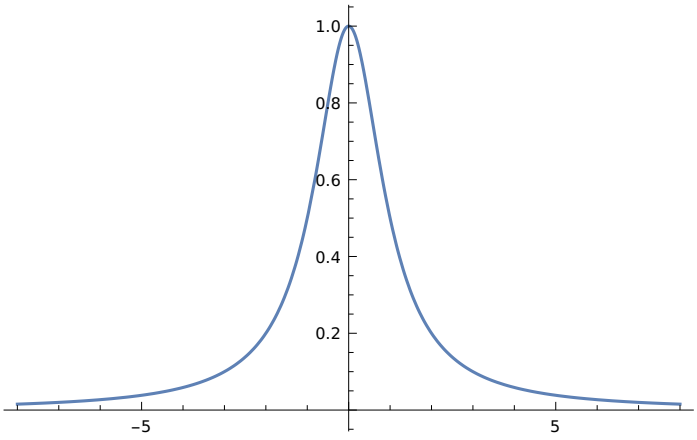
Que1. Graph each of the functions. Experiment with different domains or view points to display the best images.

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

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

In[10]:=
```
Plot[f[x], {x, -8, 8}]
```

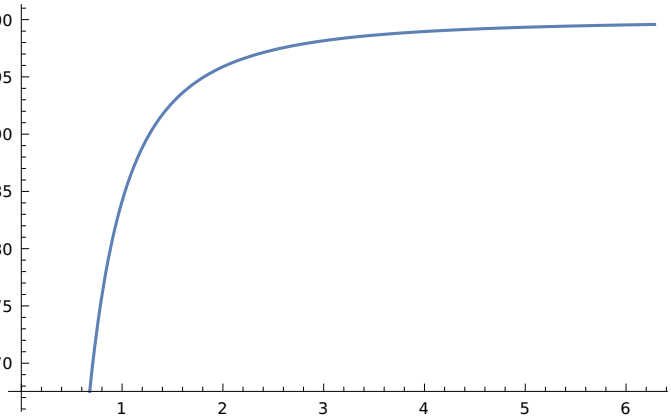
Out[10]=



b) y = xsin(1/x)

In[12]:=
```
Plot[x * Sin[1 / x], {x, 0, 2 Pi}]
```

Out[12]=

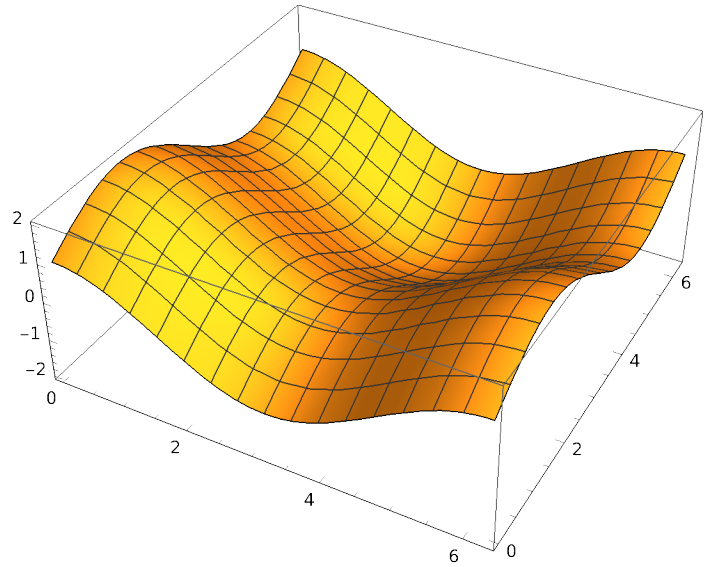


c) g(x,y) = cos(x)+sin(y)

In[13]:=
```
g[x_, y_] := Cos[x] + Sin[y]
```

In[15]:=
```
Plot3D[g[x, y], {x, 0, 2 Pi}, {y, 0, 2 Pi}]
```

Out[15]=

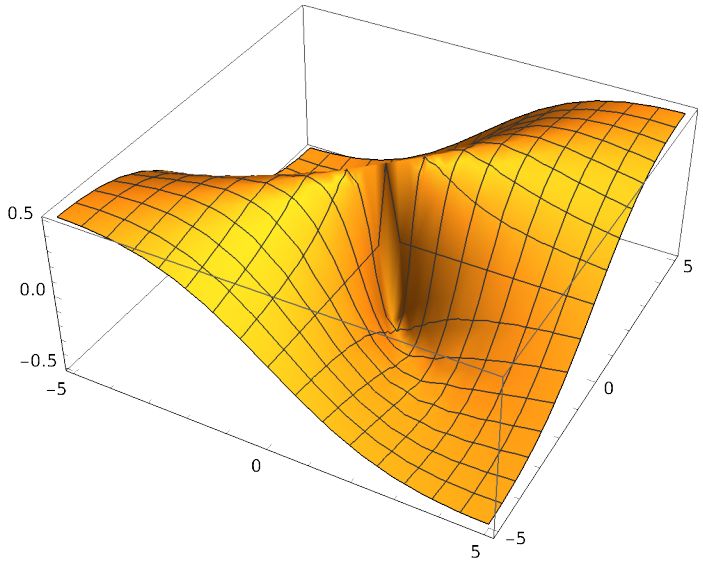


d) z = xy/(x^2+y^2)

In[16]:=
```
z[x_, y_] := x * y / (x ^ 2 + y ^ 2)
```

In[18]:=
```
Plot3D[z[x, y], {x, -5, 5}, {y, -5, 5}]
```

Out[18]=



Que2. f(x) = x/(1+x^2)

In[32]:=
```
f[x_] := x / (1 + x ^ 2)
```

In[33]:=
```
A = D[f[x], x]
```

Out[33]=
$$-\frac{2\,x^2}{(1+x^2)^2}+\frac{1}{1+x^2}$$

In[34]:=
```
B = D[f'[x], x]
```

Out[34]=
$$\frac{8\,x^3}{(1+x^2)^3}-\frac{6\,x}{(1+x^2)^2}$$

In[36]:=
```
A /. {x → -1}
```

Out[36]=
```
0
```

In[38]:=
```
A /. {x → 0}
```

Out[38]=
```
1
```

In[39]:=
```
B /. {x → 0}
```

Out[39]=
```
0
```

In[40]:=
```
B /. {x → 1}
```

Out[40]=
$$-\frac{1}{2}$$

Que3.

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

In[41]:=
```
FactorInteger [3 527 218 133 309 949 276 293 ]
```

Out[41]=
```
{{15 013 , 2}, {25 013 , 3}}
```

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

In[42]:=
```
FactorInteger [471 945 325 930 166 269 ]
```

Out[42]=
```
{{4211 , 1}, {34 589 , 1}, {46 747 , 1}, {69 313 , 1}}
```

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

In[43]:=
```
FactorInteger [471 945 325 930 166 281 ]
```

Out[43]=
```
{{471 945 325 930 166 281 , 1}}
```

Que4.

a) 3^6 mod 7

In[44]:=
```
Mod[3 ^ 6, 7]
```

Out[44]=
```
1
```

b) 6^10 mod 11

In[45]:=
```
Mod[6 ^ 10, 11]
```

Out[45]=
```
1
```

c) 7^20 mod 21

In[46]:=
```
Mod[7 ^ 20, 21]
```

Out[46]=
```
7
```

d) 7^22 mod 23

In[47]:=
```
Mod[7^22, 23]
```

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

Que8.

a)

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

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

In[53]:=
```
f[n_] := f[n] = M^n;
```

In[56]:=
```
Table[f[n], {n, 2, 10}]
```

Out[56]=
```
{{{1, 1}, {1, 0}}, {{1, 1}, {1, 0}}, {{1, 1}, {1, 0}}, {{1, 1}, {1, 0}},
  {{1, 1}, {1, 0}}, {{1, 1}, {1, 0}}, {{1, 1}, {1, 0}}, {{1, 1}, {1, 0}}, {{1, 1}, {1, 0}}}
```

b)

In[78]:=
```
ClearAll[f]
```

In[79]:=
```
f[0] = 1;
```

In[80]:=
```
f[1] = 1;
```

In[81]:=
```
f[n_] := f[n] = f[n - 2] + f[n - 1];
```

In[82]:=
```
f[n] /. {n → 100}
```

Out[82]=
```
573 147 844 013 817 084 101
```

Que9.

a)

In[90]:=
```
Solve[x^2 + x == 1, x]
```

Out[90]=
$$\left\{\left\{x \to \frac{1}{2}\left(-1-\sqrt{5}\right)\right\}, \left\{x \to \frac{1}{2}\left(-1+\sqrt{5}\right)\right\}\right\}$$

b)

In[91]:=
```
Solve[x^2 + x == -1, x]
```

Out[91]=
$$\{\{x \to -(-1)^{1/3}\}, \{x \to (-1)^{2/3}\}\}$$

c)

In[92]:=
```
Solve[{4 x - 3 y == 5, 6 x + 2 y == 14}, {x, y}]
```

Out[92]=
$$\{\{x \to 2, y \to 1\}\}$$

d)

In[93]:=
```
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[93]=
$$\{\{x \to 2, y \to 1, z \to 3, t \to 5\}\}$$

Que10.

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]=
$$\{r \to 0.084104\}$$

Que11.

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]=
$$1.73205$$

Que12.

In[7]:=
```
Clear[collatz];
```

In[8]:=
```
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[9]:= **collatz[27]**

Out[9]= 111