JASNOOR KAUR CHHABRA-Mat-19-58

PRACTICAL OF CH. 12

GETTING STARTED WITH MATHEMATICA.

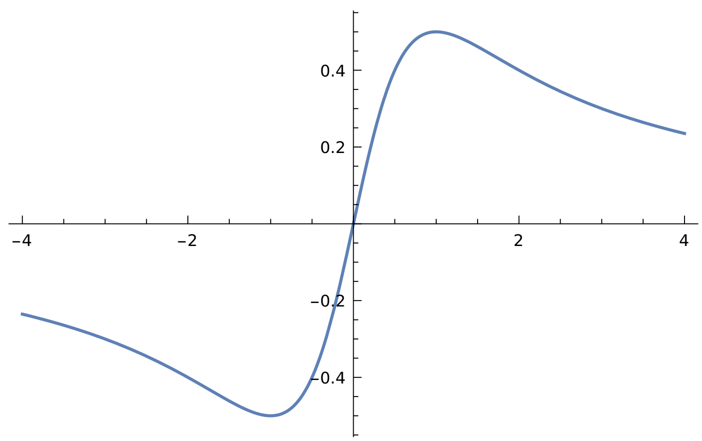
1- GRAPH EACH OF THE FUNCTIONS, EXPERIMENT WITH DIFFERENT DOMAINS OR VIEWPOINTS TO DISPLAY THE BEST IMAGES.

a)-

In[15]:=
```
f[x_] := x / (1 + x ^ 2);
```

In[16]:=
```
Plot[f[x], {x, -4, 4}]
```

Out[16]=



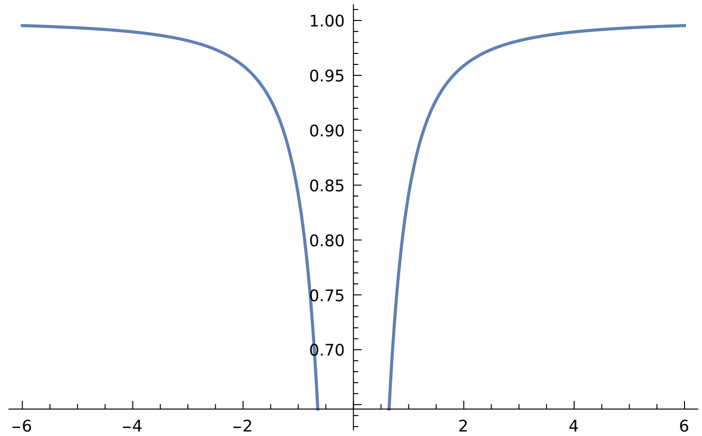
b)-

In[18]:=
```
ClearAll[f, x]
```

In[19]:=
```
f[x_] := x * Sin[1 / x];
```

In[20]:= `Plot[f[x], {x, -6, 6}]`

Out[20]=

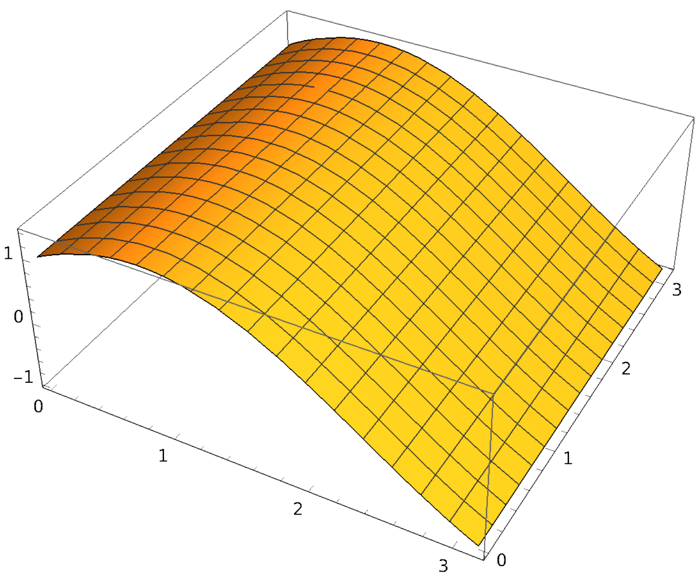


c)-

In[21]:= `g[x_, y_] := Cos[x] + Sin[x];`

In[22]:= `Plot3D[g[x, y], {x, 0, Pi}, {y, 0, Pi}]`

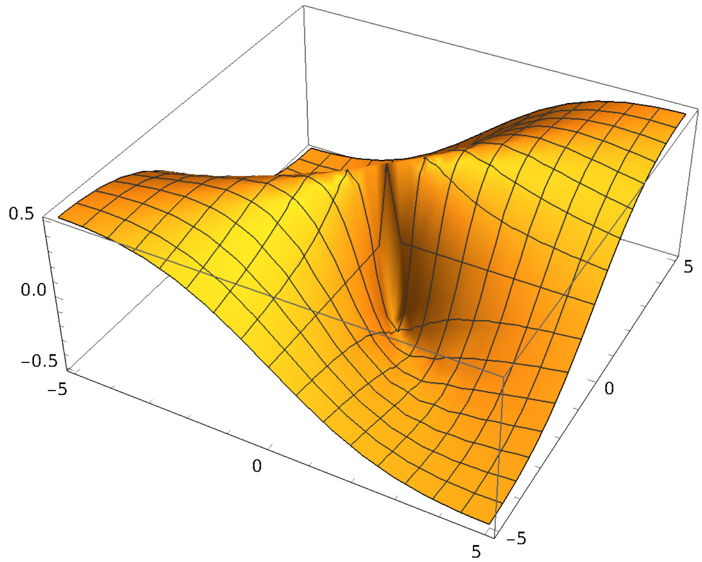
Out[22]=



In[24]:= `ClearAll[f, x, y]`

In[26]:= `h[x_, y_] := x * y / (x ^ 2 + y ^ 2);`

In[27]:=
```
Plot3D[h[x, y], {x, -5, 5}, {y, -5, 5}]
```

Out[27]=


2)- Let f(x)=x/1+x^2

In[28]:=
```
f[x_] := x / (1 + x ^ 2);
```

In[29]:=
```
f'[x]
```

Out[29]= $-\frac{2x^2}{(1+x^2)^2}+\frac{1}{1+x^2}$

In[30]:=
```
f''[x]
```

Out[30]= $\frac{8x^3}{(1+x^2)^3}-\frac{6x}{(1+x^2)^2}$

In[31]:=
```
f'[-1]
```

Out[31]= 0

In[32]:=
```
f'[0]
```

Out[32]= 1

In[33]:=
```
f''[0]
```

Out[33]= 0

In[34]:=
```
f''[1]
```

Out[34]= $-\frac{1}{2}$

In[35]:=
```
ClearAll[f, x, h]
```

3)- find prime factorization of each prime integer.

In[37]:=
```
FactorInteger [3 527 218 133 309 949 276 293 ]
```
Out[37]= {{15 013 , 2}, {25 013 , 3}}

In[38]:=
```
FactorInteger [471 945 325 930 166 269 ]
```
Out[38]= {{4211 , 1}, {34 589 , 1}, {46 747 , 1}, {69 313 , 1}}

In[39]:=
```
FactorInteger [471 945 325 930 166 281 ]
```
Out[39]= {{471 945 325 930 166 281 , 1}}

4)- compute each expression, do notice a pattern.

In[40]:=
```
Mod[3 ^ 6, 7]
```
Out[40]= 1

In[41]:=
```
Mod[6 ^ 10, 11]
```
Out[41]= 1

In[43]:=
```
Mod[7 ^ 20, 21]
```
Out[43]= 7

In[45]:=
```
Mod[7 ^ 22, 23]
```
Out[45]= 1

8)-

In[46]:=
```
M = {{1, 1}, {1, 0}}
```
Out[46]= {{1 , 1}, {1 , 0}}

In[47]:=
```
MatrixPower [M, 2]
```
Out[47]= {{2 , 1}, {1 , 1}}

In[48]:=
```
MatrixPower [M, 3]
```
Out[48]= {{3 , 2}, {2 , 1}}

In[49]:=
```
MatrixPower [M, 4]
```
Out[49]= {{5 , 3}, {3 , 2}}

In[50]:=
```
MatrixPower [M, 5]
```
Out[50]= {{8 , 5}, {5 , 3}}

In[51]:=
```
MatrixPower [M, 6]
```
Out[51]= {{13 , 8}, {8 , 5}}

```
In[52]:= MatrixPower[M, 7]
Out[52]= {{21, 13}, {13, 8}}

In[54]:= MatrixPower[M, 8]
Out[54]= {{34, 21}, {21, 13}}

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

In[56]:= MatrixPower[M, 10]
Out[56]= {{89, 55}, {55, 34}}

In[57]:= f[0] = 1;

In[58]:= f[1] = 1;

In[59]:= f[n_] := f[n] = f[n - 2] + f[n - 1]

In[60]:= f[100]
Out[60]= 573 147 844 013 817 084 101
```

Q.9- find the solutions to the following equations or system of equations. hint:- if you use Mathematica,the command you are looking for is Solve. Maple and Maxima both use ()to find algebraic solutions.check the help for:-

```
In[61]:= Solve[x ^ 2 + x == 1, x]
```

Out[61]= $\left\{\left\{x \to \frac{1}{2}\left(-1-\sqrt{5}\right)\right\}, \left\{x \to \frac{1}{2}\left(-1+\sqrt{5}\right)\right\}\right\}$

```
In[62]:= Solve[4 x - 3 y == 5 && 6 x + 2 y == 14, {x, y}]
Out[62]= {{x → 2, y → 1}}

In[63]:= 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[63]= {{x → 2, y → 1, z → 3, t → 5}}
```

Q.10-some equations are difficult to solve explicitely, even with the software . in such situations,we often resort to numerical methods ,Mathematica uses FindRoot, Maple uses fsolve(), and Maxima uses find_root()to find the numerical solutions to equations.

eg- assume that invest $250at the beginning of the year and $300 at the beginning of the second quarter and $400 at the beginning of the forth quarter. at the end of the year i have $1365(beacuse of my investment grow).To find my continous rate of return , solve this equation for r .

In[65]:=
```
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[65]=
```
{r → 0.084104}
```

11)- if n is a positive number , and g>0 is any guess for the square root of n , then a better estimate of Sqrt[n] is the average of g and n/g ie. (g+n/g)/2. Write a function called mysqrt that accepts one argumentbegins with an initial guess of 1.0, finds 20 new guesses and returns the answer.

In[66]:=
```
mysqrt[n_] := Module[{i = 1, g = 1}, While [i ≤ 20, g = (g + n / g) / 2; i = i + 1]; g]
```
In[67]:=
```
N[mysqrt[2], 6]
```
Out[67]=
```
1.41421
```
In[68]:=
```
N[Sqrt[2], 6]
```
Out[68]=
```
1.41421
```
In[69]:=
```
N[Sqrt[3], 6]
```
Out[69]=
```
1.73205
```
In[70]:=
```
N[Sqrt[3], 6]
```
Out[70]=
```
1.73205
```

12)-

In[88]:=
```
ClearAll[f, x, y, n]
```
In[89]:=
```
Clear[collatz];
```
In[92]:=
```
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]];
collatz[
 27]
```
Out[93]=
```
111
```