MAT/19/102 RIDIMA BADOLA

ASSIGNMENT -1

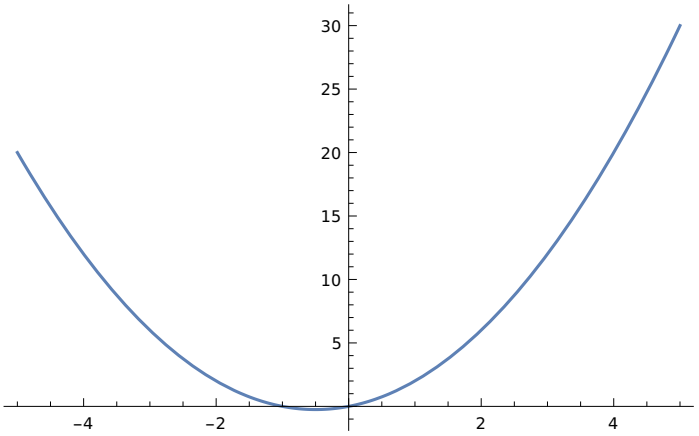
QUESTION 1:

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

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

In[2]:=
```
Plot[f[x], {x, -5, 5}]
```

Out[2]=

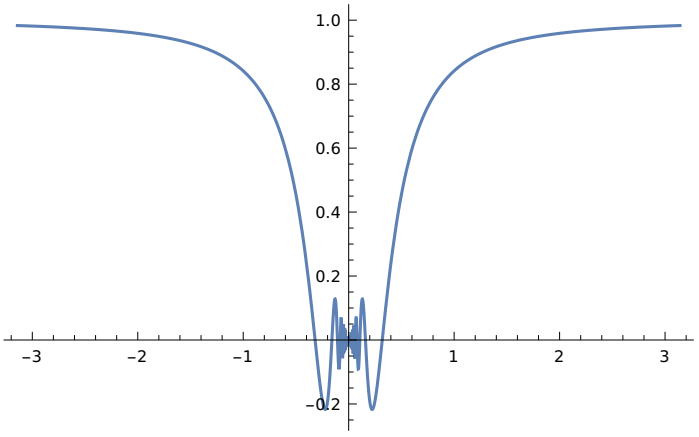


ii) y=xSin(1/x)

```
f[x_] := x Sin[1 / x]
```

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

Out[4]=

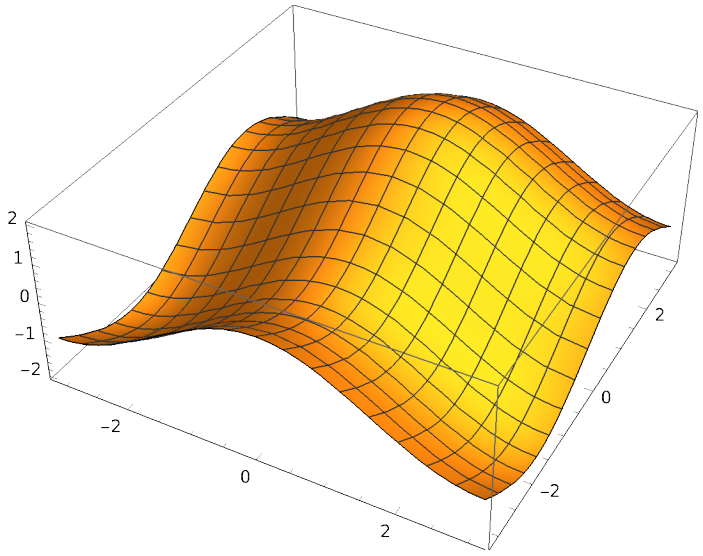


iii) g(x,y)=Cos(x) + Sin(y)

In[12]:=
```
f[x_, y_] := Cos[x] + Sin[y]
```

In[13]:=
```
Plot3D[f[x, y], {x, -Pi, Pi}, {y, -Pi, Pi}]
```

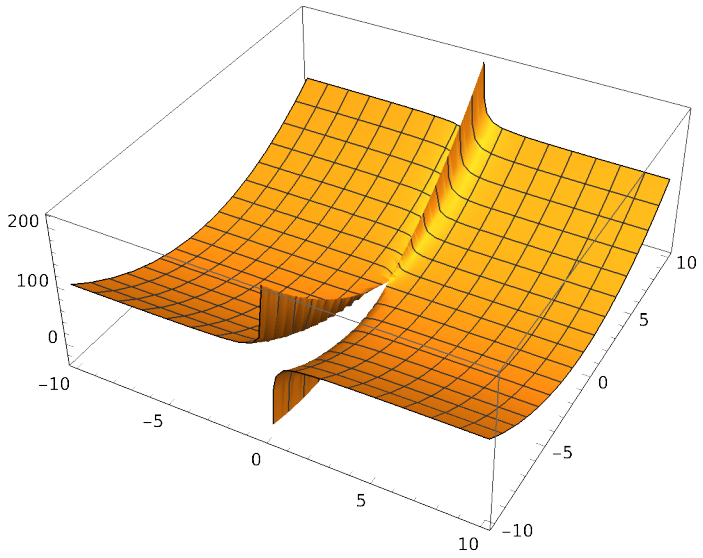
Out[13]=



iv) z=xy/x^2 + y^2

In[27]:=
```
Plot3D[{x y / x ^ 2 + y ^ 2}, {x, - 10, 10}, {y, - 10, 10}]
```

Out[27]=



QUESTION 2:

i) f'(x) and f''(x)

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

In[29]:=
```
D[f[x], x]
```

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

In[30]:=
```
D[f[x], {x, 2}]
```

Out[30]=
$$-\frac{4\,x}{\left(1+x^2\right)^2}+x\left(\frac{8\,x^2}{\left(1+x^2\right)^3}-\frac{2}{\left(1+x^2\right)^2}\right)$$

ii) f'(-1) and f'(0)

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

Out[31]=
```
0
```

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

Out[32]=
```
0
```

iii) f''(0) and f''(1)

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

Out[33]=
```
0
```

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

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

QUESTION 3:

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

In[39]:=
```
FactorInteger [3 × 527 × 218 × 133 × 309 × 949 × 276 × 293]
```

Out[39]=
```
{{2, 3}, {3, 3}, {7, 1}, {13, 1}, {17, 1}, {19, 1},
 {23, 1}, {31, 1}, {73, 1}, {103, 1}, {109, 1}, {293, 1}}
```

ii) 475,945,325,930,166,269

In[40]:=
```
FactorInteger[475 × 945 × 325 × 930 × 166 × 269]
```

Out[40]=
```
{{2, 2}, {3, 4}, {5, 6}, {7, 1}, {13, 1}, {19, 1}, {31, 1}, {83, 1}, {269, 1}}
```

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

In[41]:=
```
FactorInteger[471 × 945 × 325 × 930 × 166 × 281]
```

Out[41]=
```
{{2, 2}, {3, 5}, {5, 4}, {7, 1}, {13, 1}, {31, 1}, {83, 1}, {157, 1}, {281, 1}}
```

QUESTION 4:

i) 3^6 mod 7

In[42]:=
```
Mod[3^6, 7]
```

Out[42]=
```
1
```

ii) 6^10 mod 11

In[43]:=
```
Mod[6^10, 11]
```

Out[43]=
```
1
```

iii) 7^20 mod 21

In[44]:=
```
Mod[7^20, 21]
```

Out[44]=
```
7
```

iv) 7^22 mod 23

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

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

QUESTION 8:

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

Out[46]=
```
{{1, 1}, {1, 0}}
```

In[47]:=
```
m.m
```
Out[47]= {{2, 1}, {1, 1}}

In[48]:=
```
m.m.m
```
Out[48]= {{3, 2}, {2, 1}}

In[49]:=
```
m.m.m.m
```
Out[49]= {{5, 3}, {3, 2}}

In[50]:=
```
m.m.m.m.m
```
Out[50]= {{8, 5}, {5, 3}}

In[51]:=
```
m.m.m.m.m.m
```
Out[51]= {{13, 8}, {8, 5}}

In[52]:=
```
m.m.m.m.m.m.m
```
Out[52]= {{21, 13}, {13, 8}}

In[53]:=
```
m.m.m.m.m.m.m.m
```
Out[53]= {{34, 21}, {21, 13}}

In[54]:=
```
m.m.m.m.m.m.m.m.m
```
Out[54]= {{55, 34}, {34, 21}}

In[55]:=
```
m.m.m.m.m.m.m.m.m.m
```
Out[55]= {{89, 55}, {55, 34}}

Fibonacci Series:

In[56]:=
```
f[0] = 1;
```

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

In[58]:=
```
f[n_] := f[n] = f[n - 2] + f[n - 1]
```

In[59]:=
```
f[100]
```
Out[59]= 573 147 844 013 817 084 101

QUESTION 9:

i) x^2 + x =1

In[60]:=
```
Solve[{x ^ 2 + x == 1}, x]
```

Out[60]= $\left\{\left\{x \to \frac{1}{2}\left(-1-\sqrt{5}\right)\right\}, \left\{x \to \frac{1}{2}\left(-1+\sqrt{5}\right)\right\}\right\}$

ii) x^2 + x =-1

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

Out[61]= $\{\{x \to -(-1)^{1/3}\}, \{x \to (-1)^{2/3}\}\}$

iii) 4x - 3y =5 and 6x + 2y =14

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

Out[62]= {{x → 2, y → 1}}

iv) -2x - 2y + 3z + t =8 , -3x + 0y - 6z + t =-19, 6x - 8y + 6z + 5t =47 and x + 3y - 3z - t =-9

In[65]:=
```
Solve[{-2 x - 2 y + 3 z + t == 8, -3 x - 6 z + t == -19,
   6 x - 8 y + 6 z + 5 t == 47, x + 3 y - 3 z - t == -9}, {x, y, t, z}]
```

Out[65]= {{x → 2, y → 1, t → 5, z → 3}}

QUESTION 10:

In[66]:=
```
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[66]= {r → 0.084104}

QUESTION 11:

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

In[2]:=
```
N[mysqrt[2], 6]
```

Out[2]= 1.41421

In[3]:=
```
N[Sqrt[2], 6]
```

Out[3]=
```
1.41421
```

In[4]:=
```
N[mysqrt[3]]
```

Out[4]=
```
1.73205
```

QUESTION 12:

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