PRACTICAL 1

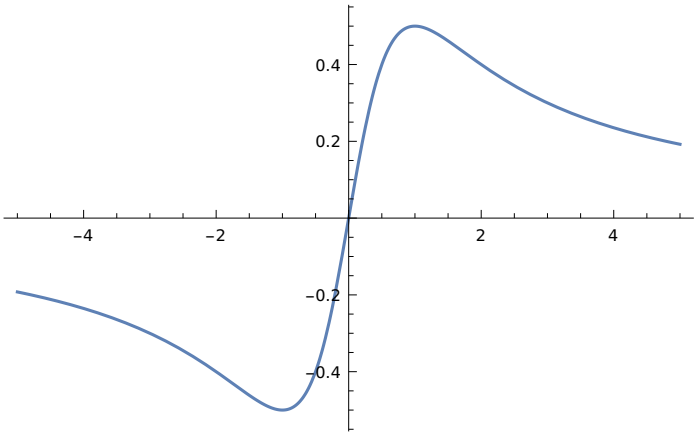
QUES1. Graph each of the following functions.

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

In[1]:=
$$f[x\_] := \frac{x}{1 + x^2};$$

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

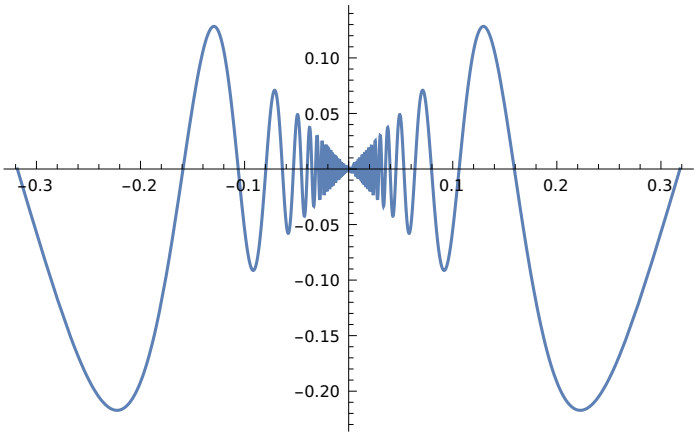
Out[2]=



b) y=x Sin(1/x)

In[4]:=
```
y[x_] := x Sin (1 / x);
Plot[x Sin[1 / x], {x, 1 / π, -1 / π}]
```

Out[5]=

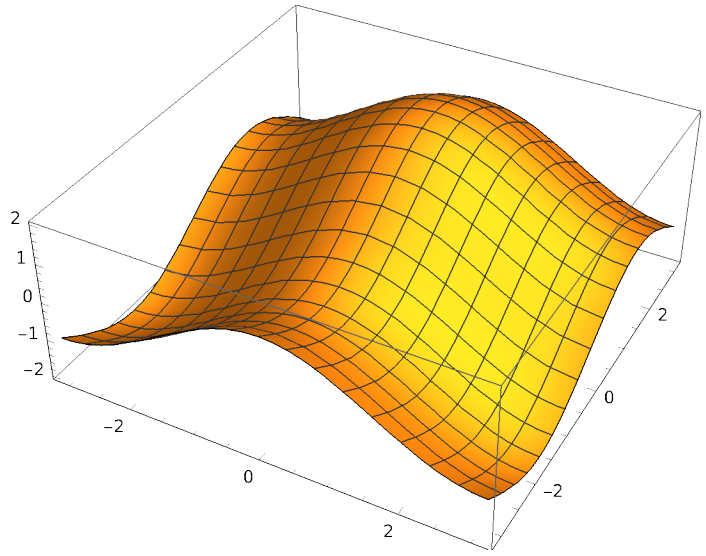


In[6]:=

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

In[7]:=
```
Plot3D[Cos[x] + Sin[y], {x, π, -π}, {y, π, -π}]
```

Out[7]=

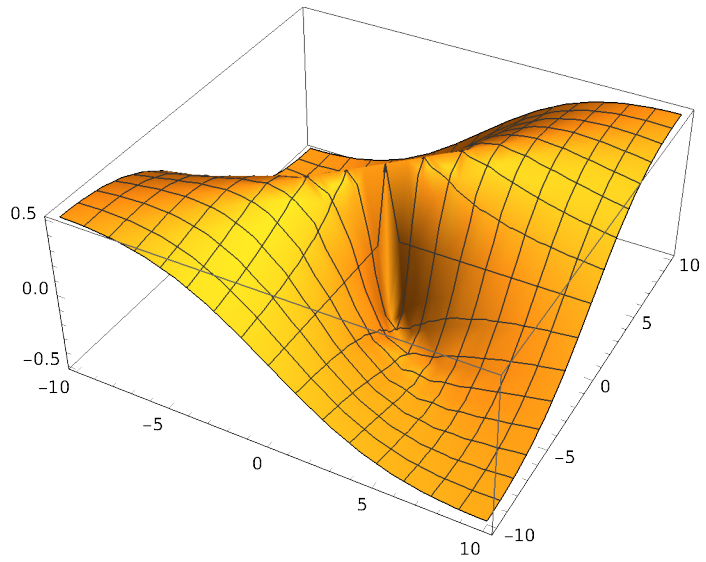


(d) $z = \dfrac{xy}{x^2 + y^2}$

Out[8]=
$$\frac{xy}{x^2 + y^2}$$

In[9]:=
```
Plot3D[x y / (x^2 + y^2), {x, 10, -10}, {y, 10, -10}]
```

Out[9]=



QUESTION 2 :

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

In[11]:=
```
f[x_] := x / (1 + x ^ 2)
f'[x]
```

Out[12]=
$$-\frac{2x^2}{(1+x^2)^2}+\frac{1}{1+x^2}$$

In[14]:=
```
f''[x]
```

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

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

In[15]:=
```
f'[-1]
```

Out[15]= 0

In[16]:=
```
f'[0]
```

Out[16]= 1

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

In[17]:=
```
f''[0]
```

Out[17]= 0

In[18]:=
```
f''[1]
```

Out[18]=
$$-\frac{1}{2}$$

Ques3). Find the prime factorization of each integer.

a) 3527218133309949276293

In[19]:=
```
FactorInteger [ 3 527 218 133 309 949 276 293 ]
```

Out[19]= {{15 013 , 2}, {25 013 , 3}}

(b) 471945325930166269

In[35]:=
```
FactorInteger [ 471 945 325 930 166 269 ]
```

Out[35]= {{4211 , 1}, {34 589 , 1}, {46 747 , 1}, {69 313 , 1}}

(c)471945325930166281

In[36]:=
```
FactorInteger [ 471 945 325 930 166 281 ]
```

Out[36]= {{471 945 325 930 166 281 , 1}}

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

(a) 3^6 mod 7

In[21]:=
```
PowerMod[3, 6, 7]
```
Out[21]= 1

(b)6^10 mod11

In[22]:=
```
PowerMod[6, 10, 11]
```
Out[22]= 1

(c)7^20 mod21

In[23]:=
```
PowerMod[7, 20, 21]
```
Out[23]= 7

(d)7^22 mod23

In[24]:=
```
PowerMod[7, 22, 23]
```
Out[24]= 1

Q8. Let M={{1,1},{0,1}}

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

In[25]:=
```
M = {{1, 1}, {1, 0}}
```
Out[25]= {{1, 1}, {1, 0}}

In[26]:=
```
Table [MatrixPower [M, n], {n, 2, 10}]
```
Out[26]= {{{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}}}

In[27]:=
```
Fibonacci [100, M]
```
Out[27]= {{354 224 848 179 261 915 075 , 354 224 848 179 261 915 075 }, {354 224 848 179 261 915 075 , 0}}

In[28]:=
```
Fibonacci [100]
```
Out[28]= 354 224 848 179 261 915 075

Q9. Find solutions to the following equations or systems of equations.

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

In[29]:=
```
Solve[x ^ 2 + x == 1, x]
```
Out[29]= $\left\{\left\{x \to \frac{1}{2}\left(-1-\sqrt{5}\right)\right\}, \left\{x \to \frac{1}{2}\left(-1+\sqrt{5}\right)\right\}\right\}$

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

In[30]:=
```
Solve[x ^ 2 + x == -1, x]
```
Out[30]= $\left\{\{x \to -(-1)^{1/3}\}, \{x \to (-1)^{2/3}\}\right\}$

(c) Find x and y. 4x-3y=5 and 6x+2y=14

In[31]:=
```
Solve[4 x - 3 y == 5 && 6 x + 2 y == 14, {x, y}]
```

Out[31]=
```
{{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+3y-3z-t=-9.

In[32]:=
```
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]
```

Out[32]=
```
{{t → 5, x → 2, xy → 15, y → 1}}
```

Q10. Solve this equation for r.

In[3]:=
```
Findroot[250 * e^r + 300 * e^0.75 r + 350 * e^0.5 r + 400 * e^0.25 r == 1365, {r, 0}]
```

Out[3]=
```
Findroot[250 e^r + 1725.76 r == 1365, {r, 0}]
```

Q11. Write a function called mysqrt that accepts one argument, begins with an initial guess of 1.0, 0 finds 20 new guesses, and returns the answer.

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

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

Out[2]=
```
1.41421
```

In[4]:=
```
N[Sqrt[2], 6]
```

Out[4]=
```
1.41421
```

In[5]:=
```
N[mysqrt[3]]
```

Out[5]=
```
1.73205
```

Q12. (a) Write a function called collatz that accepts a single argument, n, and returns:

- 0 if n=1,
- 1+ collatz(n/2) if n is even.
- 1+ collatz(3*n+1) if n is odd