CHAPTER-12 EXERCISE

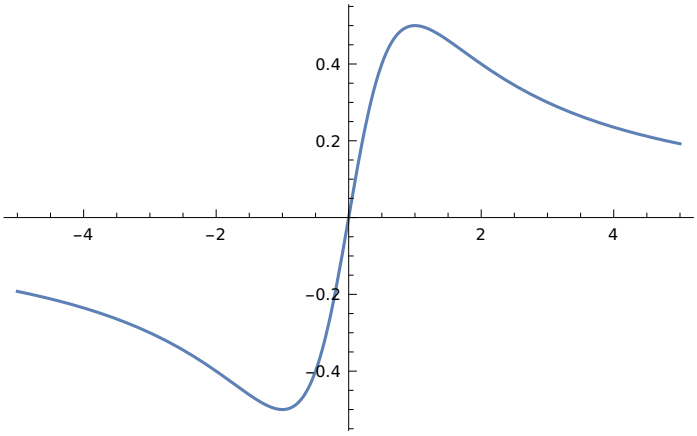
Q1 GRAPH EACH OF THE FOLLOWING FUNCTION . EXPERIMENT WITH DIFFERENTIAL DOMAINS OR VIEWPOINT TO DISPLAY THE BEST IMAGES

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

In[43]:=
```
f[x_] := x / (1 + x ^ 2);
```

In[44]:=
```
Plot[f[x], {x, -5, 5}]
```

Out[44]=

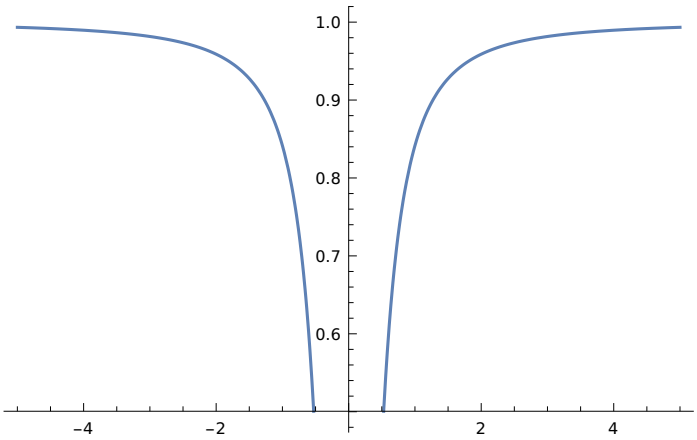


b) y = x Sin [1 / x]

In[45]:=
```
f[x_] := x Sin[1 / x];
```

In[46]:=
```
Plot[f[x], {x, -5, 5}]
```

Out[46]=

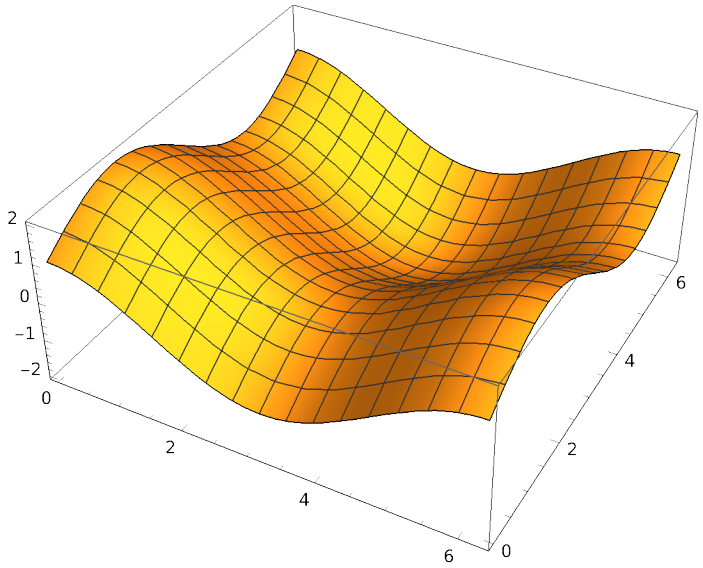


c) g (x , y) = Cos [x] + Sin [y]

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

In[4]:=
```
Plot3D[f[x, y], {x, 0, 2 Pi}, {y, 0, 2 Pi}]
```

Out[4]=

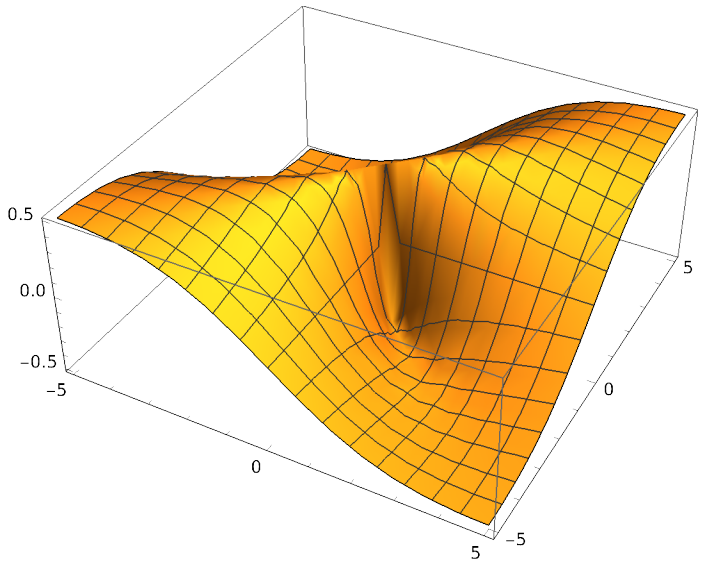


d) z = x y / (x ^ 2 + y ^ 2)

In[13]:=
```
f[x_, y_] := (x y) / (x ^ 2 + y ^ 2);
```

In[14]:=
```
Plot3D[f[x, y], {x, -5, 5}, {y, -5, 5}]
```

Out[14]=



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

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

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

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

Out[16]=
$$-\frac{2x^2}{(1+x^2)^2}+\frac{1}{1+x^2}$$

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

Out[17]=
$$\frac{8x^3}{(1+x^2)^3}-\frac{6x}{(1+x^2)^2}$$

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

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

Out[18]=
```
0
```

In[20]:=
```
f'[0]
```

Out[20]=
```
1
```

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

In[21]:=
```
f''[0]
```

Out[21]=
```
0
```

In[22]:=
```
f''[1]
```

Out[22]=
$$-\frac{1}{2}$$

Q3 Find the prime factorisation of each integer.

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

In[23]:=
```
FactorInteger [3]
```

Out[23]=
```
{{3, 1}}
```

In[24]:=
```
FactorInteger [527]
```

Out[24]=
```
{{17, 1}, {31, 1}}
```

In[25]:=
```
FactorInteger [218]
```

Out[25]=
```
{{2, 1}, {109, 1}}
```

In[26]:=
```
FactorInteger [133]
```

Out[26]=
```
{{7, 1}, {19, 1}}
```

In[27]:=
```
FactorInteger [309]
```

Out[27]=
```
{{3, 1}, {103, 1}}
```

In[28]:= **FactorInteger [949]**

Out[28]= {{13 , 1}, {73 , 1}}

In[29]:= **FactorInteger [276]**

Out[29]= {{2 , 2}, {3 , 1}, {23 , 1}}

In[30]:= **FactorInteger [293]**

Out[30]= {{293 , 1}}

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

In[31]:= **FactorInteger [471]**

Out[31]= {{3 , 1}, {157 , 1}}

In[32]:= **FactorInteger [945]**

Out[32]= {{3 , 3}, {5 , 1}, {7 , 1}}

In[33]:= **FactorInteger [325]**

Out[33]= {{5 , 2}, {13 , 1}}

In[36]:= **FactorInteger [930]**

Out[36]= {{2 , 1}, {3 , 1}, {5 , 1}, {31 , 1}}

In[35]:= **FactorInteger [166]**

Out[35]= {{2 , 1}, {83 , 1}}

In[37]:= **FactorInteger [269]**

Out[37]= {{269 , 1}}

c) 471 , 945 , 345 , 930 , 166 , 281

In[38]:= **FactorInteger [471]**

Out[38]= {{3 , 1}, {157 , 1}}

In[39]:= **FactorInteger [945]**

Out[39]= {{3 , 3}, {5 , 1}, {7 , 1}}

In[40]:= **FactorInteger [345]**

Out[40]= {{3 , 1}, {5 , 1}, {23 , 1}}

In[41]:= **FactorInteger [930]**

Out[41]= {{2 , 1}, {3 , 1}, {5 , 1}, {31 , 1}}

In[42]:= **FactorInteger [166]**

Out[42]= {{2 , 1}, {83 , 1}}

In[43]:=
```
FactorInteger[281]
```

Out[43]= {{281, 1}}

Q4 COMPUTE EACH EXPRESSION . DO YOU NOTICE A PATTERN ?

a) 3 ^6 mod 7
b) 6 ^ 10 mod 11
c) 7 ^20 mod 21
d) 7 ^ 22 mod 23

In[45]:=
```
Mod[3^6, 7]
```

Out[45]= 1

In[46]:=
```
Mod[6^10, 11]
```

Out[46]= 1

In[47]:=
```
Mod[7^20, 21]
```

Out[47]= 7

In[49]:=
```
Mod[7^22, 21]
```

Out[49]= 7

Q 5 LET M = [{1 ,1 } , {1 , 0 }].

In[50]:=
```
M = {{1, 1}, {1, 0}}
```

Out[50]= {{1, 1}, {1, 0}}

a) FIND M ^2 , M^ 3 , -------- M ^ 10

In[51]:=
```
MatrixPower[M, 2]
```

Out[51]= {{2, 1}, {1, 1}}

In[52]:=
```
MatrixPower[M, 3]
```

Out[52]= {{3, 2}, {2, 1}}

In[53]:=
```
MatrixPower[M, 4]
```

Out[53]= {{5, 3}, {3, 2}}

In[54]:=
```
MatrixPower[M, 5]
```

Out[54]= {{8, 5}, {5, 3}}

In[55]:=
```
MatrixPower[M, 6]
```

Out[55]= {{13, 8}, {8, 5}}

In[56]:=
```
MatrixPower[M, 7]
```
Out[56]= {{21, 13}, {13, 8}}

In[57]:=
```
MatrixPower[M, 8]
```
Out[57]= {{34, 21}, {21, 13}}

In[58]:=
```
MatrixPower[M, 9]
```
Out[58]= {{55, 34}, {34, 21}}

In[59]:=
```
MatrixPower[M, 10]
```
Out[59]= {{89, 55}, {55, 34}}

b) DO YOUR ANSWERS SUGGEST THE WAY TO COMPUTE FIBONACCI NUMBERS ? FIND THE 100th FIBONNACI NUMBER .

In[60]:=
```
f[0] = 1;
```

In[61]:=
```
f[1] = 1;
```

In[62]:=
```
f[n_] := f[n] = f[n - 2] + f[n - 1]
```

In[63]:=
```
f[100]
```
Out[63]= 573 147 844 013 817 084 101

QUES 9 FIND SOLUTIONS TO THE FOLLOWING EQUATIONS OR SYSTEM OF EQUATON

a) Find x , if x ^ 2 + x = 1
b) Find x, if x ^2 + x = -1
c) Find x and y
4 x -3 y = 5
6 x + 2 y = 14
d) Find x , y , z and t
- 2 x - 2 y +3 z + t = 8
- 3 x + 0 y - 6 z + 5 t = 47
x + 3 y - 3 z - t = -9

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

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

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

Out[5]=
```
{{x → 2, y → 1}}
```

In[9]:=
```
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[9]=
```
{{x → 2, y → 1, z → 3, t → 5}}
```

Q 10 SOME EQUATION .....FOR r 250 Exp[1.0 r]+300 Exp[0.75 r]+350 Exp[0.5 r]+400 Exp[0.25 r]=1365

In[10]:=
```
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[10]=
```
{r → 0.084104}
```

Q 11 IF N IS A POSITIVE NUMBER , AND .....THE ANSWER.

In[4]:=
```
mysqrt[n_] := Module[{i = 1, g = 1}, While[i ≤ 20, g = (g + n / g) / 2; i = i + 1]; g]
```

In[5]:=
```
N[mysqrt[2], 6]
```

Out[5]=
```
1.41421
```

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

Out[6]=
```
1.41421
```

In[7]:=
```
N[mysqrt[3]]
```

Out[7]=
```
1.73205
```

QUES 12

In[1]:=
```
Clear[collatz];
```

In[2]:=
```
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[3]:=
```
collatz[27]
```

Out[3]=
```
111
```