HIMANI SINGH
MAT/19/4

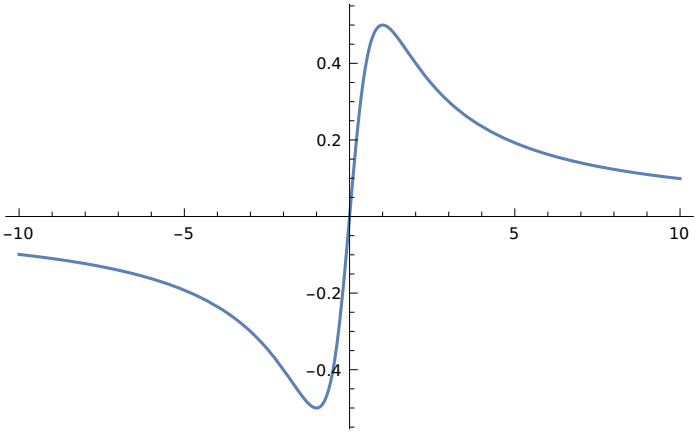
CHAPTER 12

QUES 1 : Graph each of the functions . Experiment with different domains or viewpoints to display the best images .

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

In[1]:=
```
Plot[x / (1 + x ^ 2), {x, -10, 10}]
```

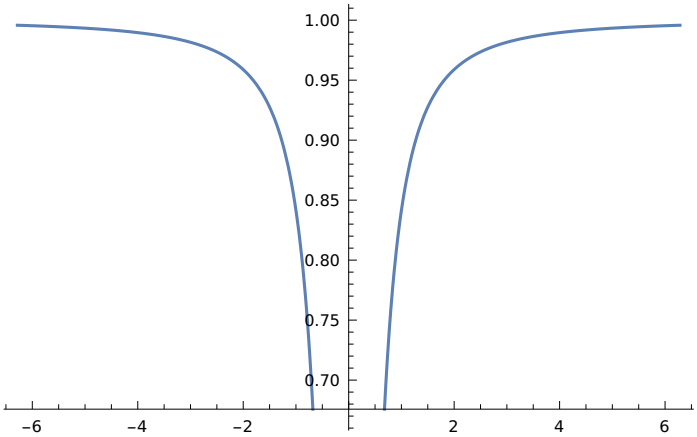
Out[1]=



(b) y = x sin (1 / x)

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

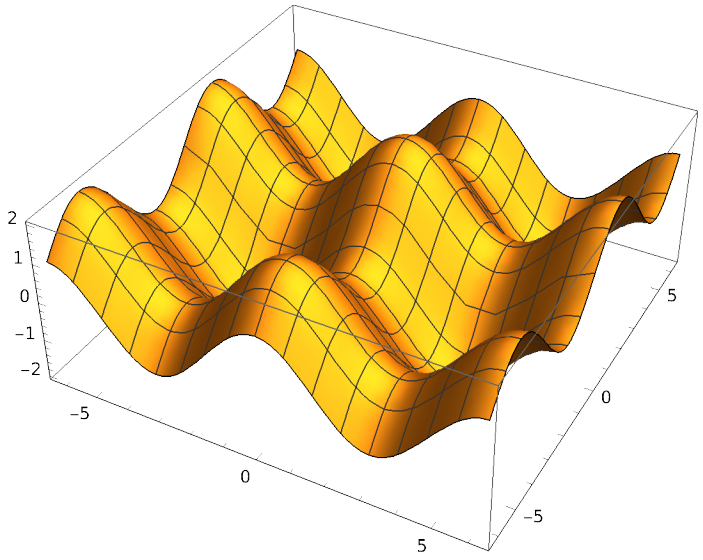
Out[2]=



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

In[3]:=
```
Plot3D[Cos[x] + Sin[y], {x, -2 Pi, 2 Pi}, {y, -2 Pi, 2 Pi}]
```

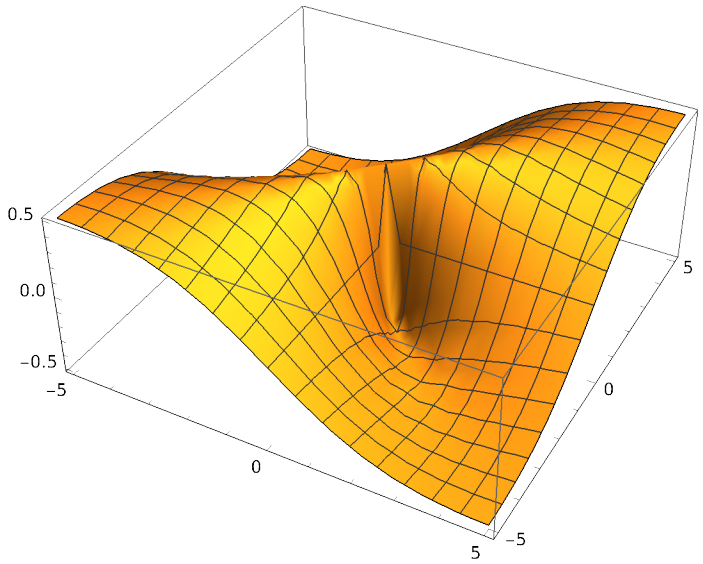
Out[3]=



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

In[4]:=
```
Plot3D[x * y / (x ^ 2 + y ^ 2), {x, -5, 5}, {y, -5, 5}]
```

Out[4]=



QUES 2 : Let f (x) = x / (1 + x ^ 2)

In[5]:=
```
f[x_] = x / (1 + x ^ 2)
```

Out[5]=

$$\frac{x}{1 + x^2}$$

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

In[6]:= `f'[x]`

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

In[7]:= `f''[x]`

Out[7]= $\frac{8x^3}{(1+x^2)^3}-\frac{6x}{(1+x^2)^2}$

(b) Find f'(−1) and f'(0).

In[8]:= `f'[-1]`

Out[8]= 0

In[9]:= `f'[0]`

Out[9]= 1

(c) Find f"(0) and f"(1).

In[10]:= `f''[0]`

Out[10]= 0

In[11]:= `f''[1]`

Out[11]= $-\frac{1}{2}$

In[12]:= `ClearAll[f]`

QUES 3 : Find the prime factorization of each integer .

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

In[13]:= `FactorInteger [3 527 218 133 309 949 276 293 ]`

Out[13]= {{15 013 , 2}, {25 013 , 3}}

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

In[14]:= `FactorInteger [471 945 325 930 166 269 ]`

Out[14]= {{4211 , 1}, {34 589 , 1}, {46 747 , 1}, {69 313 , 1}}

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

In[15]:= **FactorInteger [471 945 325 930 166 281]**

Out[15]= {{471 945 325 930 166 281 , 1}}

QUES 4 : Compute each expression .

(a) 3 ^ 6 mod 7

In[16]:= **Mod[3 ^ 6, 7]**

Out[16]= 1

(b) 6 ^ 10 mod 11

In[17]:= **Mod[6 ^ 10, 11]**

Out[17]= 1

(c) 7 ^ 20 mod 21

In[18]:= **Mod[7 ^ 20, 21]**

Out[18]= 7

(d) 7 ^ 22 mod 23

In[19]:= **Mod[7 ^ 22, 23]**

Out[19]= 1

QUES 8

(a)

In[20]:= **M = {{1, 1}, {1, 0}}**

Out[20]= {{1, 1}, {1, 0}}

In[21]:= **M.M**

Out[21]= {{2, 1}, {1, 1}}

In[22]:= **M.M.M**

Out[22]= {{3, 2}, {2, 1}}

In[23]:= **M.M.M.M**

Out[23]= {{5, 3}, {3, 2}}

In[24]:=
```
M.M.M.M.M
```
Out[24]= {{8, 5}, {5, 3}}

In[25]:=
```
M.M.M.M.M.M
```
Out[25]= {{13, 8}, {8, 5}}

In[26]:=
```
M.M.M.M.M.M.M
```
Out[26]= {{21, 13}, {13, 8}}

In[27]:=
```
M.M.M.M.M.M.M.M
```
Out[27]= {{34, 21}, {21, 13}}

In[28]:=
```
M.M.M.M.M.M.M.M.M
```
Out[28]= {{55, 34}, {34, 21}}

In[29]:=
```
M.M.M.M.M.M.M.M.M.M
```
Out[29]= {{89, 55}, {55, 34}}

(b)

In[30]:=
```
f[0] = {{1, 1}, {1, 0}};
```

In[31]:=
```
f[1] = {{2, 1}, {1, 1}};
```

In[32]:=
```
f[n_] := f[n] = f[n - 2] + f[n - 1]
```

In[33]:=
```
f[100]
```
Out[33]= {{927 372 692 193 078 999 176 , 573 147 844 013 817 084 101 },
{573 147 844 013 817 084 101 , 354 224 848 179 261 915 075 }}

QUES 9

(a)

In[34]:=
```
Solve[{x^2 + x == 1}, {x}]
```
Out[34]= $\left\{\left\{x \to \frac{1}{2}\left(-1-\sqrt{5}\right)\right\}, \left\{x \to \frac{1}{2}\left(-1+\sqrt{5}\right)\right\}\right\}$

(b)

In[35]:=
```
Solve[{x^2 + x == -1}, {x}]
```
Out[35]= $\left\{\left\{x \to -(-1)^{1/3}\right\}, \left\{x \to (-1)^{2/3}\right\}\right\}$

(c)

In[36]:=
```
Solve[{4 * x - 3 * y == 5, 6 * x + 2 * y == 14}, {x, y}]
```

Out[36]=
```
{{x → 2, y → 1}}
```

(d)

In[37]:=
```
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[37]=
```
{{x → 2, y → 1, z → 3, t → 5}}
```

QUES 10

In[38]:=
```
FindRoot[250 * e^(1.0 * r) + 300 * e^(0.75 * r) + 350 * e^(0.5 * r) + 400 * e^(0.25 * r) == 1365, {r, 1}]
```

Out[38]=
```
{r → 0.084104}
```

QUES 11

In[40]:=
```
mysqrt[n_] := Module[{i = 1, g = 1}, While[i ≤ 20, g = (g + n / g) / 2; i = i + 1]; g]
```

In[41]:=
```
N[mysqrt[2], 6]
```

Out[41]=
```
1.41421
```

In[43]:=
```
N[Sqrt[2], 6]
```

Out[43]=
```
1.41421
```

In[44]:=
```
N[mysqrt[3]]
```

Out[44]=
```
1.73205
```

QUES 12

(a)

In[45]:=
```
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]]
```

(b)

In[47]:=
```
collatz[1]
```

Out[47]=
```
0
```

In[48]:=
```
collatz[2]
```

Out[48]=
```
1
```

In[49]:= **collatz[6]**

Out[49]= 8

In[50]:= **collatz[27]**

Out[50]= 111