

ASSINGMENT-1

(Chapter - 12)

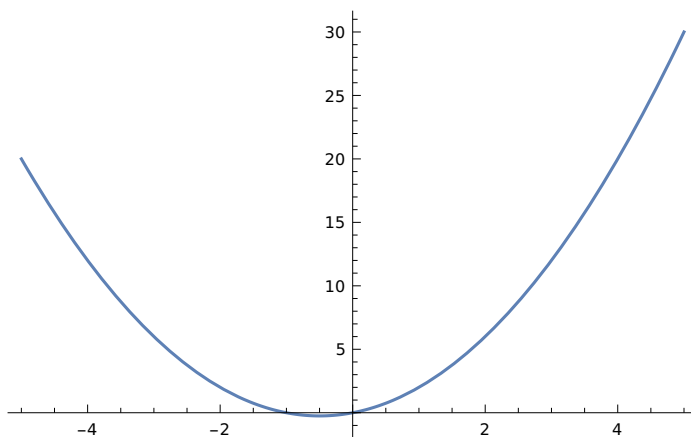
Ques1:

A) $f(x) = x/(1+x^2)$

In[5]:=

```
f[x_] := x/1 + x^2  
Plot[f[x], {x, -5, 5}]
```

Out[6]=

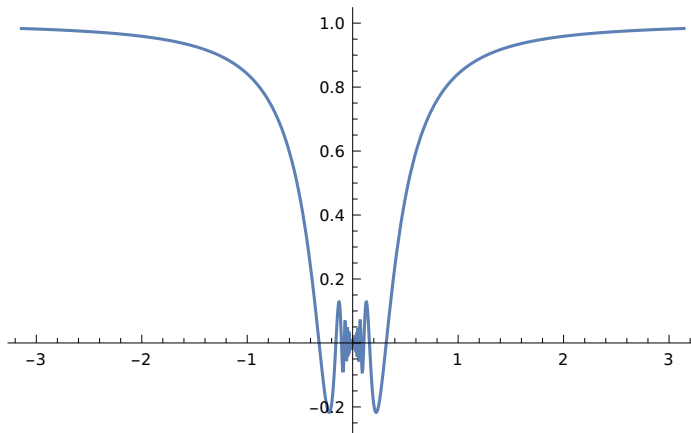


B) $y = x \sin(1/x)$

In[10]:=

```
f[x_] := x Sin[1/x]
Plot[f[x], {x, -Pi, Pi}]
```

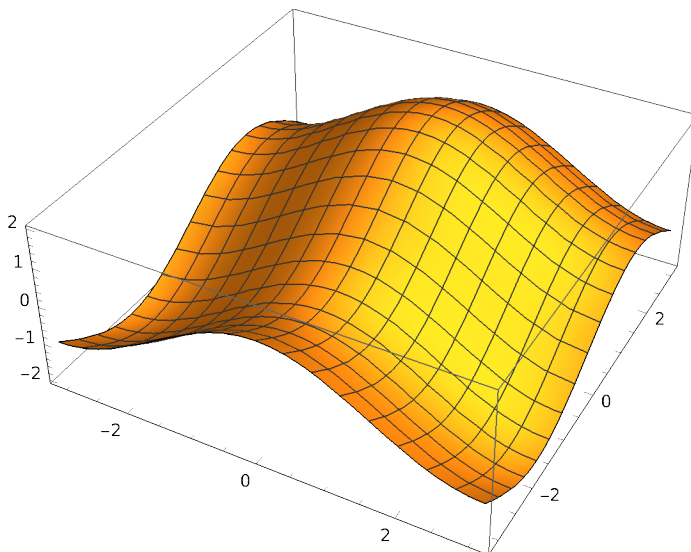
Out[11]=

C) $g(x,y) = \cos(x) + \sin(y)$

In[12]:=

```
Plot3D[Cos[x] + Sin[y], {x, -Pi, Pi}, {y, -Pi, Pi}]
```

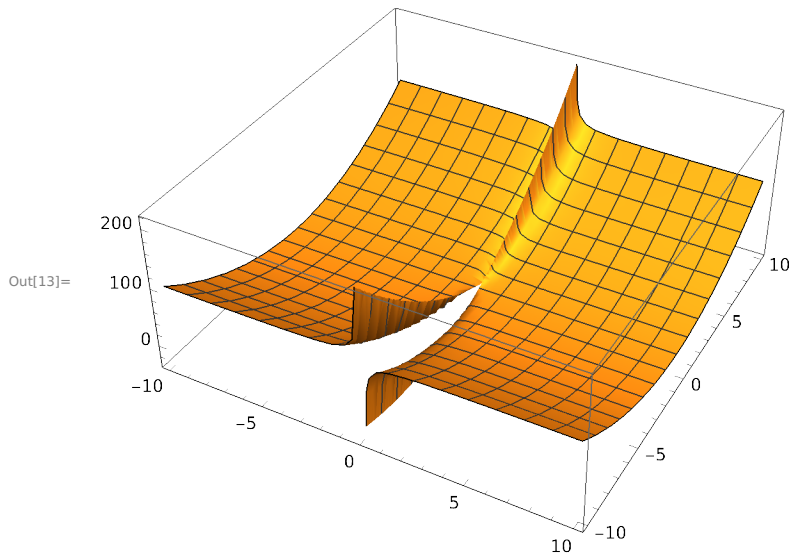
Out[12]=



D) $z = xy/x^2 + y^2$

In[13]:=

```
Plot3D[{x y / x ^ 2 + y ^ 2}, {x, - 10, 10}, {y, - 10, 10}]
```



Ques 2:

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

A) $f'(x)$ and $f''(x)$

In[16]:=

```
f[x_] := x / (1 + x ^ 2)
D[f[x], x]
```

Out[17]=

$$-\frac{2x^2}{(1+x^2)^2} + \frac{1}{1+x^2}$$

In[18]:=

```
D[f[x], {x, 2}]
```

Out[18]=

$$-\frac{4x}{(1+x^2)^2} + x \left(\frac{8x^2}{(1+x^2)^3} - \frac{2}{(1+x^2)^2} \right)$$

B) $f'(-1)$ and $f'(0)$

In[19]:=

```
f'[-1]
```

Out[19]= 0

In[20]:=

`f''[0]`

Out[20]=

0

B) $f''(0)$ and $f''(1)$

In[21]:=

`f''[0]`

Out[21]=

0

In[22]:=

`f''[1]`

Out[22]=

 $-\frac{1}{2}$

Ques 3 :

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

In[25]=

`FactorInteger [3527218133309949276293 ]`

Out[25]=

`{{15 013 , 2}, {25 013 , 3}}`

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

In[6]=

`FactorInteger [471945325930166269 ]`

Out[6]=

`{{4211 , 1}, {34 589 , 1}, {46 747 , 1}, {69 313 , 1}}`

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

In[28]=

`FactorInteger [471945325930166281 ]`

Out[28]=

`{{471 945 325 930 166 281 , 1}}`

Ques4:

A) $3^6 \bmod 7$

In[29]=

`Mod[3 ^ 6, 7]`

Out[29]=

1

B) $6^{10} \bmod 11$

In[30]:= `Mod[6 ^ 10, 11]`

Out[30]= 1

C) $7^{20} \bmod 21$

In[31]:= `Mod[7 ^ 20, 21]`

Out[31]= 7

D) $7^{22} \bmod 23$

In[32]:= `Mod[7 ^ 22, 23]`

Out[32]= 1

Ques 8:

In[14]:= `M = {{1, 1}, {1, 0}}`
`MatrixForm [M]`

Out[14]= `{{1, 1}, {1, 0}}`

Out[15]//MatrixForm=

$$\begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix}$$

A) Find $M_2, M_3, \dots, M_{10}$

In[16]:= `F[n_] := MatrixPower [M, (n - 1)].M`
`List[F[2], F[3], F[4], F[5], F[6], F[7], F[8], F[9], F[10]]`

Out[17]= `{{{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[18]:= `MatrixForm [F[2]]`

Out[18]//MatrixForm=

$$\begin{pmatrix} 2 & 1 \\ 1 & 1 \end{pmatrix}$$

In[19]:= **MatrixForm** [F[3]]

Out[19]//MatrixForm=

$$\begin{pmatrix} 3 & 2 \\ 2 & 1 \end{pmatrix}$$

In[20]:= **MatrixForm** [F[4]]

Out[20]//MatrixForm=

$$\begin{pmatrix} 5 & 3 \\ 3 & 2 \end{pmatrix}$$

In[21]:= **MatrixForm** [F[5]]

Out[21]//MatrixForm=

$$\begin{pmatrix} 8 & 5 \\ 5 & 3 \end{pmatrix}$$

In[22]:= **MatrixForm** [F[6]]

Out[22]//MatrixForm=

$$\begin{pmatrix} 13 & 8 \\ 8 & 5 \end{pmatrix}$$

In[23]:= **MatrixForm** [F[7]]

Out[23]//MatrixForm=

$$\begin{pmatrix} 21 & 13 \\ 13 & 8 \end{pmatrix}$$

In[24]:= **MatrixForm** [F[8]]

Out[24]//MatrixForm=

$$\begin{pmatrix} 34 & 21 \\ 21 & 13 \end{pmatrix}$$

In[25]:= **MatrixForm** [F[9]]

Out[25]//MatrixForm=

$$\begin{pmatrix} 55 & 34 \\ 34 & 21 \end{pmatrix}$$

In[26]:= **MatrixForm** [F[10]]

Out[26]//MatrixForm=

$$\begin{pmatrix} 89 & 55 \\ 55 & 34 \end{pmatrix}$$

In[42]:= **ClearAll**

Out[42]= **ClearAll**

B) Fibonacci sequence

```
In[43]:= f[0] = 1;
         f[1] = 1;
         f[n_] := f[n] = f[n - 2] + f[n - 1]
         f[100]
```

```
Out[46]= 573 147 844 013 817 084 101
```

Ques 9:

A) $x^2 + x = 1$

```
In[47]:= Solve[{x ^ 2 + x == 1}, x]
```

```
Out[47]= {{x -> 1/2 (-1 - Sqrt[5])}, {x -> 1/2 (-1 + Sqrt[5])}}
```

B) $x^2 + x = -1$

```
In[48]:= Solve[{x ^ 2 + x == -1}, x]
```

```
Out[48]= {{x -> -(-1)^(1/3)}, {x -> (-1)^(2/3)}}
```

C) $4x - 3y = 5$

$$6x + 2y = 14$$

```
In[49]:= Solve[{4 x - 3 y == 5, 6 x + 2 y == 14}, {x, y}]
```

```
Out[49]= {{x -> 2, y -> 1}}
```

D) $-2x - 2y + 3z + t = 8$

$$-3x + 0y - 6z + t = -19$$

$$6x - 8y + 6z + 5t = 47$$

$$x + 3y - 3z - t = -9$$

```
In[50]:= 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[50]= {{x -> 2, y -> 1, z -> 3, t -> 5}}
```

Ques 10:

```
In[51]:= 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[51]= {r -> 0.084104}
```

Ques 11:

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

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

```
In[3]:= N[mysqrt[10]]
```

```
Out[3]= 3.16228
```

Ques 12:

A)

```
In[4]:= 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 [15]
```

```
Out[5]= 17
```

B)

```
In[8]:= collatz [1]
```

```
Out[8]= 0
```

```
In[9]:= collatz [2]
```

```
Out[9]= 1
```

```
In[10]:= collatz [6]
```

```
Out[10]= 8
```

```
collatz [21]
```

```
Out[11]= 111
```