9. Newton Divided Difference Interpolation

Q. Solve the following question by newton's divided difference interpolation

x	:	3	5	6	9
f(x)	:	293	508	585	764

In[ ]:=

```
ClearAll
p = {{3, 293}, {5, 508}, {6, 585}, {9, 764}}
no = Length[p]
y = p[[All, 1]]
f = p[[All, 2]]
dd[k_] :=
 Sum[f[[i]] / Product[If[Equal[j, i], 1, (y[[i]] - y[[j]])], {j, 1, k}], {i, 1, k}]
px = Expand[Sum[(dd[i] * Product[If[i <= j, 1, x - y[[j]]], {j, 1, i - 1}]), {i, 1, no}]]
px /. x → 2.5
```

Out[ ]= ClearAll

Out[ ]= {{3, 293}, {5, 508}, {6, 585}, {9, 764}}

Out[ ]= 4

Out[ ]= {3, 5, 6, 9}

Out[ ]= {293, 508, 585, 764}

Out[ ]= $-\frac{539}{2}+\frac{3001\,x}{12}-\frac{214\,x^2}{9}+\frac{35\,x^3}{36}$

Out[ ]= 222.288

Q2. Form equation for the following data

x:	-4	-1	0	2	5
y:	1245	33	5	9	1335

In[1]:=
```
ClearAll
p = {{-4, 1245}, {-1, 33}, {0, 5}, {2, 9}, {5, 1335}}
no = Length[p]
y = p[[All, 1]]
f = p[[All, 2]]
dd[k_] :=
 Sum[f[[i]] / Product[If[Equal[j, i], 1, (y[[i]] - y[[j]])], {j, 1, k}], {i, 1, k}]
px = Expand[Sum[(dd[i] * Product[If[i <= j, 1, x - y[[j]]], {j, 1, i - 1}]), {i, 1, no}]]
px /. x → 2.5
```

Out[1]= ClearAll

Out[2]= {{-4, 1245}, {-1, 33}, {0, 5}, {2, 9}, {5, 1335}}

Out[3]= 5

Out[4]= {-4, -1, 0, 2, 5}

Out[5]= {1245, 33, 5, 9, 1335}

Out[7]= $5 - 14\,x + 6\,x^2 - 5\,x^3 + 3\,x^4$

Out[8]= 46.5625

Q3. Form equation for the following

x:	-2	-1	0	1	3	4
y:	9	16	17	18	44	81

In[9]:=
```
p = {{-2, 9}, {-1, 16}, {0, 17}, {1, 18}, {3, 44}, {4, 81}}
no = Length[p]
y = p[[All, 1]]
f = p[[All, 2]]
dd[k_] :=
 Sum[f[[i]] / Product[If[Equal[j, i], 1, (y[[i]] - y[[j]])], {j, 1, k}], {i, 1, k}]
px = Expand[Sum[(dd[i] * Product[If[i <= j, 1, x - y[[j]]], {j, 1, i - 1}]), {i, 1, no}]]
px /. x → 0.5
px /. x → 3.1
```

Out[9]= {{-2, 9}, {-1, 16}, {0, 17}, {1, 18}, {3, 44}, {4, 81}}

Out[10]= 6

Out[11]= {-2, -1, 0, 1, 3, 4}

Out[12]= {9, 16, 17, 18, 44, 81}

Out[14]= $17 + x^3$

Out[15]= 17.125

Out[16]= 46.791

Q4. Form equation using the following data points

x:	1	3	4	5	7	10
Y:	3	31	69	131	351	1011

In[17]:=

```
p = {{1, 3}, {3, 31}, {4, 69}, {5, 131}, {7, 351}, {10, 1011}}
no = Length[p]
y = p[[All, 1]]
f = p[[All, 2]]
dd[k_] :=
 Sum[f[[i]] / Product[If[Equal[j, i], 1, (y[[i]] - y[[j]])], {j, 1, k}], {i, 1, k}]
px = Expand[Sum[(dd[i] * Product[If[i <= j, 1, x - y[[j]]], {j, 1, i - 1}]), {i, 1, no}]]
px /. x → 3.5
px /. x → 8
```

Out[17]= {{1, 3}, {3, 31}, {4, 69}, {5, 131}, {7, 351}, {10, 1011}}

Out[18]= 6

Out[19]= {1, 3, 4, 5, 7, 10}

Out[20]= {3, 31, 69, 131, 351, 1011}

Out[22]= $1 + x + x^3$

Out[23]= 47.375

Out[24]= 521