8. Lagrange Interpolation

Q1 . Find f(5) by Lagrange interpolation

x	:	1	3	4	6	10
f(x)	:	0	18	48	180	900

In[ ]:=
```
ClearAll
p = {{1, 0}, {3, 18}, {4, 48}, {6, 180}, {10, 900}};
no = Length[p]
y = p[[All, 1]]
f = p[[All, 2]]
Lagrange[no_, n_] :=
  Product[If[Equal[k, n], 1, (x - y[[k]]) / (y[[n]] - y[[k]])], {k, 1, no}];
px = Expand[Simplify[Sum[f[[i]] * Lagrange[no, i], {i, 1, no}]]]
px /. x → 5
```

Out[ ]= ClearAll

Out[ ]= 5

Out[ ]= {1, 3, 4, 6, 10}

Out[ ]= {0, 18, 48, 180, 900}

Out[ ]= $-x^2 + x^3$

Out[ ]= 100

Q2 . Given that f(0) = 1, f(1) = 3, f(3) = 55 find the unique polynomial of degree 2 or less, which fits the data

In[ ]:=
```
ClearAll
p = {{0, 1}, {1, 3}, {3, 55}}
no = Length[p]
y = p[[All, 1]]
f = p[[All, 2]]
Lagrange[no_, n_] :=
  Product[If[Equal[k, n], 1, (x - y[[k]]) / (y[[n]] - y[[k]])], {k, 1, no}];
px = Expand[Simplify[Sum[f[[i]] * Lagrange[no, i], {i, 1, no}]]]
px /. x → 34
```

Out[ ]= ClearAll

Out[ ]= {{0, 1}, {1, 3}, {3, 55}}

Out[ ]= 3

Out[ ]= {0, 1, 3}

Out[ ]= {1, 3, 55}

Out[ ]= $1 - 6x + 8x^2$

Out[ ]= 9045

Q3. construct equation for the following data

x:	-1	1	4	7
f:	-2	0	63	342

In[•]:=
```
ClearAll
p = {{-1, -2}, {1, 0}, {4, 63}, {7, 342}}
no = Length[p]
y = p[[All, 1]]
f = p[[All, 2]]
Lagrange[no_, n_] :=
  Product[If[Equal[k, n], 1, (x - y[[k]]) / (y[[n]] - y[[k]])], {k, 1, no}];
px = Expand[Simplify[Sum[f[[i]] * Lagrange[no, i], {i, 1, no}]]]
px /. x → 2
```

Out[•]= ClearAll

Out[•]= {{-1, -2}, {1, 0}, {4, 63}, {7, 342}}

Out[•]= 4

Out[•]= {-1, 1, 4, 7}

Out[•]= {-2, 0, 63, 342}

Out[•]= $-1 + x^3$

Out[•]= 7

Q4. Construct equation for the following data

x:	10	20	30
y:	1.1585	1.2817	1.3660

In[•]:=
```
ClearAll
p = {{10, 1.1585}, {20, 1.2817}, {30, 1.3660}}
no = Length[p]
y = p[[All, 1]]
f = p[[All, 2]]
Lagrange[no_, n_] :=
  Product[If[Equal[k, n], 1, (x - y[[k]]) / (y[[n]] - y[[k]])], {k, 1, no}];
px = Expand[Simplify[Sum[f[[i]] * Lagrange[no, i], {i, 1, no}]]]
px /. x → (π / 12)
```

Out[•]= ClearAll

Out[•]= {{10, 1.1585}, {20, 1.2817}, {30, 1.366}}

Out[•]= 3

Out[•]= {10, 20, 30}

Out[•]= {1.1585, 1.2817, 1.366}

Out[•]= $0.9964 + 0.018155\,x - 0.0001945\,x^2$

Out[•]= 1.00114

In[•]:=

In[ ]:=