PRACTICAL–7
LAGRANGE INTERPOLATION

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```
LagrangePolynomial[x0_, f0_] := Module[{xi = x0, fi = f0, n, m, polynomial}, n = Length[xi];
  m = Length[fi];
  If[n ≠ m,
   Print["List of points and function's values are not of same size"];
   Return[];];
  For[i = 1, i ≤ n, i++,
   L[i, x_] = (Product[(x - xi[[j]]) / (xi[[i]] - xi[[j]]), {j, 1, i - 1}]) *
      (Product[(x - xi[[j]]) / (xi[[i]] - xi[[j]]), {j, i + 1, n}]);];
  polynomial[x_] = Sum[L[k, x] * fi[[k]], {k, 1, n}];
  Return[polynomial[x]];]
```

Ques 1

```
nodes = {0, 1, 3};
values = {1, 3, 55};
LagrangePolynomial[x_] = LagrangePolynomial[nodes, values]
```

$$\frac{1}{3}(1-x)(3-x)+\frac{3}{2}(3-x)x+\frac{55}{6}(-1+x)x$$

```
Expand[%]
```

$$1-6x+8x^2$$

Ques 2

```
nodes = {0, 1, 3};
values = {1, 3};
LagrangePolynomial[x_] = LagrangePolynomial[nodes, values]
```

```
List of points and function's values are not of same size
```

Ques 3

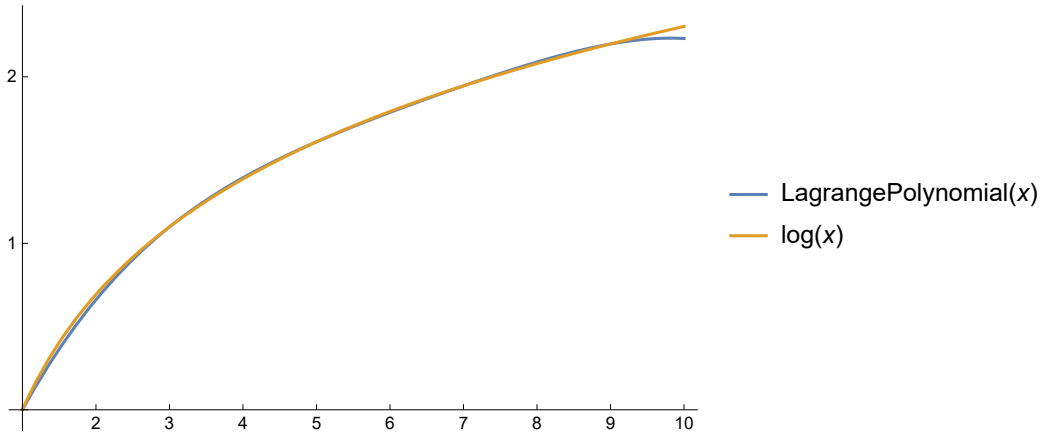
```
nodes = {1, 3, 5, 7, 9};
values = {N[Log[1]], N[Log[3]], N[Log[5]], N[Log[7]], N[Log[9]]};
LagrangePolynomial[x_] = LagrangePolynomial[nodes, values]
```

$$0.+0.0114439(5-x)(7-x)(9-x)(-1+x)+0.0251475(7-x)(9-x)(-3+x)(-1+x)+$$
$$0.0202699(9-x)(-5+x)(-3+x)(-1+x)+0.00572194(-7+x)(-5+x)(-3+x)(-1+x)$$

```
Simplify[%]
```

$$-0.987583 + 1.18991\,x - 0.223608\,x^2 + 0.0221231\,x^3 - 0.000844369\,x^4$$

```
Plot[{LagrangePolynomial[x], Log[x]}, {x, 1, 10},
 Ticks → {Range[0, 10]}, PlotLegends → "Expressions"]
```



Ques 4

```
nodes = {-1, 0, 1, 2};
values = {5, 1, 1, 11};
LagrangePolynomial[x_] = LagrangePolynomial[nodes, values]
```

$$-\frac{5}{6}(1-x)(2-x)\,x + \frac{1}{2}(1-x)(2-x)(1+x) + \frac{1}{2}(2-x)\,x\,(1+x) + \frac{11}{6}(-1+x)\,x\,(1+x)$$

```
Simplify[%]
```

$$1 - 3\,x + 2\,x^2 + x^3$$

```
LagrangePolynomial[1.5]
```

4.375