PRACTICAL–7 LAGRANGE INTERPOLATION

```
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[%]
```

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

Ques 2

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

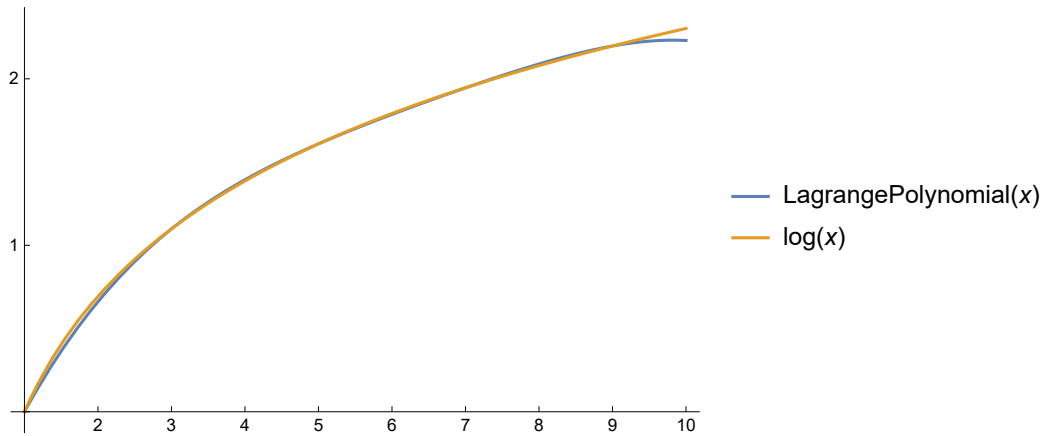List of points and function's values are not of same size

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"]

— LagrangePolynomial(x)
— log(x)

Ques 4

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

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

Simplify[%]

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

LagrangePolynomial[1.5]

4.375