PRACTICAL-13

Euler Method

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Ques-1

In[70]:=
```
EulerMethod[a0_, b0_, n0_, f_, alpha_] :=
  Module[{a = a0, b = b0, n = n0, h, ti},
   h = (b - a) / n;
   ti = Table[a + (j - 1) h, {j, 1, n + 1}];
   ui = Table[0, {n + 1}];
   ui[[1]] = alpha;
   OutputDetails = {{0, ti[[1]], alpha}};
   For[i = 1, i ≤ n, i++,
    ui[[i + 1]] = ui[[i]] + h * f[ti[[i]], ui[[i]]];
    OutputDetails = Append[OutputDetails,
      {i, N[ti[[i + 1]], N[ui[[i + 1]]}];];
   Print[NumberForm[
     TableForm[OutputDetails, TableHeadings → {None, {"i", "ti", "ui"}}], 6]];
   Print["Subinterval size h used= ", h];
  ];
f[t_, w_] := 1 + w / t;
a = 1; b = 6; n = 10; alpha = 1;
EulerMethod[a, b, 10, f, alpha];
```

i	ti	ui
0	1	1
1	1.5	2.
2	2.	3.16667
3	2.5	4.45833
4	3.	5.85
5	3.5	7.325
6	4.	8.87143
7	4.5	10.4804
8	5.	12.1448
9	5.5	13.8593
10	6.	15.6193

Subinterval size h used= $\frac{1}{2}$

Euler Method with h

Ques-2

In[60]:=
```
EulerMethodwithH[a0_, b0_, h0_, f_, alpha_] :=
  Module[{a = a0, b = b0, h = h0, n, ti},
   n = (b - a) / h;
   ti = Table[a + (j - 1) h, {j, 1, n + 1}];
   ui = Table[0, {n + 1}];
   ui[[1]] = alpha;
   OutputDetails = {{0, ti[[1]], alpha}};
   For[i = 1, i ≤ n, i++,
    ui[[i + 1]] = ui[[i]] + h * f[ti[[i]], ui[[i]]];
    OutputDetails = Append[OutputDetails,
      {i, N[ti[[i + 1]]], N[ui[[i + 1]]]}];];
   Print[NumberForm[
     TableForm[OutputDetails, TableHeadings → {None, {"i", "ti", "ui"}}], 6]];
   Print["Subinterval size h used= ", h];
  ];
g[t_, w_] := 1 + w / t;
a = 1; b = 6; h = .2; alpha = 1;
EulerMethodwithH[a, b, h, g, alpha];
```

i	ti	ui
0	1.	1
1	1.2	1.4
2	1.4	1.83333
3	1.6	2.29524
4	1.8	2.78214
5	2.	3.29127
6	2.2	3.8204
7	2.4	4.36771
8	2.6	4.93168
9	2.8	5.51104
10	3.	6.10469
11	3.2	6.71167
12	3.4	7.33115
13	3.6	7.96239
14	3.8	8.60474
15	4.	9.25763
16	4.2	9.92051
17	4.4	10.5929
18	4.6	11.2744
19	4.8	11.9646
20	5.	12.6631
21	5.2	13.3696
22	5.4	14.0839
23	5.6	14.8055
24	5.8	15.5343
25	6.	16.2699

Subinterval size h used= 0.2

Ques-3

In[64]:=
```
f[t_, x_] := x;
h = 0.2;
EulerMethodwithH[0, 0.4, h, f, 1];
```

i	ti	ui
0	0.	1
1	0.2	1.2
2	0.4	1.44

Subinterval size h used= 0.2

Ques-4

In[74]:=
```
f[t_, x_] := x;
n = 2;
EulerMethod[0, 0.4, n, f, 1];
```

i	ti	ui
0	0.	1
1	0.2	1.2
2	0.4	1.44

Subinterval size h used= 0.2

Ques-5

In[77]:=
```
DSolve[{x'[t] == x[t], x[0] == 1}, x[t], t]
```

Out[77]= $\{\{x[t] \to e^{t}\}\}$

In[79]:=
```
Abs[1.2 - N[Exp[0.2]]]
```

Out[79]= 0.0214028

In[80]:=
```
Abs[1.44 - N[Exp[0.4]]]
```

Out[80]= 0.0518247