Practical 13

Euler's Method

Euler's Method with subinterval length h as input-:

Q. Using Euler's Method, find approximate solution to the initial value problem $\mathbf{x'(t) = -2\,tx^2}$, $0 \le t \le 1$, $x(0) = 1$ with

(a) $h = 0.2$

(b) $h = 0.1$.

Solution-:

```
EulerMethod[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}];
   wi = Table[0, {n + 1}];
   wi[[1]] = alpha;
   OutputDetails = {{0, ti[[1]], alpha}};
   For[i = 1, i ≤ n, i++,
    wi[[i + 1]] = wi[[i]] + h * f[ti[[i]], wi[[i]]];
    OutputDetails = Append[OutputDetails,
      {i, N[ti[[i + 1]]], N[wi[[i + 1]]]}];];
   Print[NumberForm[TableForm[OutputDetails,
     TableHeadings → {None, {"i", "tᵢ", "wᵢ"}}], 6]];
   Print["Subinterval size h used = ", h];
  ];
f[t_, x_] := -2 t x^2;
h = 0.2;
EulerMethod[0, 1, h, f, 1];
```

i	t_i	w_i
0	0	1
1	0.2	1.
2	0.4	0.92
3	0.6	0.784576
4	0.8	0.636842
5	1.	0.50706

```
Subinterval size h used = 0.2
```

```
h = 0.1;

EulerMethod[0, 1, h, f, 1];
```

i	t_i	w_i
0	0	1
1	0.1	1.
2	0.2	0.98
3	0.3	0.941584
4	0.4	0.888389
5	0.5	0.82525
6	0.6	0.757147
7	0.7	0.688354
8	0.8	0.622018
9	0.9	0.560113
10	1.	0.503642

Subinterval size h used = 0.1