```
R0 = 6 378 137;
μ = 3.9860047 * 10^14;

h0 = 1 000 000;
R = R0 + h0;
h[x_, y_] := √(x^2 + y^2) - R0
T[R_] := 2 * π * √(R^3 / μ) ;
Vx0 = √(μ / R) ;
Rcube[x_, y_] := (√(x^2 + y^2))^3 ;
crkamat = {{1 / 2}, {0, 1 / 2}, {0, 0, 1}};
crkbvec = {1 / 6, 1 / 3, 1 / 3, 1 / 6};
crkcvec = {1 / 2, 1 / 2, 1};
ClassicalRungeKuttaCoefficients[4, p_] := N[{crkamat, crkbvec, crkcvec}, p];
benchmarkTest[tStart_, tEnd_, tStep_, printOutput_, rungeKutta4_] :=
  Module[{},
   system := {
     x'[t] == Vx[t],
     y'[t] == Vy[t],
     Vx'[t] == -μ / Rcube[x[t], y[t]] * x[t],
     Vy'[t] == -μ / Rcube[x[t], y[t]] * y[t],
     x[0] == 0,
     y[0] == R,
     Vx[0] == Vx0,
     Vy[0] == 0
    };
   solution := If[rungeKutta4,
     First@NDSolve[system, {x, y, Vx, Vy}, {t, 0, 10 000},
       Method → {"ExplicitRungeKutta", "DifferenceOrder" → 4, "Coefficients" →
           ClassicalRungeKuttaCoefficients}, StartingStepSize → tStep]
     ,
     First@NDSolve[
       system, {x, y, Vx, Vy}, {t, 0, 10 000}, PrecisionGoal → 10
      ]
    ];
   {Vx1, Vy1, x1, y1} = {Vx, Vy, x, y} /. solution;
   Print[Vx1[10 000 - tStep] - -6314.591];
   Print[Vy1[10 000 - tStep]  - 3761.713];
   Print[x1[10 000 - tStep] + 3 776 042];
   Print[y1[10 000 - tStep] - -6 338 645];

   Print[Vx1[10 000 - 1]];
   Print[Vy1[10 000 - 1]];
   Print[x1[10 000 - 1]];
   Print[y1[10 000 - 1]];
```

```
    If[printOutput, Module[{},
      table = Table[{t, x[t], y[t], Vx[t], Vy[t]},
         {t, tStart, tEnd, tStep}] /. solution;
      Export["output.tr", table, "csv"];
     ], Null];
    (*If[printOutput, writeTable[table], Null];*)
   ];
(*time :=First@AbsoluteTiming[benchmarkTest[0, 10000,0.01,False, False]];
time*)

steps = {1, 0.1, 0.01};

times = ConstantArray[0, 12];

For[i = 3, i <= Length[steps], i++,
 times[[i]] =
  First@AbsoluteTiming[benchmarkTest[0, 10 000, steps[[i]], False, False]];
 (*times[[i+3]]=First@AbsoluteTiming[
     benchmarkTest[0, 10000,steps[[i]],True, False]];*)
 times[[i + 6]] = First@AbsoluteTiming[benchmarkTest[
     0, 10 000, steps[[i]], False, True]];
]

times
```

```
-0.0000300461
-0.000377808
0.279127
0.467148
-6318.3
3755.48
-3.76979 × 10^6
-6.34237 × 10^6
-0.0000369835
-0.000393715
0.297848
0.456064
-6318.3
3755.48
-3.76979 × 10^6
-6.34237 × 10^6
```

```
{0, 0, 0.011001, 0, 0, 0, 0, 0, 4.773273, 0, 0, 0}
```