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//Who: Hamza AlHasan-1181636
//What: A code to evaluate the time needed for a spacecraft to reach the moon, without ignoring the moon gravity
#include <stdio.h>
#include <stdlib.h>
#include <math.h>

//Constants:
#define Me 5.972e24 //Mass of the Earth
#define Mm 7.348e22 //Mass of the Moon
#define re 6371e3 //Radius of the Earth
#define rm 1737e3 //Radius of the Moon
#define R 384400e3 //The distance between the centers of the Earth and the Moon
#define G 6.67e-11 //Gravitational constant
#define ve 11.186e3 //The escaping speed
double f(double x,double v0)
{
   //x is the distance from the center of the Earth
   return (double)( 1/sqrt( ( pow(v0,2) + (2*G*Me/re) ) - 2*( (-G*Me/x) + (-G*Mm/(R-x)) ) ) );
}
int main()
{
   double a=re, b=R-rm-re; //The interval from a to b
   int n=1000; //Number of subintervals - must be even in Simpson's Rule
   double delta_x=(b-a)/n;
   FILE *output=fopen("t_VS_v0.txt","w");
   double result;
   for(double v=11.0e3; v<15000e3; v+=5e3)
   {
      result=0.0;
      if(v>=ve)
      {
         //Calculating the integral using Simpson's Rule
         for(int i=0; i<=n; i++)
         {
            if(i==0 || i==n)
            {
               result+=f(i*delta_x+a,v);
            }
            else if(i%2!=0)
            {
               result+=f(i*delta_x+a,v)*4;
            }
            else
            {
               result+=f(i*delta_x+a,v)*2;
            }
         }
         result=result*(delta_x/3);
         fprintf(output, "%e\t%e\n",result,v);
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            //printf("In speed %e ,the time needed is = %e sec = %e hours = %f
days\n",v,result,result/3600,result/86400.0);
        }
        else
        {
            printf("This spacecraft cannot escape from the Earth, because v0 = %e <11.186e+003\n",v);
        }
    }
    printf("Done\n");
    return 0;
}
```