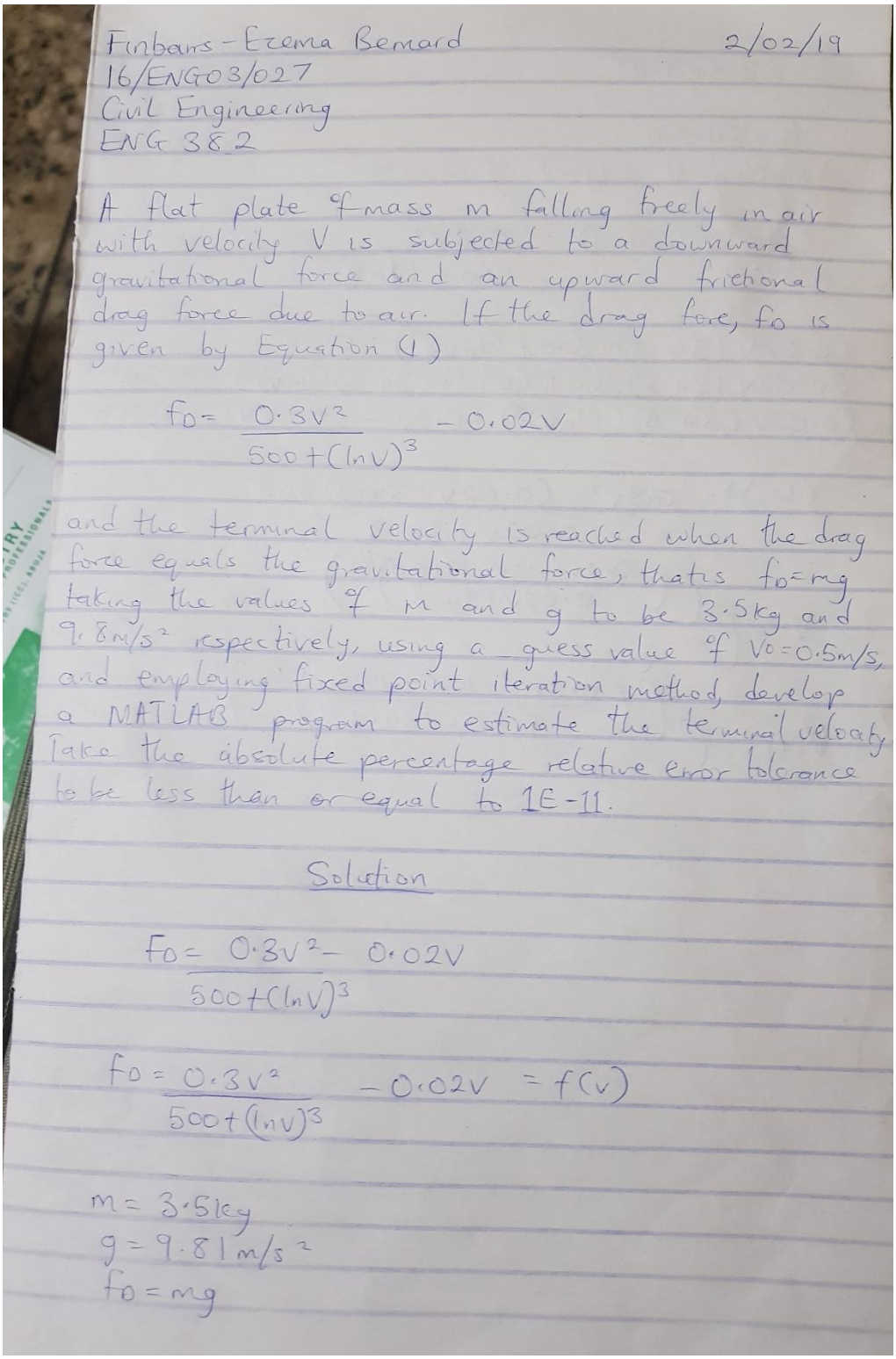
FINBARRS-EZEMA BERNARD ASSIGNMENT 1

16/ENG03/027

CIVIL ENGINEERING

ENG382



Finbars-Ezema Bernard 2/02/19
16/ENG03/027
Civil Engineering
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A flat plate of mass m falling freely in air with velocity V is subjected to a downward gravitational force and an upward frictional drag force due to air. If the drag fore, f_D is given by Equation (1)

$$f_D = \frac{0.3V^2}{500+(\ln V)^3} - 0.02V$$

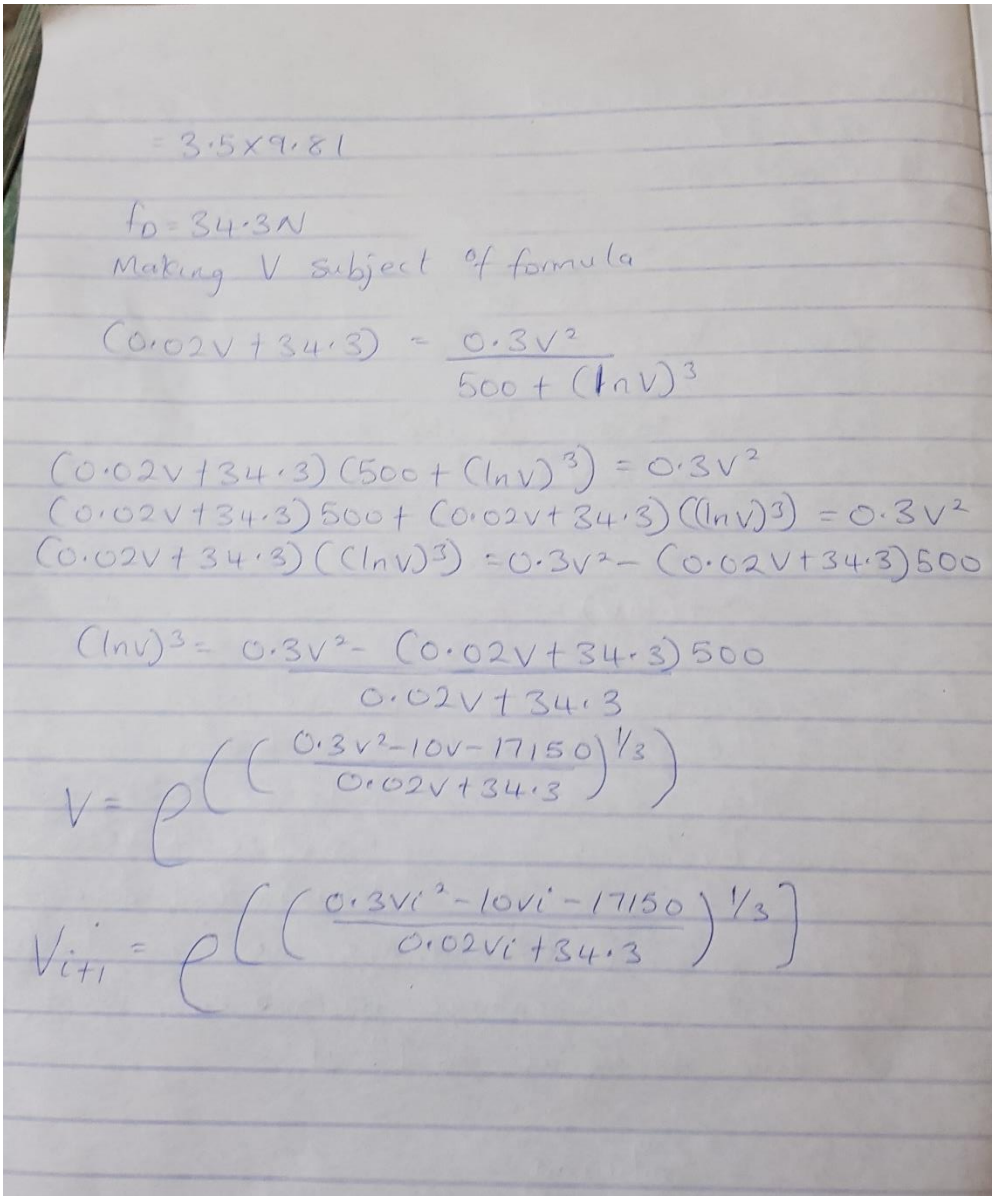
and the terminal velocity is reached when the drag force equals the gravitational force, thatis $f_D = mg$ taking the values of m and g to be 3.5kg and $9.8 m/s^2$ respectively, using a guess value of $V_0 = 0.5 m/s$, and employing fixed point iteration method, develop a MATLAB program to estimate the terminal velocity. Take the absolute percentage relative error tolerance to be less than or equal to 1E-11.

Solution

$$F_D = \frac{0.3V^2}{500+(\ln V)^3} - 0.02V$$

$$f_D = \frac{0.3V^2}{500+(\ln V)^3} - 0.02V = f(v)$$

$m = 3.5kg$
$g = 9.81 m/s^2$
$f_D = mg$



MATLAB CODE

```
commandwindow
clear
clc
syms v
v=0.5;
for i=1:50
   iter(i+1)=i
```

```
    v(i+1)=exp((((0.3*(v(i))^2)-10*v(i)-17150)/(0.02*v(i)+34.3))^(1/3))
    Ea(i+1)=abs((v(i+1)-v(i))/v(i+1))*100
    if Ea(i+1)<=1E-11
       break
    end
end
v'
iter'
Ea'
tablo=[iter' v' Ea']
```

COMMAND WINDOW

```
tablo =

   0.0000 + 0.0000i   0.5000 + 0.0000i   0.0000 + 0.0000i
   1.0000 + 0.0000i  43.9475 -29.4542i  99.2163 + 0.0000i
   2.0000 + 0.0000i  50.4454 -26.8898i  12.2200 + 0.0000i
   3.0000 + 0.0000i  50.6792 -24.9333i   3.4887 + 0.0000i
   4.0000 + 0.0000i  50.1890 -24.6434i   1.0186 + 0.0000i
   5.0000 + 0.0000i  50.0588 -24.7398i   0.2901 + 0.0000i
   6.0000 + 0.0000i  50.0695 -24.7843i   0.0820 + 0.0000i
   7.0000 + 0.0000i  50.0823 -24.7865i   0.0232 + 0.0000i
   8.0000 + 0.0000i  50.0843 -24.7834i   0.0066 + 0.0000i
   9.0000 + 0.0000i  50.0837 -24.7825i   0.0019 + 0.0000i
  10.0000 + 0.0000i  50.0834 -24.7826i   0.0005 + 0.0000i
  11.0000 + 0.0000i  50.0834 -24.7827i   0.0001 + 0.0000i
  12.0000 + 0.0000i  50.0834 -24.7827i   0.0000 + 0.0000i
  13.0000 + 0.0000i  50.0834 -24.7827i   0.0000 + 0.0000i
  14.0000 + 0.0000i  50.0834 -24.7827i   0.0000 + 0.0000i
  15.0000 + 0.0000i  50.0834 -24.7827i   0.0000 + 0.0000i
```

16.0000 + 0.0000i 50.0834 -24.7827i   0.0000 + 0.0000i

17.0000 + 0.0000i 50.0834 -24.7827i   0.0000 + 0.0000i

18.0000 + 0.0000i 50.0834 -24.7827i   0.0000 + 0.0000i

19.0000 + 0.0000i 50.0834 -24.7827i   0.0000 + 0.0000i

20.0000 + 0.0000i 50.0834 -24.7827i   0.0000 + 0.0000i

21.0000 + 0.0000i 50.0834 -24.7827i   0.0000 + 0.0000i

22.0000 + 0.0000i 50.0834 -24.7827i   0.0000 + 0.0000i

23.0000 + 0.0000i 50.0834 -24.7827i   0.0000 + 0.0000i

24.0000 + 0.0000i 50.0834 -24.7827i   0.0000 + 0.0000i

25.0000 + 0.0000i 50.0834 -24.7827i   0.0000 + 0.0000i