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MECHANICS ENGINEERING

Assignment 1

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

* rearrange to make v subject of formula

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

given

$m = 3.5 \text{ kg}$ and $g = 9.8$

$$F_D = 3.5 \times 9.8 = \frac{0.3 v^2}{500 + (\ln v)^3} - 0.02v$$

$$F_D = 34.3 = \frac{0.3 v^2}{500 + (\ln v)^3} - 0.02v$$

$$F_D = 34.3 + 0.02v = \frac{0.3 v^2}{500 + (\ln v)^3}$$

$$(34.3 + 0.02v)(500 + (\ln v)^3) = 0.3 v^2$$

$$500 + (\ln v)^3 = \frac{0.3 v^2}{34.3 + 0.02v}$$

$$(\ln v)^3 = \frac{0.3 v^2}{34.3 + 0.02v} - 500$$

$$\ln v = \sqrt[3]{\frac{0.3 v^2}{34.3 + 0.02v} - 500}$$

$$v = \sqrt[3]{\frac{0.3 v^2}{34.3 + 0.02v} - 500}$$

MATLAB CODE FOR FIXED POINT METHOD

```
- Command window
- clear
- clc
- Syms v
- v = 0.5
- for i = 1:50
- iter(i+1) = i
- v(i+1) = exp(((0.3*(v(i)^2))/(34.3 + (0.02*v(i)))) - 500)^(1/3)
- Ea(i+1) = abs((v(i+1) - v(i))/v(i+1)) * 100
- if Ea(i+1) <= 1E-11
- break
- end
- end
- table [v' iter' Ea']
```

Estimated terminal velocity is 304.7 m/s