15/ENG02/011
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① $f(x) = e^{-0.5x}(4 - x) - 2$

Using Product rule: $U\frac{dv}{dx} + U\frac{dv}{dx}$

$f'(x) = -0.5e^{-0.5x}(4 - x) - e^{-0.5x}$

$$x_{i+1} = \frac{f(x_i)}{f'(x_i)} + x_i$$

when $i = 0$, $x_i = 0.5$;

when $i = 1$; $x_i = 0.8389$

$$x_{i+1} = -\left(\frac{(e^{-0.5(0.5)}(4 - 0.5) - 2)}{-0.5e^{-0.5(0.5)}(4 - 0.5) - e^{-0.5(0.5)}}\right) + 0.5$$

$= 0.8389$

when $i = 2$; $x_i = 0.885$

$$x_{i+1} = \frac{e^{-0.5(0.311)}(4 - 0.311) - 2}{(-0.5e^{-0.5}(4 - 0.311) - e^{-0.5(0.5)})} + 0.$$

$= 0.885$

when $i = 3$; $x_i = 0.8857$

$$x_{i+1} = -\frac{e^{-0.5(0.0197)}(4 - 0.0197) - 2}{(-0.5e^{-0.5}(4 - 0.0197) - e^{-0.5(0.0197)}}$$

$= 0.8857$

when $i = 4$; $x_i = 0.8857$

$$x_{i+1} = \frac{e^{-0.5(0.2236)}(4 - 0.2236) - 2}{(-0.5e^{-0.5}(4 - 0.2236) - e^{-0.5(0.2236)}} + 0.$$

$x = 0.8857$

When $i = 5$ $x_i = 0.8857$

$$x_{i+1} = \frac{-e^{-0.5(0.2236)} \times (4 - 0.2236) - 2}{(-0.5 e^{-0.5}(4 - 0.2236 4) \cdot e^{-0.5(0.2236)} + 0}$$

$=$ . . . .

i	x_i	
0	0.5	
1	0.8389	40.39
2	0.885	5.28
3	0.8857	0.079
4	0.8857	0
5	0.8857	0

$$\%\text{ absolute error} = \left| \frac{x_{i+1} + x}{x_{i+1}} \right| \times 100$$

when $i = 1$,

$$\%\text{ error} = \left| \frac{0.8389 - 0.5}{0.8389} \right| \times 100 = 40.3$$

When $i = 2$

$$\%\text{ error} = \left| \frac{0.885 - 0.8389}{0.885} \right| \times 100 = 5.2$$

$$i = 3 \quad \left| \frac{0.8857 - 0.857}{0.8857} \right| \times 100 = 0.07$$

$$i = 4 \quad \left| \frac{0.8857 - 0.8857}{0.8857} \right| \times 100 = 0$$

$$i = 5 \quad \left| \frac{0.8857 - 0.8857}{0.8857} \right| \times 100 = 0$$

2)

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

v

$f_D = mg$

where $m = 3.5\,kg$

$g = 9.8\,m/s$

$f_D = 9.8 \times 3.5 = 34.3$

equating both equations

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

$$0 = \frac{0.3v^2}{500+(\ln v)^3}$$

u v

Using quotient rule

$$\frac{u'v - v'u}{v^2}$$

$u = 0.3v^2$

$u' = 0.6v$

$v = 500+(\ln v)^3$

$v' = \frac{3(\ln v)^2}{v}$

$$= \frac{0.6v(500+(\ln v)^3) - 0.3v^2\left(3\left(\frac{\ln v^2}{v}\right)\right)}{(500+(\ln v)^3)^2}$$

$$= \frac{300v+(\ln v)^3 0.6v - 0.9v(\ln v)^2}{500^2+\ln v^6}$$

$$f'(v) = \frac{300v+\ln v^3(0.6v) - 0.9v(\ln v)^2}{500^2+\ln v^6} - 0.02$$

$$x_{i+1} = x_i - \frac{f(v)}{f'(v)}$$