2020

Q1

(a).

(b). taylor's series is given by,

$$f(x) = f(a) + \frac{(x-a)}{1!} f'(a) + \frac{(x-a)^2}{2!} f''(a) + \cdots + \frac{(x-a)^n}{n!} f^n(a).$$

if α is the root of $f(x)=0$, then expanding $f(x)$ about a point x_0 which is near α;

$$f(\alpha) = 0$$

$$f(x_0) + \frac{(\alpha - x_0)}{1!} f'(x_0) + \frac{(\alpha - x_0)^2}{2!} f''(x_0) + \cdots + \frac{(\alpha - x_0)^n}{n!} f^n(x_0) = 0.$$

$\alpha - x_0$ is the error of initial stage.

Let $\varepsilon_0 = \alpha - x_0$

$$\therefore f(x_0) + \varepsilon_0 f'(x_0) + \frac{\varepsilon_0^2}{2!} f''(x_0) + \cdots + \frac{\varepsilon_0^n}{n!} f^n(x_0) = 0$$

since ε_0 is small,

we can neglect $\varepsilon_0^2, \varepsilon_0^3, \ldots, \varepsilon_0^n$

$$\therefore \quad 0 = f(x_0) + \varepsilon_0 f'(x_0)$$

$$-f(x_0) = \varepsilon_0 \cdot f'(x_0)$$

$$\varepsilon_0 = -\frac{f(x_0)}{f'(x_0)}$$

$$\alpha - x_0 = -\frac{f(x_0)}{f'(x_0)}$$

$$\alpha = x_0 - \frac{f(x_0)}{f'(x_0)}$$

As x_1 is a better approximation to α than x_0,

$\therefore$ we can obtain a closer value to α using x_1

$$\therefore \quad x_2 = x_1 - \frac{f(x_1)}{f'(x_1)}$$

$\therefore$ we get,

$$\underline{\underline{x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}}}$$

(c) $$Ar = M\left[1 - \frac{1}{(1+r)^n}\right]$$

$A = 2500000$

$n = 60$

$M = 50000$

$$\therefore 2500000r = 50000\left[1 - \frac{1}{(1+r)^{60}}\right]$$

$$50r = 1 - \frac{1}{(1+r)^{60}}$$

$$50r + \frac{1}{(1+r)^{60}} - 1 = 0$$

$$f(r) = 50r + \frac{1}{(1+r)^{60}} - 1$$

$$f'(r) = 50 + (-60)(1+r)^{-61}$$

$$= 50 - \frac{60}{(1+r)^{61}}$$

from newton raphson formular.

$$r_{n+1} = r_n - \frac{f(r)}{f'(r)}$$

$$r_{n+1} = r_n - \frac{50r + \frac{1}{(1+r)^{60}} - 1}{50 - \frac{60}{(1+r)^{61}}}$$

R.S 2500000 $\longrightarrow$ R.S 50000

$$\therefore \text{initial interest rate} = \frac{50000}{2500000} = 0.02$$

$$= \underline{2\%}$$

Let's take initial guess as,

$$r_0 = \frac{0 + 0.02}{2} = \underline{0.01}$$

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n	r_n	r_{n+1}
0	0.01	0.0070838
1	0.0070838	0.0062721

$$r_1 - r_2 = 0.0070838 - 0.0062721$$
$$= 0.0008117 < 0.001$$

$\therefore$ monthly interest rate $= 0.00627$
$= \underline{\underline{0.627\%}}$

(Q2)

(a). $$L_i(x) = \prod_{\substack{j=0 \\ i \neq j}}^{n} \left(\frac{x - x_j}{x_i - x_j} \right)$$

$$= \frac{(x - x_1)(x - x_2)\ldots(x - x_{i-1})(x - x_{i+1})\ldots(x - x_n)}{(x_i - x_1)(x_i - x_2)\ldots(x_i - x_{i-1})(x_i - x_{i+1})\ldots(x_i - x_n)}$$

$L_i(x_j) =$

$$= \frac{(x_j - x_1)(x_j - x_2)\ldots(x_j - x_{i-1})(x_j - x_{i+1})\ldots(x_j - x_n)}{(x_i - x_1)(x_i - x_2)\ldots(x_i - x_{i-1})(x_i - x_{i+1})\ldots(x_i - x_n)}$$

when $i = j \Rightarrow L_i(x_j) = 1$

$$L_i(x_j) = \prod_{\substack{j=0 \\ i \neq j}}^{n} \left(\frac{x_j - x_j}{x_i - x_j} \right)$$

when $i \neq j \Rightarrow x_i - x_j \neq 0$

$\therefore \; L_i(x_j) = 0.$

$$\therefore L_i(x_j) = \begin{cases} 0 & ; \text{if } i \neq j \\ 1 & ; \text{if } i = j \end{cases}$$

(b)

(i) $P_n(x) = y[x_0] + \sum_{i=1}^{n} y[x_0, x_1, \dots, x_i](x-x_0)(x-x_1)\dots(x-x_{i-1})$

$$P_n(x) = y[x_0] + \sum_{i=1}^{n} y[x_0, x_1, \dots, x_i] \prod_{j=0}^{i-1} (x - x_j)$$

(ii)

i	x_i	y	1st DD	2nd DD	3rd DD	4th DD
0	0.1	0.75				
			5.25			
1	0.3	1.80		-1.25		
			4.75		-3.125	
2	0.5	2.75		-3.125		5.2083
			3.5		2.0833	
3	0.7	3.45		-1.875		
			2.75			
4	0.9	4.00				

using the Newton's divided difference interpolation formula,

$$P(x) = y[x_0] + y[x_0, x_1](x - x_0)$$
$$+ y[x_0, x_1, x_2](x - x_0)(x - x_1)(x - x_2)$$

$$+ y[x_0, x_1, x_2, x_3](x - x_0)(x - x_1)(x - x_2)$$

$$+ y[x_0, x_1, x_2, x_3, x_4](x - x_0)(x - x_1)(x - x_2)(x - x_3)$$

when $x = 0.6$

$$P(0.6) = 0.75 + 5.25(0.6 - 0.1)$$

$$-1.25(0.6 - 0.1)(0.6 - 0.3)$$
$$-3.125(0.6 - 0.1)(0.6 - 0.3)(0.6 - 0.5)$$

$$+5.2083(0.6 - 0.1)(0.6 - 0.3)(0.6 - 0.5)(0.6 - 0.7)$$

$$= \underline{\underline{3.1329 \text{ cm/s}}}$$

(c) $x_1 + 5x_2 + 3x_3 = 28$
$3x_1 + 7x_2 + 13x_3 = 76$
$12x_1 + 3x_2 - 5x_3 = 1$

$|1| \ngtr |5| + |3|$
$|7| \ngtr |3| + |13|$
$|-5| \ngtr |12| + |3|$

$\therefore$ The coefficient matrix of the given system is not diagonally dominant.

Hence, we rearrange the equation as follows, such that the elements in the coefficient matrix are diagonally dominant.

$$12x_1 + 3x_2 - 5x_3 = 1$$
$$x_1 + 5x_2 + 3x_3 = 28$$
$$3x_1 + 7x_2 + 13x_3 = 76$$

$$\therefore x_1 = \frac{1}{12}(1 - 3x_2 + 5x_3)$$

$$x_2 = \frac{1}{5}(28 - x_1 - 3x_3)$$

$$x_3 = \frac{1}{13}(76 - 3x_1 - 7x_2)$$

initial guess, $x_1^{(0)} = 1$

$x_2^{(0)} = 0$

$x_3^{(0)} = 1$

1^{st} iteration,

$$x_1^{(1)} = \frac{1}{12}[1 - 3(0) + 5(1)] = 0.5$$

$$x_2^{(1)} = \frac{1}{5}[28 - (0.5) + 3(1)] = 4.9$$

$$x_3^{(1)} = \frac{1}{13}[76 - 3(0.5) - 7(4.9)] = 3.0923$$

2^{nd} iteration

$$x_1^{(2)} = \frac{1}{12}[1 - 3(4.9) + 5(3.0923)] = 0.1468$$

$$x_2^{(2)} = \frac{1}{5}[28 - (0.1468) + 3(3.0923)] = 3.7153$$

$$x_3^{(2)} = \frac{1}{13}[76 - 3(0.1468) - 7(3.7153)] = 3.8117$$

3^{rd} iteration,

$$x_1^{(3)} = \frac{1}{12}\left[1 - 3(3.7153) + 5(3.8187)\right] = 0.7456$$

$$x_2^{(3)} = \frac{1}{5}\left[28 - (0.7456) - 3(3.8187)\right] = 3.1639$$

$$x_3^{(3)} = \frac{1}{13}\left[76 - 3(0.7456) - 7(3.1639)\right] = 3.9705$$

4^{th} iteration,

$$x_1^{(4)} = \frac{1}{12}\left[1 - 3(3.1639) + 5(3.9705)\right] = 0.9467$$

$$x_2^{(4)} = \frac{1}{5}\left[28 - (0.9467) - 3(3.9705)\right] = 3.0284$$

$$x_3^{(4)} = \frac{1}{13}\left[76 - 3(0.9467) - 7(3.0284)\right] = 3.9970$$

5^{th} iteration,

$$x_1^{(5)} = \frac{1}{12}\left[1 - 3(3.0284) + 5(3.9970)\right] = 0.9917$$

$$x_2^{(5)} = \frac{1}{5}\left[28 - (0.9917) - 3(3.9970)\right] = 3.0035$$

$$x_3^{(5)} = \frac{1}{13}\left[76 - 3(0.9917) - 7(3.0035)\right] = 4.0000$$

6^{th} iteration,

$$x_1^{(6)} = \frac{1}{12}\left[1 - 3(3.0035) + 5(4.0000)\right] = 0.9991$$

$$x_2^{(6)} = \frac{1}{5}\left[28 - (0.9991) - 3(4.000)\right] = 3.0002$$

$$x_3^{(6)} = \frac{1}{13}\left[76 - 3(0.9991) - 7(3.0002)\right] = 4.0001$$

$\therefore$ required solutions,

$$x_1 = 0.9991 \approx 1$$
$$x_2 = 3.0002 \approx 3$$
$$x_3 = 4.0001 \approx 4$$

Q3. $f(x) = \begin{cases} 1 - e^{-ax} & : x \geq 0 \\ e^{ax} - 1 & : x < 0 \end{cases}$

(i) $\longleftarrow 0.05 \longrightarrow\longleftarrow 0.05 \longrightarrow$ $\qquad a = 0.15$

$(0.1 - 0.05) \qquad x = 0.1 \qquad (0.1 + 0.05)$

$$f'(x) = \frac{f(x+h) - f(x-h)}{2h}$$

$$f'(0.1) = \frac{f(0.1+0.05) - f(0.1-0.05)}{2 \times 0.05}$$

$$= \frac{f(0.15) - f(0.05)}{0.1}$$

$$= \frac{1 - e^{-0.15 \times 0.15} - (1 - e^{-0.15 \times 0.05})}{0.1}$$

$$= 0.1477681763$$

(ii) $$f''(x) = \frac{f(x+h) - 2f(x) + f(x-h)}{h^2}$$

$$= \frac{f(0.1+0.05) - 2f(0.1) + f(0.1-0.05)}{0.05^2}$$

$$= \frac{f(0.15) - 2f(0.1) + f(0.05)}{0.05^2}$$

$$= \frac{1 - e^{-0.15 \times 0.15} - 2(1 - e^{-0.15 \times 0.1}) + (1 - e^{-0.15 \times 0.05})}{0.05^2}$$

$$= -0.02216512254$$

(iii) $f(x) = 1 - e^{-ax} \; ; \; x \geq 0 \; , \; a = 0.15$

$f(x) = 1 - e^{-0.15x}$

$f'(x) = - e^{-0.15x}(-0.15)$

$= \underline{0.15 e^{-0.15x}}$

for 1st derivative,

$f'(0.1) = 0.15 e^{-0.15 \times 0.1} = 0.1477667909$

absolute relative error $= \left| \dfrac{0.147766909 - 0.1477681763}{0.147766909} \right|$

$= 8.576 \times 10^{-6}$

$= \underline{0.0008576} \; \%$

for 2nd derivative

$f''(x) = 0.15 e^{-0.15x} \cdot (-0.15)$

$= -0.0225 e^{-0.15x}$

$f''(0.1) = -0.0225 e^{-0.15 \times 0.1}$

$= \underline{-0.022165018}64$

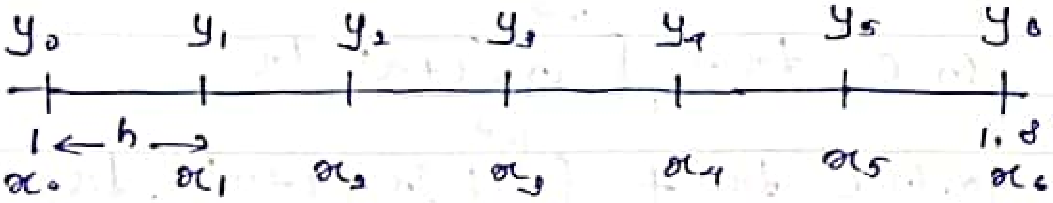
absolute relative error $= \left| \dfrac{-0.022165018 - (-0.022165122)}{-0.022165018} \right|$

$= 4.692 \times 10^{-6}$

$= \underline{0.0004692} \; \%$

(b)

(i) $I = \int_{1}^{1.8} \ln(1+x^2)\,.dx.$



$h = \dfrac{1.8-1}{6} = \dfrac{2}{15}$

$y = \ln(1+x^2)$

$y_0 = \ln[1+1^2] = 0.6931$

$y_1 = \ln[1+(\frac{17}{15})^2] = 0.8261$

$y_2 = \ln[1+(\frac{19}{15})^2] = 0.9572$

$y_3 = \ln[1+(\frac{7}{5})^2] = 1.0852$

$y_4 = \ln[1+(\frac{23}{15})^2] = 1.2093$

$y_5 = \ln[1+(\frac{5}{3})^2] = 1.3291$

$y_6 = \ln[1+(\frac{9}{5})^2] = 1.4446$

$I = \frac{h}{3}[y_0 + 4(y_1+y_3+y_5) + 2(y_2+y_4) + y_6]$

$= \frac{2}{15}\cdot\frac{1}{3}\Big[0.6931 + 4(0.8261 + 1.0852 + 1.3291) + 2(0.9572 + 1.2093) + 1.4446\Big]$

$= \underline{0.8697}$

(ii) $\int_1^{1.8} \ln(e^{3x}\cdot\sqrt{1+x^2})\,dx$

$= \int_1^{1.8} (\ln e^{3x} + \ln\sqrt{1+x^2})\,dx$

$= \int_1^{1.8} \ln e^{3x}\,dx + \int_1^{1.8} \ln\sqrt{1+x^2}\,dx$

$= \int_1^{1.8} 3x.\ln e\,dx + \int_1^{1.8} \frac{1}{2}\ln(1+x^2).\,dx$

$= \int_1^{1.8} 3x\,dx + \int_1^{1.8} \frac{1}{2}\ln(1+x)^2\,dx$

$= 3\left[\frac{x^2}{2}\right]_1^{1.8} + \frac{1}{2}\int_1^{1.8} \ln(1+x)^2\,dx$

$= \frac{3}{2}[1.8^2 - 1] + \frac{1}{2}[0.8637]$

$= \underline{3.79185}$

(Q4)

(a)

(i) ODE → differential equation involves one independent variable and derivatives with respect to that variable.

eg: $\frac{d^2y}{dx^2} + \lambda y = 0$

(ii) PDE → differential equation involves more than one independent variables and corresponding partial derivatives.

eg: $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$

(iii) IVP → It is an ordinary differential equation together with specific value called the initial condition, of the unknown function at a given point in the domain of the solution.

eg: $\frac{dy}{dx} = x$; $y(x_0) = y_0$

(iv) BVP → It is an ordinary differential equation which satisfies the boundary conditions.

eg: $\frac{\partial^2 T(x,t)}{\partial x^2} - \frac{\partial T(x,t)}{\partial t} = 0$

$T(0,t) = T(1,t) = 0$

(b) $\frac{dy}{dx} = x - y$, $x = 0 \rightarrow y = 1$

(x_0, y_0)
$(0, 1)$

$$\int_{y_0}^{y} dy = \int_{x_0}^{x} (x-y).dx$$

$$\therefore y - y_0 = \int_0^x (x-y).dx$$

$$y = y_0 + \int_0^x (x-y).dx$$

$$y = y_0 + \int_0^x f(x,y).dx$$

$$y^{(1)} = 1 + \int_0^{0.1} f(x, y_0).dx$$

$$= 1 + \int_0^{0.1} (x-1)\, dx$$

$$y^{(1)} = 1 + \left[\frac{x^2}{2} - x\right]_0^{0.1}$$

$$= 1 + \left[\frac{0.1^2}{2} - 0.1\right]$$

$$= \underline{\underline{0.905}}$$

$$y^{(2)} = 1 + \int_0^{0.1} f(x, y^{(1)}) \cdot dx$$

$$= 1 + \int_0^{0.1} (x - 0.905)\, dx$$

$$= 1 + \left[\frac{x^2}{2} - 0.905x\right]_0^{0.1}$$

$$= 1 + \left[\frac{0.1^2}{2} - 0.905(0.1)\right]$$

$$= \underline{\underline{0.9145}}$$

$$y^{(3)} = 1 + \int_0^{0.1} f(x, y^{(2)})\, dx$$

$$= 1 + \int_0^{0.1} (x - 0.9145)\, dx$$

$$= 1 + \left[\frac{x^2}{2} - 0.9145.x\right]_0^{0.1}$$

$$= 1 + \left[\frac{0.1^2}{2} - 0.9145(0.1)\right]$$

$$= \underline{\underline{0.91355}}$$

$$y^{(4)} = 1 + \int_0^{0.1} f(x, y^{(3)})\, dx$$

$$= 1 + \int_0^{0.1} (x - 0.91355)\, dx$$

$$= 1 + \left[\frac{x^2}{2} - 0.91355x\right]_0^{0.1}$$

$$y^{(4)} = 1 + \left[\frac{0.1^2}{2} - 0.91355(0.1) \right]$$

$$= \underline{\underline{0.913645}}$$

$$y^{(5)} = 1 + \int_0^{0.1} f(x, y^{(4)})\, dx$$

$$= 1 + \int_0^{0.1} (x - 0.913645)\, dx$$

$$= 1 + \left[\frac{x^2}{2} - 0.913645x \right]_0^{0.1}$$

$$= 1 + \frac{0.1^2}{2} - 0.913645(0.1)$$

$$= \underline{\underline{0.9136355}}$$

$\therefore$ required solution.

$$y(0.1) = \underline{\underline{0.9136}}$$

(c) $\frac{dC}{dt} + 0.5Ct = 0$

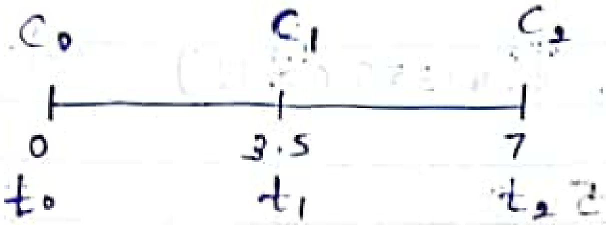
$\Rightarrow \quad \frac{dC}{dt} = -0.05C.t$

$\Rightarrow \quad f(t, C) = -0.05C.t$

$h = 3.5$

$t_0 = 0$

$C_0 = 10^7$



$f(t, C) = -0.05Ct$

$$C_1 = C_0 + \frac{1}{6}(K_1 + 2K_2 + 2K_3 + K_4)$$

$$\begin{aligned}
K_1 &= hf(t_0, C_0) \\
&= 3.5 f(0, 10^7) \\
&= 3.5(-0.05)(10^7)(0) \\
&= \underline{\underline{0}}
\end{aligned}$$

$$\begin{aligned}
K_2 &= hf\left(t_0 + \frac{h}{2}, C_0 + \frac{K_1}{2}\right) \\
&= 3.5 f\left(0 + \frac{3.5}{2}, 10^7 + 0\right) \\
&= 3.5 f(1.75, 10^7) \\
&= 3.5(-0.05)(10^7)(1.75) \\
&= \underline{\underline{-3062500}}
\end{aligned}$$

$$\begin{aligned}
K_3 &= hf\left(t_0 + \frac{h}{2}, C_0 + \frac{K_2}{2}\right) \\
&= 3.5 f\left(0 + \frac{3.5}{2}, 10^7 + \frac{(-3062500)}{2}\right) \\
&= 3.5 f(1.75, 8468750) \\
&= 3.5(-0.05)(8468750)(1.75) \\
&= \underline{\underline{-2593554.688}}
\end{aligned}$$

$$\begin{aligned}
K_4 &= hf(t_0 + h, C_0 + K_3) \\
&= 3.5 f(0 + 3.5, 10^7 - 2593554.688) \\
&= 3.5 f(3.5, 7406445.312) \\
&= 3.5(-0.05)(7406445.312)(3.5) \\
&= \underline{\underline{-4536447.754}}
\end{aligned}$$

$$\therefore C_1 = C_0 + \frac{1}{6}(K_1 + 2K_2 + 2K_3 + K_4)$$

$$= 10^7 + \frac{1}{6}\Big[0 + 2(-3062500) + 2(-2593554.688) + (-4536447.754)\Big]$$

$$= \underline{\underline{7358573.812}}$$

$$C_2 = C_1 + \frac{1}{6}(K_1 + 2K_2 + 2K_3 + K_4)$$

$$K_1 = hf(t_1, C_1)$$
$$= 3.5 f(3.5, 7358573.812)$$
$$= 3.5(-0.05)(7358573.812)(3.5)$$
$$= \underline{\underline{-4507126.46}}$$

$$K_2 = hf\left(t_1 + \frac{h}{2}, C_1 + \frac{K_1}{2}\right)$$

$$= 3.5 f\left(3.5 + \frac{3.5}{2}, 7358573.812 - \frac{4507126.46}{2}\right)$$

$$= 3.5 f(5.25, 5105010.582)$$
$$= 3.5(-0.05)(5105010.582)(5.25)$$
$$= \underline{\underline{-4690228.472}}$$

$$K_3 = hf\left(t_1 + \frac{h}{2}, C_1 + \frac{K_2}{2}\right)$$

$$= 3.5 f\left(3.5 + \frac{3.5}{2}, 7358573.812 - \frac{4690228.472}{2}\right)$$

$$= 3.5 f(5.25, 5013459.576)$$
$$= 3.5(-0.05)(5013459.576)(5.25)$$
$$= \underline{\underline{-4606115.985}}$$

$$K_4 = hf(t_1+h, c_1+k_3)$$
$$= 3.5 f(3.5+3.5, 7358573.812 - 4606115.985)$$
$$= 3.5 f(7, 2752457.827)$$
$$= 3.5(-0.05)(2752457.827)(7)$$
$$= -\underline{\underline{3371760.838}}$$

$$\therefore C_2 = c_1 + \frac{1}{6}(K_1 + 2K_2 + 2K_3 + K_4)$$

$$= 7358573.812 + \frac{1}{6}\left[-4507126.46 + 2(-4690228.472) + 2(-4606115.985) + (-3371760.838\right]$$

$$= \underline{\underline{2946644.443}}$$

$$\therefore C(7) = \underline{\underline{2946644.443}} \text{ parts}/m^3$$

(Q5)

(a) (i) non-linear, first order.

(ii) non-linear, third order.

(iii) linear, second order.

(b) (i) $8\frac{\partial^2 u}{\partial x^2} - 2\frac{\partial^2 u}{\partial x \partial y} - 3\frac{\partial^2 u}{\partial y^2} = 0$

$A = 8, \quad B = -2, \quad C = -3$

$B^2 - 4AC = (-2)^2 - 4 \times 8 \times (-3)$

$= 4 + 96$

$= \underline{\underline{100}} > 0.$

$\therefore$ it is hyperbolic.

(ii) $\alpha\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0$

$A = \alpha, \quad B = 0, \quad C = 0$

$B^2 - 4AC = 0 - 4 \times \alpha \times 0$

$= \underline{\underline{0}}$

$\therefore$ it is parabolic.

(iii) $\frac{\partial^2 u}{\partial x^2} + x^2\frac{\partial^2 u}{\partial y^2} = 0; \quad \because x \neq 0;$

$A = 1, \quad B = 0, \quad C = x^2$

$B^2 - 4AC = 0 - 4 \times 1 \times x^2$

$= \underline{\underline{-4x^2}} < 0$

$\therefore$ it is hyperbolic.

(c) $\dfrac{\partial^2 u(x,t)}{\partial x^2} - 2\dfrac{\partial u(x,t)}{\partial t} = 0.$

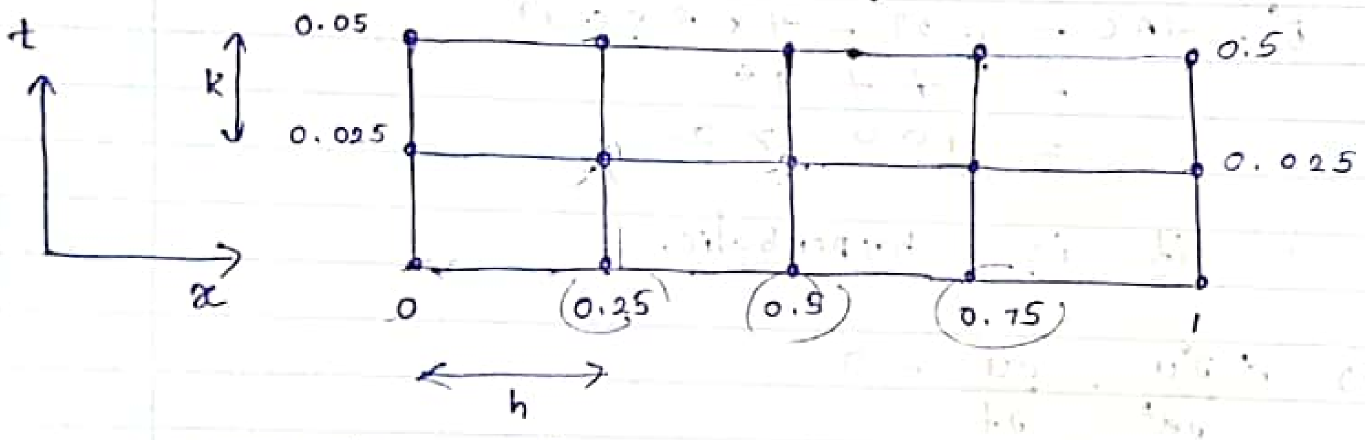
$0 \le x \le 1 \quad , \quad 0 \le t \le 0.05$

$u(x,0) = f(x) = x - x^2$

$u(0,t) = 0$

$u(1,t) = t \qquad\qquad h = 0.25$

$k = 0.025$



$2\dfrac{\partial u(x,t)}{\partial t} = \dfrac{\partial^2 u(x,t)}{\partial x^2}$

$2\left[\dfrac{u(x,t+k) - u(x,t)}{k}\right] = x\left[\dfrac{u(x+h,t) - 2u(x,t) + u(x-h,t)}{h^2}\right]$

$u(x,t+k) - u(x,t) = \dfrac{k}{2h^2}\left[u(x+h,t) - 2u(x,t) + u(x-h,t)\right]$

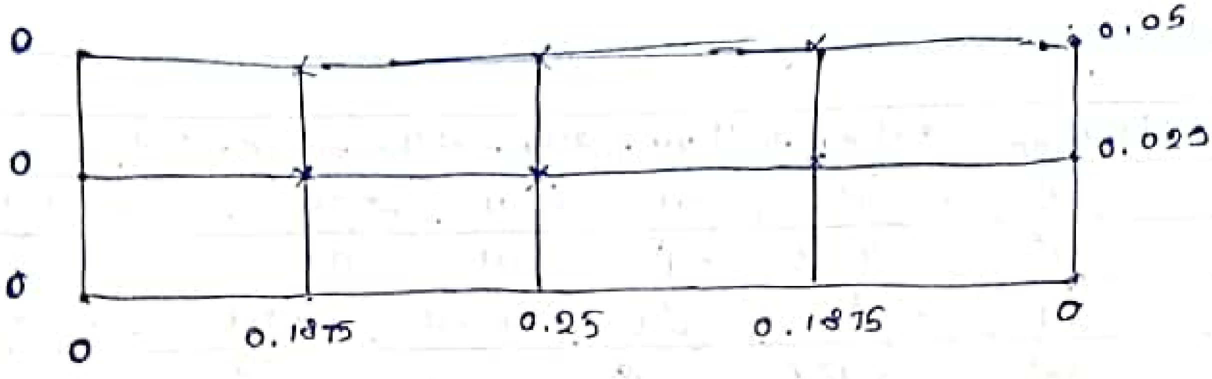
$u(x,t+k) - u(x,t) = \dfrac{0.025}{2\times 0.25^2}\left[u(x+h,t) - 2u(x,t) + u(x-h,t)\right]$

$u(x,t+k) - u(x,t) = 0.2\left[u(x+h,t) - 2u(x,t) + u(x-h,t)\right]$

$u(x,t+k) = 0.2u(x+h,t) + 0.6u(x,t) + 0.2u(x-h,t)$

$u(x,t+k) = 0.2u(x-h,t) + 0.6u(x,t) + 0.2u(x+h,t)$

Let's consider the grid,



$u(0.25, 0.025) = 0.2u(0,0) + 0.6u(0.25,0) + 0.2u(0.5,0)$
$= 0.2 \times 0 + 0.6 \times 0.1875 + 0.2 \times 0.25$
$= \underline{0.1625}$

$u(0.5, 0.025) = 0.2u(0.25,0) + 0.6u(0.5,0) + 0.2u(0.75,0)$
$= 0.2 \times 0.1875 + 0.6 \times 0.25 + 0.2 \times 0.1875$
$= \underline{0.225}$

$u(0.75, 0.025) = 0.2u(0.5,0) + 0.6u(0.75,0) + 0.2u(1,0)$
$= 0.2 \times 0.25 + 0.6 \times 0.1875 + 0.2 \times 0$
$= \underline{0.1625}$

$u(0.25, 0.05) = 0.2u(0, 0.025) + 0.6(0.25, 0.025) + 0.2u(0.5, 0.025)$
$= 0.2 \times 0 + 0.6 \times 0.1625 + 0.2 \times 0.225$
$= \underline{0.1425}$

$u(0.5, 0.05) = 0.2u(0.25, 0.025) + 0.6u(0.5, 0.025) + 0.2u(0.75, 0.025)$
$= 0.2 \times 0.1625 + 0.6 \times 0.225 + 0.1625 \times 0.2$
$= \underline{0.2}$

$u(0.75, 0.05) = 0.2u(0.5, 0.025) + 0.6u(0.75, 0.025) + 0.2u(1, 0.025)$
$= 0.2 \times 0.225 + 0.6 \times 0.1625 + 0.2 \times 0.025$
$= \underline{0.1475}$