
Shihab Muhtasim

STUDENT ID: 21301610

MAT 110

ASSIGNMENT 01

SET 15

Ans to the question no 01

$f(x)$ will be continuous at $x=0$ if left hand limit = right hand limit, $\lim_{x \rightarrow 0} f(x) = f(0)$ and $f(0)$ is defined.

$$\text{Now, L.H.L} = \lim_{x \rightarrow 0^-} f(x) = \lim_{x \rightarrow 0^-} x + 2 = 0 + 2 = 0$$

$$\text{R.H.L} = \lim_{x \rightarrow 0^+} f(x) = \lim_{x \rightarrow 0^+} x^2 - 1 = 0 - 1 = -1$$

$$\therefore L.H.L \neq R.H.L$$

Hence, the first condition of continuity is not fulfilled.
 $f(x)$ is not continuous at $x=0$

Ans to the question no 02

$\lim_{x \rightarrow 1} f(x)$ will exist if left hand limit = right hand limit,
 $\lim_{x \rightarrow 1} f(x) = f(1)$ and $f(1)$ is defined.

$$\text{Now, L.H.L} = \lim_{x \rightarrow 1^-} f(x) = \lim_{x \rightarrow 1^-} x + 5 = 1 + 5 = 6$$

$$\text{R.H.L} = \lim_{x \rightarrow 0^+} f(x) = \lim_{x \rightarrow 0^+} x^3 - 4x = 1 - 4 = -3$$

$$\therefore L.H.L \neq R.H.L$$

Hence, $\lim_{x \rightarrow 1} f(x)$ does not exist

Ans to the question no 03

Evaluating,

$$\begin{aligned}
& \frac{d^2}{dx^2} \left(\ln \left(\frac{x^4+2x^3}{x^2+1} \right) \right) \\
& \Rightarrow \frac{d}{dx} \left(\frac{d}{dx} \left(\ln \left(\frac{x^4+2x^3}{x^2+1} \right) \right) \right) \\
& \Rightarrow \frac{d}{dx} \left[\left(\frac{x^2+1}{x^4+2x^3} \right) \cdot \frac{d}{dx} \left(\frac{x^4+2x^3}{x^2+1} \right) \right] \\
& \Rightarrow \frac{d}{dx} \left[\left(\frac{x^2+1}{x^4+2x^3} \right) \cdot \frac{(x^2+1) \frac{d}{dx}(x^4+2x^3) - (x^4+2x^3) \frac{d}{dx}(x^2+1)}{(x^2+1)^2} \right] \\
& \Rightarrow \frac{d}{dx} \left[\left(\frac{x^2+1}{x^4+2x^3} \right) \cdot \frac{(x^2+1)(4x^3+6x^2) - (x^4+2x^3)(2x)}{(x^2+1)^2} \right] \\
& \Rightarrow \frac{d}{dx} \left[\frac{(x^2+1)(4x^3+6x^2) - 2x(x^4+2x^3)}{(x^4+2x^3)(x^2+1)} \right] \\
& \Rightarrow \frac{d}{dx} \left[\frac{4x^3+6x^2}{x^4+2x^3} - \frac{2x}{x^2+1} \right] \\
& \Rightarrow \frac{d}{dx} \left[\frac{4x+6}{x^2+2x} - \frac{2x}{x^2+1} \right] \\
& \Rightarrow \frac{d}{dx} \left(\frac{4x+6}{x^2+2x} \right) - \frac{d}{dx} \left(\frac{2x}{x^2+1} \right) \\
& \Rightarrow \frac{(x^2+2x) \frac{d}{dx}(4x+6) - (4x+6) \frac{d}{dx}(x^2+2x)}{(x^2+2x)^2} - \frac{(x^2+1) \frac{d}{dx}(2x) - (2x) \frac{d}{dx}(x^2+1)}{(x^2+1)^2} \\
& \Rightarrow \frac{(x^2+2x) \cdot 4 - (4x+6) \cdot (2x+2)}{(x^2+2x)^2} - \frac{(x^2+1) \cdot 2 - 2x \cdot (2x)}{(x^2+1)^2} \\
& \Rightarrow \frac{4x^2+8x-8x^2-20x-12}{(x^2+2x)^2} - \frac{2x^2+2-4x^2}{(x^2+1)^2}
\end{aligned}$$

$$\begin{aligned}
&\Rightarrow -\frac{4x^2+12x+12}{(x^2+2x)^2} + \frac{2x^2-2}{(x^2+1)^2} \\
&\Rightarrow \frac{2x^2-2}{(x^2+1)^2} - \frac{4x^2+12x+12}{(x^2+2x)^2} \\
&\Rightarrow \frac{(2x^2-2)(x^2+2x)^2 - (4x^2+12x+12)(x^2+1)^2}{(x^2+1)^2(x^2+2x)^2} \\
&\Rightarrow \frac{(2x^2-2)(x^4+4x^3+4x^2) - (4x^2+12x+12)(x^4+2x^2+1)}{x^2(x^2+1)^2(x+2)^2} \\
&\Rightarrow \frac{2x^6+8x^5+8x^4-2x^4-8x^3-8x^2-4x^6-12x^5-12x^4-8x^4-24x^3-24x^2-4x^2-12x-12}{x^2(x^2+1)^2(x+2)^2} \\
&\Rightarrow \frac{-2x^6-4x^5-14x^4-32x^3-36x^2-12x-12}{x^2(x^2+1)^2(x+2)^2}
\end{aligned}$$

Ans to the question no 04

$$\begin{aligned}\text{Given, } (x - y)^2 &= x + y - 1 \\ \Rightarrow x^2 - 2xy + y^2 &= x + y - 1 \\ \Rightarrow \frac{d}{dx}(x^2 - 2xy + y^2) &= \frac{d}{dx}(x + y - 1) \\ \Rightarrow 2x - 2y + 2y\frac{dy}{dx} - 2x\frac{dy}{dx} &= 1 + \frac{dy}{dx} - 0 \\ \Rightarrow 2y\frac{dy}{dx} - 2x\frac{dy}{dx} - \frac{dy}{dx} &= 1 - 2x + 2y \\ \Rightarrow \frac{d}{dx}(2y - 2x - 1) &= 2y - 2x + 1 \\ \Rightarrow \frac{d}{dx} &= \frac{2y-2x+1}{2y-2x-1} \\ \therefore \frac{d}{dx} &= \frac{2y-2x+1}{2y-2x-1}\end{aligned}$$

Ans to the question no 05

We have to evaluate,

$$\frac{d}{dx}(\sin^2 \frac{(2x)}{(x+1)})$$

Let,

$$\begin{aligned} a &= \frac{2x}{x+1} \\ \Rightarrow a &= 2x(x+1)^{-1} \\ \Rightarrow \frac{d}{dx}a &= \frac{d}{dx}2x(x+1)^{-1} \\ \Rightarrow \frac{d}{dx}(a) &= 2(x+1)^{-1} + 2x(-1)(x+1)^{-2} \\ \Rightarrow \frac{d}{dx}a &= \frac{2}{x+1} - \frac{2x}{(x+1)^2} \\ \Rightarrow \frac{d}{dx}a &= \frac{2(x+1)-2x}{(x+1)^2} \\ \Rightarrow \frac{d}{dx}a &= \frac{2x+2-2x}{(x+1)^2} \\ \Rightarrow \frac{d}{dx}a &= \frac{2}{(x+1)^2} \end{aligned}$$

Evaluating,

$$\begin{aligned} &\frac{d}{dx}(\sin^2 \frac{(2x)}{(x+1)}) \\ &= \frac{d}{dx}(\sin^2 a) \\ &= 2 \sin a \cos a \frac{d}{dx}a \\ &= \sin 2a \frac{d}{dx}a \\ &= \sin(\frac{2 \cdot 2x}{x+1}) \cdot \frac{2}{(x+1)^2} \\ &= \frac{2 \sin(\frac{4x}{x+1})}{(x+1)^2} \end{aligned}$$

$$\text{We get, } \frac{d}{dx}(\sin^2 \frac{(2x)}{(x+1)}) = \frac{2 \sin(\frac{4x}{x+1})}{(x+1)^2}$$

Ans to the question no 06 (a)

Given,

$$P(t) = \frac{M}{1+Ae^{-kt}}$$

$$\lim_{t \rightarrow \infty} P(t) = \lim_{t \rightarrow \infty} \frac{M}{1+Ae^{-kt}}$$

$$\Rightarrow \lim_{t \rightarrow \infty} P(t) = \lim_{t \rightarrow \infty} \frac{M}{1+\frac{A}{e^{kt}}}$$

$$\Rightarrow \lim_{t \rightarrow \infty} P(t) = \frac{M}{1+\frac{A}{e^{k\infty}}}$$

$$\Rightarrow \lim_{t \rightarrow \infty} P(t) = \frac{M}{1+\frac{A}{\infty}}$$

$$\Rightarrow \lim_{t \rightarrow \infty} P(t) = \frac{M}{1} \Rightarrow \lim_{t \rightarrow \infty} P(t) = M$$

The answer M refers to the maximum population size that can be carried and when t tends to infinity it means that the carrying capacity becomes the maximum population size that can be supported. That's why the answer M is to be expected

Ans to the question no 06 (b)

Given,

$$P(t) = \frac{M}{1+Ae^{-kt}}$$

$$\lim_{M \rightarrow \infty} P(t) = \lim_{M \rightarrow \infty} \frac{M}{1+Ae^{-kt}}$$

$$\Rightarrow \lim_{M \rightarrow \infty} P(t) = \lim_{t \rightarrow \infty} \frac{M}{1+(\frac{M-P_o}{P_o})e^{-kt}}$$

$$\Rightarrow \lim_{M \rightarrow \infty} P(t) = \lim_{M \rightarrow \infty} \frac{MP_o}{P_o(1-e^{-kt})+Me^{-kt}}$$

$$\Rightarrow \lim_{M \rightarrow \infty} P(t) = \lim_{M \rightarrow \infty} \frac{P_o}{e^{-kt}}$$

$$\Rightarrow \lim_{M \rightarrow \infty} P(t) = P_o e^{kt}$$

The result is $P_o e^{kt}$ which is an exponential function

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1 \documentclass{article}

2 \usepackage{amsmath}

3 \usepackage{amssymb}

4 \begin{document}

5 \begin{titlepage}

6 \begin{center}

7 \line(1,0){300} \\

8 [0.25 in]

9 \huge{\bfseries Shihab Muhtasim} \\

10 [0.5 cm]

11 \textsc{\Large Student ID: 21301610} \\

12 \line(1,0){400} \\

13 [2 cm]

14 \textsc{\LARGE MAT 110} \\

15 [0.5 cm]

16 \textsc{\LARGE ASSIGNMENT 01} \\

17 [0.5 cm]

18 \textsc{\LARGE SET 15} \\

19 \end{center}

20 \end{titlepage}

21 \begin{newpage}

22 \begin{flushright}

23 \textsc{Assignment 1} \\

Shihab Muhtasim

STUDENT ID: 21301610

MAT 110

ASSIGNMENT 01

SET 15

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6 \begin{center}
7 \line(1,0){300}
8 [0.25 in]
9 \huge{\bfseries Shihab Muhtasim}
10 [0.5 cm]
11 \textsc{\Large Student ID: 21301610}
12 \line(1,0){400}
13 [2 cm]
14 \textsc{\LARGE MAT 110}
15 [0.5 cm]
16 \textsc{\LARGE ASSIGNMENT 01}
17 [0.5 cm]
18 \textsc{\LARGE SET 15}
19 \end{center}
20 \end{titlepage}
21 \begin{newpage}
22 \begin{flushright}
23 \textsc{Assignment 1}
24 \textsc{Problem 1}
25 [1 cm]
26 \end{flushright}
27 \begin{center}
28 \textbf{\Large \underline{Ans to the question no 01}}}
29 [1 cm]
30 \end{center}
31 \Large {f(x) will be continuous at x=0 if left hand limit = right hand limit,  $\lim_{x \rightarrow 0^-} f(x) = f(0)$  and f(0) is defined.}
32 Now, L.H.L. =  $\lim_{x \rightarrow 0^-} f(x) = \lim_{x \rightarrow 0^-} x+2 = 0+2 = 2$ 
33 R.H.L. =  $\lim_{x \rightarrow 0^+} f(x) = \lim_{x \rightarrow 0^+} x^2 - 1 = 0 - 1 = -1$ 
34  $\therefore$  L.H.L.  $\neq$  R.H.L.
35 Hence, the first condition of continuity is not fulfilled. f(x) is not continuous at x=0 }
36 \end{newpage}
37 \begin{newpage}

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ASSIGNMENT 1

PROBLEM 1

Ans to the question no 01

$f(x)$ will be continuous at $x=0$ if left hand limit = right hand limit, $\lim_{x \rightarrow 0} f(x) = f(0)$ and $f(0)$ is defined.

Now, L.H.L. = $\lim_{x \rightarrow 0} f(x) = \lim_{x \rightarrow 0} x + 2 = 0 + 2 = 0$

$$\text{R.H.L.} = \lim_{x \rightarrow 0^+} f(x) = \lim_{x \rightarrow 0^+} x^2 - 1 = 0 - 1 = -1$$
$$\therefore L.H.L \neq R.H.L$$

Hence, the first condition of continuity is not fulfilled.
 $f(x)$ is not continuous at $x=0$

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hence, the first condition of continuity is not fulfilled. $f(x)$ is not continuous at $x=0$ }

36

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37

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38

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39

$\backslash\text{textsc}\{\text{Assignment 1}\}\backslash\backslash$

40

$\backslash\text{textsc}\{\text{Problem 2}\}\backslash\backslash$

41

[1 cm]

42

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43

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44

$\backslash\text{textbf}\{\text{\Large \underline{Ans to the question no 02}}\}\backslash\backslash$

45

[1 cm]

46

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47

$\backslash\text{Large}\{\text{\$}\lim_{x\rightarrow 1}f(x)\text{\$ will exist if left hand limit = right hand limit, }\lim_{x\rightarrow 1}f(x)=f(1)\text{\$ and }f(1)\text{ is defined.}\backslash\backslash[0.5\text{cm}]\}$

48

Now, L.H.L= $\lim_{x\rightarrow 1^-}f(x)=\lim_{x\rightarrow 1^-}x+5=1+5=6\backslash\backslash[3\text{mm}]$

49

R.H.L= $\lim_{x\rightarrow 0^+}f(x)=\lim_{x\rightarrow 0^+}x^3-4x=1-4=-3\backslash\backslash[3\text{mm}]$

50

$\text{\$}\therefore\text{L.H.L}\neq\text{R.H.L}\text{\$}\backslash\backslash[3\text{mm}]$

51

Hence, $\lim_{x\rightarrow 1}f(x)$ does not exist }

52

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55

$\backslash\text{textsc}\{\text{Assignment 1}\}\backslash\backslash$

ASSIGNMENT 1

PROBLEM 2

Ans to the question no 02

$\lim_{x\rightarrow 1}f(x)$ will exist if left hand limit = right hand limit, $\lim_{x\rightarrow 1}f(x) = f(1)$ and $f(1)$ is defined.

Now, L.H.L= $\lim_{x\rightarrow 1^-}f(x) = \lim_{x\rightarrow 1^-}x + 5 = 1 + 5 = 6$

R.H.L= $\lim_{x\rightarrow 0^+}f(x) = \lim_{x\rightarrow 0^+}x^3 - 4x = 1 - 4 = -3$

$\therefore\text{L.H.L} \neq \text{R.H.L}$

Hence, $\lim_{x\rightarrow 1}f(x)$ does not exist


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53 \begin{newpage}
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55 \textsc{Assignment 1} \\

56 \textsc{Problem 3} \\

57 [1 cm]

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58 \end{flushright}
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59 \begin{center}
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60 \textbf{\Large \underline {Ans to the question no 03}}\\
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61 [1 cm]

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62 \end{center}
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63 \Large {Evaluating,}\[2mm]

64 $\text{\LARGE } \left\{ \$\frac{d^2}{dx^2} \left(\ln \left(\frac{x^4 + 2x^3}{x^2 + 1} \right) \right) \right\} \text{\textbackslash[3mm]}$

65 $\rightarrow \frac{d}{dx} \left(\frac{d}{dx} \left(\ln \left(\frac{x^4 + 2x^3}{x^2 + 1} \right) \right) \right)$ [3mm]

$$\rightarrow \frac{dx}{\frac{x^2+1}{x^4+2x^3}} \cdot \frac{d}{dx} \left(\frac{x^4+2x^3}{x^2+1} \right)$$
$$\rightarrow \frac{d}{dx} \left[\frac{x^2+1}{x^4+2x^3} \right] \cdot \frac{(x^2+1)}{x^4+2x^3} - \frac{d}{dx} (x^2+1) \cdot \frac{(x^2+1)^2}{(x^4+2x^3)^2} \quad [3mm]$$
$$68 \quad \rightarrow \frac{d}{dx} \left[\left(\frac{x^2+1}{x^4+2x^3} \right) \cdot \frac{(x^2+1)(4x^3+6x^2) - (x^4+2x^3)(2x)}{(x^2+1)^2} \right]$$
$$\rightarrow \frac{d}{dx} \left[\frac{(x^2+1)(4x^3+6x^2)-2x(x^4+2x^3)}{(x^4+2x^3)(x^2+1)} \right]$$

70 \Rightarrow \frac{d}{dx} [\frac{4x^3+6x^2}{x^4+2x^3} - \frac{2x}{x^2+1}] \quad [3mm]

$$\rightarrow \frac{d}{dx} \left[\frac{4x+6}{x^2+2x} - \frac{2x}{x^2+1} \right]$$

72 $\rightarrow \frac{d}{dx}(\frac{4x+6}{x^2+2x}) - \frac{d}{dx}(\frac{2x}{x^2+1})$ [3mm]

$$73 \quad \rightarrow \frac{(x^2+2x)}{(x+6)-(x+6)} \frac{d}{dx} \frac{(x^2+2x)}{(x^2+2x)^2} - \frac{d}{dx} \frac{(x^2+1)}{(2x)-(2x)} \frac{d}{dx} \frac{(x^2+1)}{(x^2+1)^2} \quad [3mm]$$
$$\rightarrow \frac{(x^2+2x) \cdot 4 - (4x+6) \cdot (2x+2)}{(x^2+2x)^2} - \frac{(x^2+1) \cdot 2x}{(x^2+2x)^2}$$

ASSIGNMENT 1

PROBLEM 3

Ans to the question no 03

Evaluating.

$$\frac{d^2}{dx^2}(\ln(\frac{x^4+2x^3}{x^2+1}))$$

$$\rightarrow \frac{d}{dx} \left(\frac{d}{dx} \left(\ln \left(\frac{x^4 + 2x^3}{x^2 + 1} \right) \right) \right)$$

$$\rightarrow \frac{d}{dx} \left| \left(\frac{x^2+1}{x^4+2x^3} \right) \cdot \frac{d}{dx} \left(\frac{x^4+2x^3}{x^2+1} \right) \right|$$

$$\rightarrow \frac{d}{dx} \left[\left(\frac{x^2+1}{x^4+2x^3} \right) \right] = \frac{(x^2+1) \frac{d}{dx}(x^4+2x^3) - (x^4+2x^3) \frac{d}{dx}(x^2+1)}{(x^2+1)^2}$$

$$\rightarrow \frac{d}{dx} \left[\left(\frac{x^2+1}{x^4+2x^3} \right) \cdot \frac{(x^2+1)(4x^3+6x^2) - (x^4+2x^3)(2x)}{(x^2+1)^2} \right]$$

$$\rightarrow \frac{d}{dx} \left| \frac{(x^2+1)(4x^3+6x^2)-2x(x^4+2x^3)}{(x^4+2x^3)(x^2+1)} \right|$$

$$\rightarrow \frac{d}{dx} \left[\frac{4x^3 + 6x^2}{x^4 + 2x^3} - \frac{2x}{x^2 + 1} \right]$$

$$\rightarrow \frac{d}{dx} \left[\frac{4x+6}{x^2+2x} - \frac{2x}{x^2+1} \right]$$

$$\rightarrow \frac{d}{dx} \left(\frac{4x+6}{x^2+2x} \right) - \frac{d}{dx} \left(\frac{2x}{x^2+1} \right)$$

$$\rightarrow \frac{(x^2+2x)\frac{d}{dx}(4x+6)-(4x+6)\frac{d}{dx}(x^2+2x)}{(x^2+2x)^2} - \frac{(x^2+1)\frac{d}{dx}(2x)-(2x)\frac{d}{dx}(x^2+1)}{(x^2+1)^2}$$

$$\rightarrow \frac{(x^2+2x) \cdot 4 - (4x+6) \cdot (2x+2)}{(x^2+2x)^2} - \frac{(x^2+1) \cdot 2 - 2x \cdot (2x)}{(x^2+1)^2}$$

$$\rightarrow \frac{4x^2+8x-8x^2-20x-12}{(x^2+2x)^2} - \frac{2x^2+2-4x^2}{(x^2+1)^2}$$

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$$\Rightarrow \frac{-2x^6 - 4x^5 - 14x^4 - 32x^3 - 36x^2 - 12x - 12}{x^2(x^2+1)^2(x+2)^2}$$

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80 \Rightarrow \frac{2x^6+8x^5+8x^4-2x^4-8x^3-8x^2-4x^6-12x^5-12x^4-8x^4-24x^3-24x^2
-4x^2-12x-12}{x^2(x^2+1)^2(x+2)^2} \\\ [3mm]
81 \Rightarrow \frac{-2x^6-4x^5-14x^4-32x^3-36x^2-12x-12}{x^2(x^2+1)^2(x+2)^2} \$
82 \end{newpage}
83 \begin{newpage}
84 \begin{flushright}
85 \textsc{Assignment 1} \\\
86 \textsc{Problem 4} \\\
87 [1 cm]
88 \end{flushright}
89 \begin{center}
90 \textbf{\Large \underline{Ans to the question no 04}}} \\\
91 [1 cm]
92 \end{center}
93 \Large {Given, $ (x-y)^2=x+y-1 \\\ [3mm]
94 \Rightarrow x^2-2xy+y^2=x+y-1 \\\ [3mm]
95 \Rightarrow \frac{d}{dx}(x^2-2xy+y^2)=\frac{d}{dx}(x+y-1) \\\ [3mm]
96 \Rightarrow 2x-2y+2y\frac{dy}{dx}-2x\frac{dy}{dx}=1+\frac{dy}{dx}-0 \\\ [3mm]
97 \Rightarrow 2y\frac{dy}{dx}-2x\frac{dy}{dx}-\frac{dy}{dx}=1-2x+2y \\\ [3mm]
98 \Rightarrow \frac{d}{dx}(2y-2x-1)=2y-2x+1 \\\ [3mm]
99 \Rightarrow \frac{d}{dx}=\frac{2y-2x+1}{2y-2x-1} \$
100 \$\therefore \frac{d}{dx}=\frac{2y-2x+1}{2y-2x-1} \$
101 \end{newpage}
102 \begin{newpage}
103 \begin{flushright}
104 \textsc{Assianment 1} \\\

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ASSIGNMENT 1
PROBLEM 4

Ans to the question no 04

$$\begin{aligned}
 &\text{Given, } (x-y)^2 = x+y-1 \\
 &\Rightarrow x^2 - 2xy + y^2 = x+y-1 \\
 &\Rightarrow \frac{d}{dx}(x^2 - 2xy + y^2) = \frac{d}{dx}(x+y-1) \\
 &\Rightarrow 2x - 2y + 2y\frac{dy}{dx} - 2x\frac{dy}{dx} = 1 + \frac{dy}{dx} - 0 \\
 &\Rightarrow 2y\frac{dy}{dx} - 2x\frac{dy}{dx} - \frac{dy}{dx} = 1 - 2x + 2y \\
 &\Rightarrow \frac{d}{dx}(2y - 2x - 1) = 2y - 2x + 1 \\
 &\Rightarrow \frac{d}{dx} = \frac{2y - 2x + 1}{2y - 2x - 1} \\
 &\therefore \frac{d}{dx} = \frac{2y - 2x + 1}{2y - 2x - 1}
 \end{aligned}$$

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100 $\\therefore \\frac{d}{dx}=\\frac{2y-2x+1}{2y-2x-1} $}
101 \\end{newpage}
102 \\begin{newpage}
103 \\begin{flushright}
104 \\textsc{Assignment 1}\\
105 \\textsc{Problem 5}\\
106 [1 cm]
107 \\end{flushright}
108 \\begin{center}
109 \\textbf{\\Large \\underline {Ans to the question no 05}}\\
110 [1 cm]
111 \\end{center}
112 \\Large {We have to evaluate,\\[0.5cm]}
113 $\\frac{d}{dx}(\\sin^2(\\frac{2x}{x+1}))$ \\[0.5cm]
114 Let,\\[0.25cm]
115 a=\\frac{2x}{x+1}\\
116 \\rightarrow a = 2x(x+1)^{-1}\\
117 \\rightarrow \\frac{d}{dx}a=\\frac{d}{dx} 2x(x+1)^{-1}\\
118 \\rightarrow \\frac{d}{dx}(a) = 2(x+1)^{-1}+2x(-1)(x+1)^{-2}\\
119 \\rightarrow \\frac{d}{dx}a = \\frac{2}{x+1}-\\frac{2x}{(x+1)^2}\\
120 \\rightarrow \\frac{d}{dx}a = \\frac{2(x+1)-2x}{(x+1)^2}\\
121 \\rightarrow \\frac{d}{dx}a = \\frac{2x+2-2x}{(x+1)^2}\\
122 \\rightarrow \\frac{d}{dx}a = \\frac{2}{(x+1)^2}\\[0.75cm]$
123 Evaluating,\\[0.5cm]
124 $\\frac{d}{dx}(\\sin^2(\\frac{2x}{x+1}))$\\
125 = \\frac{d}{dx}(\\sin^2a)\\
126 =2\\sin{a}\\cos{a}\\frac{d}{dx}a\\
127 =\\sin{2a}\\frac{d}{dx}a\\
128 =\\sin(\\frac{2\\cdot 2x}{x+1})\\cdot \\frac{2}{(x+1)^2}\\
129 =\\frac{2\\sin(\\frac{4x}{x+1})}{(x+1)^2}\\[0.25mm]$
130 we get, $\\frac{d}{dx}(\\sin^2(\\frac{2x}{x+1}))=\\frac{2\\sin(\\frac{4x}{x+1})}{(x+1)^2}$
131 \\end{newpage}

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ASSIGNMENT 1

PROBLEM 5

Ans to the question no 05

We have to evaluate,

$$\frac{d}{dx}(\sin^2(\frac{2x}{x+1}))$$

Let,

$$a = \frac{2x}{x+1}$$

$$\Rightarrow a = 2x(x+1)^{-1}$$

$$\Rightarrow \frac{d}{dx}a = \frac{d}{dx} 2x(x+1)^{-1}$$

$$\Rightarrow \frac{d}{dx}(a) = 2(x+1)^{-1} + 2x(-1)(x+1)^{-2}$$

$$\Rightarrow \frac{d}{dx}a = \frac{2}{x+1} - \frac{2x}{(x+1)^2}$$

$$\Rightarrow \frac{d}{dx}a = \frac{2(x+1)-2x}{(x+1)^2}$$

$$\Rightarrow \frac{d}{dx}a = \frac{2x+2-2x}{(x+1)^2}$$

$$\Rightarrow \frac{d}{dx}a = \frac{2}{(x+1)^2}$$

Evaluating,

$$\frac{d}{dx}(\sin^2(\frac{2x}{x+1}))$$

$$= \frac{d}{dx}(\sin^2 a)$$

$$= 2 \sin a \cos a \frac{d}{dx}a$$

$$= \sin 2a \frac{d}{dx}a$$

$$= \sin(\frac{2 \cdot 2x}{x+1}) \cdot \frac{2}{(x+1)^2}$$

$$= \frac{2 \sin(\frac{4x}{x+1})}{(x+1)^2}$$

We get, $\frac{d}{dx}(\sin^2(\frac{2x}{x+1})) = \frac{2 \sin(\frac{4x}{x+1})}{(x+1)^2}$


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130 we get,  $\frac{dx}{dt}(\sin^2(\frac{2x}{x+1})) = \frac{2\sin(\frac{4x}{x+1})}{(x+1)^2}$ 
131 \end{newpage}
132 \begin{newpage}
133 \begin{flushright}
134 \textsc{Assignment 1}\\
135 \textsc{Problem 6(a)}\\
136 [1 cm]
137 \end{flushright}
138 \begin{center}
139 \textbf{\Large \underline{Ans to the question no 06 (a)}}\\
140 [1 cm]
141 \end{center}
142 \Large {Given,}
143  $P(t) = \frac{M}{1+Ae^{-kt}}$ 
144  $\lim_{t \rightarrow \infty} P(t) = \lim_{t \rightarrow \infty} \frac{M}{1+Ae^{-kt}}$ 
145  $\Rightarrow \lim_{t \rightarrow \infty} P(t) = \lim_{t \rightarrow \infty} \frac{M}{1+\frac{A}{e^{kt}}}$ 
146  $\Rightarrow \lim_{t \rightarrow \infty} P(t) = \frac{M}{1+\frac{A}{e^{k\infty}}}$ 
147  $\Rightarrow \lim_{t \rightarrow \infty} P(t) = \frac{M}{1+\frac{A}{\infty}}$ 
148  $\Rightarrow \lim_{t \rightarrow \infty} P(t) = \frac{M}{1}$ 
149  $\Rightarrow \lim_{t \rightarrow \infty} P(t) = M$ 
150 The answer M refers to the maximum population size that can be carried and when t tends to infinity it means that the carrying capacity becomes the maximum population size that can be supported. That's why the answer M is to be expected
151 \end{newpage}
152 \begin{newpage}

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The answer M refers to the maximum population size that can be carried and when t tends to infinity it means that the carrying capacity becomes the maximum population size that can be supported. That's why the answer M is to be expected

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151 \end{newpage}
152 \begin{newpage}
153 \begin{flushright}
154 \textsc{Assignment 1}\\
155 \textsc{Problem 6(b)}\\
156 [1 cm]
157 \end{flushright}
158 \begin{center}
159 \textbf{\Large \underline {Ans to the question no 06 (b)}}\\
160 [1 cm]
161 \end{center}
162 \Large {Given,\\[3mm]
163 $ P(t) = \frac{M}{1+Ae^{-kt}}$\\[3mm]
164 $\lim_{M \to \infty} P(t) = \lim_{M \to \infty} \frac{M}{1+Ae^{-kt}}$\\[3mm]
165 $\Rightarrow \lim_{M \to \infty} P(t) = \lim_{t \to \infty} \frac{M}{1+(\frac{M-P_o}{P_o})e^{-kt}}$\\[3mm]
166 $\Rightarrow \lim_{M \to \infty} P(t) = \lim_{M \to \infty} \frac{MP_o}{P_o(1-e^{-kt})+Me^{-kt}}$\\[3mm]
167 $\Rightarrow \lim_{M \to \infty} P(t) = \lim_{M \to \infty} \frac{P_o}{e^{-kt}}$\\[3mm]
168 $\Rightarrow \lim_{M \to \infty} P(t) = P_o e^{kt}$\\[0.75cm]$
169 The result is $P_o e^{kt}$ which is an exponential function}
170 \end{newpage}
171 \end{document}
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173

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The result is $P_0 e^{kt}$ which is an exponential function