Mata Sundri College For women
(University of Delhi)

Assignment 2

Name - Aashi Rajput

Roll no.- MAT/20/118

University roll no.- 20044563040

My Document

1. Let $\mathbf{x} = (x_1, \ldots, x_n)$,where the x_i are nonnegative real numbers. Set

$$M_r(x) = \left(\frac{x_1^r + x_2^r + \cdots + x_n^r}{n}\right)^{1/r}, \quad r \in \mathbf{R} \setminus \{0\},$$

and

$$M_0(x) = (x_1 x_2 \ldots x_n)^{1/n}.$$

We call $M_r(x)$ the *rth power mean* of $\mathbf{x}$
Claim :

$$\lim_{r \to 0} M - r(x) = M_0\mathbf{x}$$

2 Define

$$V_n = \begin{bmatrix} 1 & 1 & 1 & \dots & 1 \\ x_1 & x_2 & x_3 & \dots & x_n \\ x_1^2 & x_2^2 & x_3^2 & \dots & x_n^2 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ x_1^{n-1} & x_2^{n-1} & x_3^{n-1} & \dots & x_n^{n-1} \end{bmatrix}.$$

We call V_n the *Vandermode matrix* of order n.

Claim:

$$\det V_n = \prod_{1 \leq i < j \leq n} (x_j - x_i).$$

Question 4.

Make the following equations;

1. $$3^3 + 4^3 + 5^3 = 6^3$$
2. $$\sqrt{100} = 10$$
3. $$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$
4. $$\sum_{k=1}^{n} k = \frac{n(n+1)}{2}$$
5. $$\frac{\pi}{4} = \frac{1}{1} - \frac{1}{3} + \frac{1}{5} - \frac{1}{9} - \frac{1}{11} + \dots$$

Remaining parts of question 4

6 $$cos\theta = sin(90^\circ - \theta)$$

7 $$e^{i\theta} = cos\theta + isin\theta$$

8 $$\lim_{\theta \to 0} \frac{sin\theta}{\theta} = 1$$

9 $$\lim_{x \to \infty} \frac{\pi(x)}{\frac{x}{logx}} = 1$$

10 $$\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}$$

Question 5.

Typeset the following sentences :

1. Positive number a,b,c are the side lengths of a triangle if and only if $a+b>c$,$b+c>a$, and $c+a>b$.
2. The area of a triangle with side lengths a,b,c is given by *Heron's formula* :

$$A = \sqrt{s(s-a)(s-b)(s-c)}$$

where s is the semiperimeter $(a+b+c)/2$.

3. The Volume of a regular tetrahedron of edge length 1 is $\frac{\sqrt{2}}{12}$.

Remaining parts of question 5.

4. The quadratic equation $ax^2 + bx + c = 0$ has roots

$$r_1, r_2 = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

5. The *derivative* of a function f,denoted f', is defined by

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

6. A real valued function f is *convex* on an interval I if

$$f(\lambda x + (1-\lambda)y) \leq \lambda f(x) + (1-\lambda)f(y),$$

$$forallxandy \in Iand 0 \leq \lambda \leq 1.$$

Remaining parts of question 5.

7 The general solution to the differential equation

$$y'' - 3y' = 2y = 0$$

is

$$y = C_1 e^x + C_2 e^{2x}.$$

8 The *Fermat number* F_n is defined as

$$F_n = 2^{2^n}, n \geq 0.$$

Question 6.

Make the following equations. Notice the large delimiters.

1. $\frac{d}{dx}\frac{x}{x+1} = \frac{1}{(x+1)^2}$
2. $\lim_{n\to\infty}(1+\frac{1}{n})^n = e$
3. $\left|\begin{matrix} a & b \\ c & d \end{matrix}\right| = ad - bc$
4. $R_\theta = \left[\begin{matrix} cos\theta & -sin\theta \\ sin\theta & cos\theta \end{matrix}\right]$

Remaining Parts of question 6.

5 $$\begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix} = \begin{vmatrix} a_2 & a_3 \\ b_2 & b_3 \end{vmatrix} \mathbf{i} - \begin{vmatrix} a_1 & a_3 \\ b_1 & b_3 \end{vmatrix} \mathbf{j} + \begin{vmatrix} a_1 & a_2 \\ b_1 & b_2 \end{vmatrix} \mathbf{k}$$

6 $$\begin{bmatrix} a_1 1 & a_1 2 \\ a_2 1 & a_2 2 \end{bmatrix} \begin{bmatrix} b_1 1 & b_1 2 \\ b_2 1 & b22 \end{bmatrix} = \begin{bmatrix} a_1 1 b_1 1 + b_1 2 b_2 1 & a_1 1 b_1 2 + a_1 2 b_2 2 \\ a_2 1 b_1 1 + a_2 2 b_2 1 & a_2 1 b_1 2 + a_2 2 b_2 2 \end{bmatrix}$$

7 $$f(x) = \begin{cases} -x^2, & x < 0 \\ x^2, & 0 \leq x \leq 2 \\ 4, & x > 2 \end{cases}$$

Question 7.

Make the following multi-line equations;

1

$$1 + 2 = 3$$

$$4 + 5 + 6 = 7 + 8$$

$$9 + 10 + 11 + 12 = 13 + 14 + 15$$

$$16 + 17 + 18 + 19 + 20 = 21 + 22 + 23 + 24$$

$$25 + 26 + 27 = 28 + 30 = 31 + 32 + 33 + 34 + 35$$

2

$$\begin{aligned}(a+b)^2 &= (a+b)(a+b)\\ &= (a+b)a+(a+b)b\\ &= a^2+ab+ba+b^2\\ &= a^2+ab+ab+b^2\\ &= a^2=2ab+b^2\end{aligned}$$

3

$$
\begin{aligned}
tan(\alpha+\beta+\gamma) &= \frac{tan(\alpha+\beta)+tan\gamma}{1-tan(\alpha+\beta)tan\gamma} \\
&= \frac{\frac{tan\alpha+tan\beta}{1-tan\alpha tan\beta}+tan\gamma}{1-(\frac{tan\alpha+tan\beta}{1-tan\alpha tan\beta})tan\gamma} \\
&= \frac{tan\alpha+tan\beta+(1-tan\alpha tan\beta)tan\gamma}{1-tan\alpha tan\beta-(tan\alpha+tan\beta)tan\gamma} \\
&= \frac{tan\alpha+tan\beta+tan\gamma-tan\alpha tan\beta\tan\gamma}{1-tan\alpha tan\beta-tan\alpha\, tan\gamma-tan\beta tan\gamma}
\end{aligned}
$$

4

$$\begin{aligned}
\prod_p \left(1 - \frac{1}{p^2}\right) &= \prod_p \frac{1}{1 + \frac{1}{p^2} + \frac{1}{p^4} + \dots} \\
&= \left(\prod_p \left(1 + \frac{1}{p^2} + \frac{1}{p^4} + \dots\right)\right)^{-1} \\
&= \left(1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots\right)^{-1} \\
&= \frac{6}{\pi^2}
\end{aligned}$$

Thank You

Source Rich Text

```latex
\documentclass{beamer}
\usepackage[utf8]{inputenc}
\usepackage{xcolor}
\usepackage{shadowtext}
\usepackage{graphicx}
\geometry{papersize={13cm,12cm}}
\usetheme{Berlin}
\setbeamerfont{title}{size=\huge}
\setbeamerfont{author}{size=\LARGE}
\setbeamertemplate{background}
{
\includegraphics[width=\paperwidth,height=\paperheight]{th (5).jpg}
}
\title{\textcolor{black}{Assignment 2}}
\author{\textcolor{purple}{Name - Aashi Rajput}\\\vspace{0.5cm}{\textcolor{purple}{Roll no.-
MAT/20/118}}\\\vspace{0.5cm}{\textcolor{purple}{University roll no.- 20044563040}}}
\date{}
\begin{document}
\begin{frame}
\begin{minipage}{0.13\linewidth}
\includegraphics[width=1.5cm,height=1.5cm]{th (2).jpg}
\end{minipage}\hfill
\begin{minipage}{0.7\linewidth}
\centering\Large{\textcolor{purple}{\shadowtext{Mata Sundri College For women}}}
\\{\Large{\textcolor{purple}{{\shadowtext{(University of Delhi)}}}}}
\end{minipage}\hfill
\begin{minipage}{0.13\linewidth}
\includegraphics[width=1.5cm,height=1.5cm]{th (3).jpg}
\end{minipage}\hfill\vspace{0.5cm}
\Large\titlepage
\end{frame}
\begin{enumerate}
\begin{frame}{My Document}
\begin{block}

    \item \Large{Let $\textbf{x}=(x_1,\dots,x_n)$,where the $x_i$ are nonnegative real numbers. Set
    \[M_r(\mathbf{x})=\left(\frac{x_1^r+x_2^r+\cdots+x_n^r}{n}\right)^{1/r},\; \;r \in \textbf{R} \setminus \{0\},\] \\
    and
    \[M_0(\mathbf{x})=\left(x_1x_2 \dots x_n \right)^{1/n}.\]
    We call $M_r(\mathbf{x}$) the \emph{$r$th power mean} of  $\textbf{x}$\\
    Claim :
    \[\lim_{r \rightarrow 0} M-r(\mathbf{x})=M_0{\textbf{x}} \]}

    \end{block}
    \end{frame}
\begin{frame}
\begin{block}

    \item \Large{Define
    \[V_n=
    \left[
    \begin{array}{ccccc}
    1 & 1 & 1 & \ldots & 1 \\
    x_1 & x_2 & x_3 & \ldots & x_n\\
    x_1^2 & x_2^2 & x_3^2 & \ldots & x_n^2\\
    \vdots & \vdots & \vdots & \ddots & \vdots\\
    x_1^{n-1} & x_2^{n-1} & x_3^{n-1} & \ldots & x_n^{n-1}
    \end{array}\right]. \]
    We call $V_n$ the \emph{ Vandermode matrix} of order $n$.\\
    Claim:
    \[\det V_n = \prod_{1 \leq i < j \leq n}(x_j-x_i).\]}
    \end{block}
\end{frame}
\end{enumerate}
\begin{enumerate}
\begin{frame}[fragile]{Question 4.}
\begin{block}{\LARGE{Make the following equations;}}
   \item \LARGE{\framebox[\textwidth]{$3^3+4^3+5^3=6^3$}
   \item \framebox[\textwidth]{$\sqrt{100}=10$}
   \item \framebox[\textwidth]{$(a+b)^3=a^3+3a^2b+3ab^2+b^3$}
   \item \framebox[\textwidth]{$\sum_{k=1}^n k= \frac{n(n+1)}{2}$}
   \item \framebox[\textwidth]{$\frac{\pi}{4}=\frac{1}{1}-\frac{1}{3}+\frac{1}{5}-\frac{1}{9}-\frac{1}{11}+\ldots$}}
\end{block}
\end{frame}
\begin{frame}{Remaining parts of question 4}
\begin{block}

   \item \LARGE{\framebox[\textwidth]{$cos\theta=sin(90^\circ-\theta)$}
   \item \framebox[\textwidth]{$e^{i\theta}=cos\theta+i sin\theta$}
   \item \framebox[\textwidth]{$\lim_{ \theta \rightarrow 0}\frac{sin\theta}{\theta}=1$}
   \item \framebox[\textwidth]{$\lim_{ x \rightarrow \infty}\frac{\pi(x)}{\frac{x}{logx}}=1 $}
   \item \framebox[\textwidth]{$\int_{- \infty}^{\infty} e^{-x^2}dx = \sqrt{\pi}$}}
 \end{block}
\end{frame}
\end{enumerate}
\begin{enumerate}
\begin{frame}{Question 5.}
\begin{block}{\Large{Typeset the following sentences :}}
   \item \Large{Positive number $a$,$b$,$c$ are the side lengths of a triangle if and only if $a+b>c$,$b+c>a$, and
   $c+a>b$.
```

Assignment 2

Source Rich Text

```latex
  \item \Large{Positive number $a$,$b$,$c$ are the side lengths of a triangle if and only if $a+b>c$,$b+c>a$, and
  $c+a>b$.
 \item The area of a triangle with side lengths $a$,$b$,$c$ is given by \emph{Heron's formula} :
  \[A = \sqrt{s(s-a)(s-b)(s-c)}\] where \emph{s} is the semiperimeter $(a+b+c)/2$.
  \item The Volume of a regular tetrahedron of edge length 1 is $\frac{\sqrt{2}}{12}$.}
\end{block}
\end{frame}
\begin{frame}{Remaining parts of question 5.}
\begin{block}

  \item \Large{The quadratic equation $ax^2+bx+c=0$ has roots
  \[r_1,r_2=\frac{-b \pm \sqrt{b^2-4ac}}{2a}\]
  \item The \emph{derivative} of a function f,denoted f', is defined by
  \[f'(x)=\lim_{h \rightarrow 0}\frac{f(x+h)-f(x)}{h}\]
  \item A real valued function f is \emph{convex} on an interval \emph{I} if
  \[f(\lambda x+(1-\lambda)y) \leq \lambda f(x)+(1-\lambda)f(y),\]
  $ for all $x$ and $y$ \in $I$ and  0 \leq \lambda \leq 1.$}
\end{block}
\end{frame}
\begin{frame}{Remaining parts of question 5.}
\begin{block}

   \item \LARGE{The general solution to the differential equation
   \[y''-3y'=2y=0\]
   is \[y=C_1 e^x + C_2 e^{2x}.\]
   \item The \emph{Fermat number} $F_n$ is defined as
   \[F_n=2^{2^n}, n \geq 0.\]}
\end{block}
\end{frame}
\end{enumerate}
\begin{enumerate}
\begin{frame}{Question 6.}
\begin{block}{\LARGE{Make the following equations. Notice the large delimiters.}}
  \item \LARGE{$\frac{d}{dx}\frac{x}{x+1}=\frac{1}{(x+1)^2}$
  \item $\lim_{n \rightarrow \infty}(1+\frac{1}{n})^n=e$
  \item $\left|
  \begin{array}{cc}
      a & b \\
      c & d
  \end{array} \right|
  =ad-bc$
  \item $R_\theta=
  \left[
  \begin{array}{cc}
      cos \theta & -sin \theta \\
      sin \theta & cos \theta
  \end{array}\right]$}
\end{block}
\end{frame}
\begin{frame}{Remaining Parts of question 6.}
\begin{block}

   \item \Large{$\left|
   \begin{array}{ccc}
      \textbf{i}  & \textbf{j} & \textbf{k} \\
       a_1 & a_2 & a_3\\
       b_1 & b_2 & b_3
   \end{array}\right|= \left|
   \begin{array}{cc}
      a_2  & a_3 \\
      b_2  & b_3
   \end{array}\right|\textbf{i} -
   \left|
   \begin{array}{cc}
      a_1  & a_3 \\
      b_1  & b_3
   \end{array}\right|\textbf{j}+\left|
   \begin{array}{cc}
      a_1  & a_2 \\
       b_1 & b_2
   \end{array}\right|\textbf{k}$}
   \item \small{$ \left[
   \begin{array}{cc}
   a_11 & a_12\\
   a_21 & a_22
   \end{array} \right]
   \left[
   \begin{array}{cc}
      b_11  & b_12  \\
      b_21  & b22
   \end{array} \right]=
   \left[
   \begin{array}{cc}
    a_11 b_11+b_12 b_21 & a_11 b_12+a_12 b_22 \\
    a_21 b_11+a_22 b_21 & a_21 b_12+a_22 b_22
   \end{array} \right] $}
   \item \Large{$f(x) =\begin{cases}-x^2, \hspace{0.2cm} x<0\\
   x^2 , \hspace{0.2cm} 0 \leq x \leq 2 \\
   4,\hspace{0.2cm} x>2\end{cases}$}
\end{block}
```

```latex
    x^2 , \hspace{0.2cm} 0 \leq x \leq 2 \\
    4,\hspace{0.2cm} x>2\end{cases}$}
\end{block}
\end{frame}
\end{enumerate}
\begin{enumerate}
\begin{frame}{\LARGE{Question 7.}}
\begin{block}{\LARGE{Make the following multi-line equations;}}
    \item \Large{\[1+2=3\]
    \[4+5+6=7+8\]
    \[9+10+11+12=13+14+15\]
    \[16+17+18+19+20=21+22+23+24\]
    \[25+26+27=28+30=31+32+33+34+35\]}
\end{block}
\end{frame}
\begin{frame}
\begin{block}

    \item \LARGE{
    \begin{eqnarray*}
    (a+b)^2&=&(a+b)(a+b)\\
    &=&(a+b)a+(a+b)b\\
    &=&a^2+ab+ba+b^2\\
    &=&a^2+ab+ab+b^2\\
    &=&a^2=2ab+b^2
\end{eqnarray*}}
\end{block}
\end{frame}
\begin{frame}
\begin{block}

    \item \large{
    \begin{eqnarray*}
    tan(\alpha+\beta+\gamma)&=&\frac{tan(\alpha+\beta)+tan\gamma}{1-tan(\alpha+\beta)tan\gamma}\\
    &=&\frac{\frac{tan\alpha+tan\beta}{1-tan\alpha tan\beta}+tan\gamma}{1-(\frac{tan\alpha+tan\beta}{1-tan\alpha tan\beta})tan\gamma}\\
    &=&\frac{tan\alpha+tan\beta+(1-tan\alpha tan\beta)tan\gamma}{1-tan\alpha tan\beta-(tan\alpha+tan\beta)tan\gamma}\\
    &=&\frac{tan\alpha+tan\beta+tan\gamma-tan\alpha tan\beta \tan\gamma}{1-tan\alpha tan\beta-tan\alpha \, tan\gamma-tan\beta tan\gamma}
    \end{eqnarray*}}
\end{block}
\end{frame}
\begin{frame}
\begin{block}

    \item \Large{
    \begin{eqnarray*}
    \prod_p\left(1-\frac{1}{p^2}\right)&=&\prod_p\frac{1}{1+\frac{1}{p^2}+\frac{1}{p^4}+\ldots}\\
    &=&\left(\prod_p\left(1+\frac{1}{p^2}+\frac{1}{p^4}+\ldots\right)\right)^{-1}\\
    &=&\left(1+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+\ldots\right)^{-1}\\
    &=&\frac{6}{\pi^2}
    \end{eqnarray*}}
\end{block}
\end{frame}
\end{enumerate}
\begin{frame}{Thank You}
\includegraphics[angle=360,scale=1.2]{th (6).jpg}
\end{frame}
\end{document}
```