# Presentation

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MAT/20/88

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

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

and

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

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

$$\lim_{r \to 0} M_r(\mathbf{x}) = M_0(\mathbf{x}).$$

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

We call $V_n$ the *Vandermonde matrix* of order $n$. Claim:

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

# Q4. Make the following equations.

- $$3^3 + 4^3 + 5^3 = 6^3$$
- $$\sqrt{100} = 10$$
- $$(a+b)^3 = a^3 + 3ab^2 + 3a^2b + b^3$$
- $$\sum_{k=1}^{n} k = \frac{n(n+1)}{2}$$
- $$\frac{\pi}{4} = \frac{1}{1} - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} + \cdots$$

# Remaining parts of question 4

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

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

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

- $$\lim_{\theta \to \infty} \frac{\pi(x)}{x/logx} = 1$$

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

# Q 5. Typeset the following sentences.

- Positive numbers a,b,and c are the side lengths of a triangle if and only if $a + b > c, b + c > 0, and\ c + a > b.$

- The area of a triangle with side lengths a,b,c is given by **Heron's formula:**

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

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

- The volume of a regular tetrahedron of edge length 1 is$\sqrt{2}/12$.

# Remaining parts of question 5

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

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

- The derivative of a function f, denoted by $f'$,is defined by

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

- A real-valued function f is convex on an interval I if

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

for all x,y $\in I$ and $0 \leq \lambda \leq 1$.

# Remaining parts of question 5

- The general solution to the differential equation

$$y - 3y + 2y = 0$$

is

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

- The Fermat number $F_n$ is defined as

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

# Q6.Make the following equations. Notice the large delimiters.

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

# Remaining parts of question 6

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

- $$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} = \begin{bmatrix} a_{11}b_{11} + a_{12}b_{21} & a_{11}b_{12} + a_{12}b_{22} \\ a_{21}b_{11} + a_{22}b_{21} & a_{21}b_{12} + a_{22}b_{22} \end{bmatrix}$$

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

# Q7. Make the following multi-line equations.

- $$\begin{aligned} 1+2 &= 3 \\ 4+5+6 &= 7+8 \\ 9+10+11+12 &= 13+14+15 \\ 16+17+18+19+20 &= 21+22+23+24 \\ 25+26+27+28+29+30 &= 31+32+33+34+35 \end{aligned}$$

# Q7. Part-2

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

# Q7. Part-3

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

# Q7. Part-4

- $$\prod_p \left(1 - \frac{1}{p^2}\right) = \prod_p \frac{1}{1 + \frac{1}{p^2} + \frac{1}{p^4} + \cdots}$$
  $$= \left(\prod_p \left(1 + \frac{1}{p^2} + \frac{1}{p^4} + \cdots\right)\right)^{-1}$$
  $$= \left(1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \cdots\right)^{-1}$$
  $$= \frac{6}{\pi^2}$$


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```latex
\documentclass{beamer}
\usepackage[utf8]{inputenc}
%\usetheme{Madrid}
\usepackage{gensymb}
\usepackage{fancybox}
\usepackage{xcolor}
\setbeamercolor{titlelike}{parent=structure,bg=teal}
\title{{\textbf{Presentation}}}
\author{\Large {\textcolor{teal}{Anisha Choudhary}\\{\small \textcolor{orange}{MAT/20/88}}
\and\\{\small\textcolor{violet}{20044563014}}}}
\date{}
\institute{{\large \textcolor{cyan}{Mata Sundri College For Women}}\\{\normalsize \textcolor{red} {University of Delhi}}}
\usecolortheme{orchid}
\usetheme{Warsaw}
\usepackage{graphicx}
\begin{document}
\beamertemplateshadingbackground{green!20}{red!20}
\begin{frame}
    \titlepage
\end{frame}

\begin{frame}{Example-9.5 (Part-1)}
\begin{itemize}
\item Let $\mathbf{x}=(x_1,\ldots,x_n)$,
where the $x_i$ are nonnegative real numbers.
Set
\[
M_r(\mathbf{x}) = \left(\frac{x_1^r+x_2^r
+\cdots+x_n^r}{n}\right)^{1/r},
\; \; r \in \mathbf{R} \setminus \{0\},
\]
and
\[
M_0(\mathbf{x})=\left(x_1 .x_2. \ldots. x_n\right)^{1/n}
\]
We call $M_r(\mathbf{x})$ the \emph{$r$th power mean}
of $\mathbf{x}$.
Claim:
\[ \lim_{r\rightarrow0}M_r(\mathbf{x})=M_0(\mathbf{x}).\]
\end{itemize}
\end{frame}
...
\vskip 0.5cm

\begin{frame}{Example-9.5 (Part-2)}
\[
V_n=
\left[
\begin{array}{ccccc}
1 & 1 & 1 & \ldots & 1\\
x_1 & x_2 & x_3 & \ldots & x_n\\
x_1^2 & x_2^2 & x_3^2 & \ldots & x_n^2\\
\vdots & \vdots & \vdots & \ddots & \vdots\\
x_1^{n-1} & x_2^{n-1} & x_3^{n-1} & \ldots & x_n^{n-1}
\end{array}
\right].
\]
We call $V_n$ the \emph{Vandermonde matrix} of order $n$.
Claim:
\[
\det V_n = \prod_{1 \leq i < j \leq n}(x_j-x_i).
\]
\end{frame}

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\begin{itemize}
         \item  \[ 3^3+4^3+5^3=6^3 \]\\
        \item \[\sqrt{100}=10\]\\
        \item\[(a+b)^3=a^3+3ab^2+3a^2b+b^3 \]\\
        \item \[\sum_{k=1}^n k= \frac{n(n+1)}{2}\]\\
        \item \[\frac{\pi}{4}=\frac{1}{1}-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\frac{1}{9}-\frac{1}{11}+\cdots\]\\

 \end{itemize}
 \end{frame}

 \begin{frame}{Remaining parts of question 4}
 \begin{itemize}
       \item \[\theta = sin(90\degree-\theta)\]
       \item \[e^{i\theta} =cos\theta + isin\theta\]\\
        \item \[\lim_{\theta\rightarrow 0}\frac{sin\theta}{\theta} = 1\]\\
        \item \[\lim_{\theta \rightarrow \infty} \frac{\pi(x)}{x/logx}=1\]\\
        \item \[\int_{-\infty}^{\infty} e^{-x^2}\,dx =\sqrt{\pi}\]
\end{itemize}
\end{frame}
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\begin{itemize}
        \item Positive numbers a,b,and c are the side lengths of a triangle if and only if $a+b > c,b+c > 0, and\, c+a >
        b.$\\[0.5cm]
        \item The area of a triangle with side lengths a,b,c is given by \textbf{Heron's formula:}
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 $$ \textbf{A}= \sqrt{s(s-a)(s-b)(s-c)}\,, $$
  where s is the semiperimeter(a+b+c)/2.
        \item The volume of a regular tetrahedron of edge length 1 is$\sqrt{2}/12$.
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      \item The quadratic equation $ax^2+bx+c=0$ has roots\\
$$ r_1,r_2 =\frac{-b\pm \sqrt{b^2+4ac}}{2a} $$

     \item The derivative of a function f, denoted by $f'$,is defined by\\
 $$ f'(x)=\lim_{h \rightarrow 0} \frac{f(x+h)-f(x)}{h}.$$\\

      \item A real-valued function  f is convex on an interval I if\\
$$f(\lambda x+(1-\lambda)y)\leq \lambda f(x) + (1-\lambda)f(y),$$\\
for all x,y $\in I$ \, and\, $ 0\leq \lambda \leq 1.$
\end{itemize}
\end{frame}
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\begin{itemize}
       \item The general solution  to the differential equation
$$y-3y+2y=0$$\\
is\\
$$y=C_1e^x+C_2e^2x.$$\\
       \item The Fermat number $F_n$ is defined as
$$ F_n=2^{2^n} ,n\geq 0.$$
\end{itemize}
\end{frame}
\begin{frame}{Q6.Make the following equations. Notice the large delimiters.}
\begin{itemize}
       \item \[\frac{d}{dx}{\left(\frac{x}{x+1}\right)} =\frac{1}{(x+1)^2}\]
       \item \[\lim_{n \rightarrow \infty }\left(1+\frac{1}{n}\right)^n = e \]
       \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{itemize}
\end{frame}

\begin{frame}{Remaining parts of question 6}
\begin{itemize}
       \item \[\left| \begin{array}{ccc}
 \textbf i   & \textbf{j} & \textbf{k} \\
  a_1   & a_2&a_3\\
  b_1&b_2&b_3
\end{array}\right| =\left| \begin{array}{cc}
   a_1  & a_3 \\
  b_2   & b_3
\end{array}\right|\textbf{i }-\left| \begin{array}{cc}
  a_1   & a_3 \\
  b_1   & b_3
\end{array}\right|\textbf{j }+\left| \begin{array}{cc}
   a_1  & a_2 \\
   b_1  & b_2
\end{array}\right|\textbf{k}\]\\

      \item \[\left[ \begin{array}{cc}
 a_{11}    & a_{12} \\
  a_{21}   & a_{22}
\end{array}\right] \left[ \begin{array}{cc}
  b_{11 }  &  b_{12}\\
  b_{21}   & b_{22}
\end{array}\right] =\left[ \begin{array}{cc}
  a_{11}b_{11}+a_{12}b_{21}   & a_{11}b_{12}+a_{12}b_{22} \\
   a_{21}b_{11}+a_{22}b_{21}  & a_{21}b_{12}+a_{22}b_{22}
\end{array}\right]\]


   \item  \[f(x)  = \left \{ \begin{array}{cc}
      -x^2 ,  & x<0 \\
       x^2 , & 0 \leq x \leq 2\\
       4,    &  x>0
    \end{array}\right.\]
\end{itemize}
\end{frame}

\begin{frame}{Q7. Make the following multi-line equations.}
\begin{itemize}
    \item \[ \begin{array}{rcl}
      1+2 & =  &3  \\
      4+5+6& =   & 7+8\\
      9+10+11+12& =& 13+14+15\\
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        16+17+18+19+20& =& 21+22+23+24 \\
        25+26+27+28+29+30 &=& 31+32+33+34+35
    \end{array} \]
  \end{itemize}
  \end{frame}

  \begin{frame}{Q7. Part-2}
  \begin{itemize}
       \item \[\begin{array}{ccl}
      (a+b)^2   & =& (a+b)(a+b) \\
        & =& (a+b)a+(a+b)b\\
        &=& a(a+b)+b(a+b)\\
        &=& a^2+ab+ba+b^2\\
        &=& a^2+ab+ab+b^2\\
        &=& a^2+2ab+b^2\\
    \end{array}\]
    \end{itemize}
    \end{frame}
  \begin{frame}{Q7. Part-3}
  \begin{itemize}
       \item \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{itemize}
  \end{frame}

  \begin{frame}{Q7. Part-4}
  \begin{itemize}
         \item \begin{eqnarray*}
  \prod_{p}\left(1-\frac{1}{p^2}\right) &=&\prod_{p}\frac{1}{1+\frac{1}{p^2}+\frac{1}{p^4}+\cdots}\\
  &=&\left(\prod_{p}\left(1+\frac{1}{p^2}+\frac{1}{p^4}+\cdots\right)\right)^{-1}\\
  &=&\left(1+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+\cdots\right)^{-1}\\
  &=& \frac{6}{\pi^2}\\
  \end{eqnarray*}
  \end{itemize}
  \end{frame}
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