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21

Project2

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```
\documentclass[10pt]{beamer}
\usepackage[utf8]{inputenc}
\usepackage{mathtools}
\usepackage{fancybox}
\usepackage{graphicx}
\usetheme{Berlin}
\useoutertheme{shadow}
\useinnertheme{circles}
\usefonttheme{serif}
\begin{document}
\date{}
\setbeamertemplate{background}{\includegraphics[width=\paperwidth,height=\paperheight]{t2.jpg}}
\title[Mata Sundri College for Women, (University of Delhi)]{Document}
\author[Shveta]{{{{\Large \textrm{\textbf{\textit{\color{blue}\shadowbox{Shveta}}}}}}}}\\\vskip0.4cm\textit{\large \textbf{\color{blue}College Roll no. - \color{red} MAT/20/132\\ \color{blue}University Roll no. - \color{red}20044563057}}}
\institute{\textit{\textbf{\large{ \color{blue}Mata Sundri College for Women\\\color{red}(University of Delhi)}}}}
\begin{frame}{LaTeX Presentation}
    \titlepage
\end{frame}
%next slide
\begin{frame}{Content of the page no. 69}
    \begin{enumerate}
        \item Let $\mathbf{x}={(x_1,\dots,x_n)}$, where the $x_i$ are non-negative 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
\[M_0(\mathbf{x})=\left(x_1x_2\cdots x_n\right)^{1/n}.\]
We call $M_r(\mathbf{x})$ the \em{$r$th power mean} of $\mathbf{x}$. \\
```

Project2

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```
We call $M_r(\mathbf{x})$ the \em{$r$th power mean} of $\mathbf{x}$. \\
Claim:
\[\lim_{r\rightarrow 0} M_r(\mathbf{x})=M_0(\mathbf{x}).\]
 \end{enumerate}
   \end{frame}
\begin{frame}
\begin{enumerate}[2]
\item
Define
  \[V_n=
  \left[
  \begin{array}{ccccc}
    1 & 1 & 1 & \cdots & 1 \\
    x_1 & x_2 & x_3 & \cdots & x_n \\
    x_1^2 & x_2^2 & x_3^2 & \cdots & x_n^2 \\
    \vdots & \vdots & \vdots & \ddots & \vdots \\
    x_1^{n-1} & x_2^{n-1} & x_3^{n-1} & \cdots & x_n^{n-1}\\
  \end{array}
  \right]\]
  We call $V_n$ the \emph{Vandermonde matrix} of order n.\\
  Claim:\[\det V_n=\prod_{1\leq i <j \leq n} \left(x_j-x_i\right).\]
  \end{enumerate}
\end{frame}
\begin{frame}{Question. 4}
\begin{itemize}
    \item \[3^3+4^3+5^3=6^3 \]\\
    \item \[\sqrt{100}=10\]\\
    \item \[\left(a+b \right)^3 =a^3+3a^2 b+3ab^2+b^3\]\\
    \item \[\sum_{k=1}^{n}k = \frac{n(n+1)}{2}\]\\
    \item \[\frac{\pi}{4}=\frac{1}{1}-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\frac{1}{9}-\frac{1}{11}+\dots\]
\end{itemize}
\end{frame}
\begin{frame}{Remaining parts of Ques.4}
  \begin{itemize}
```

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```latex
  \begin{itemize}
    \item \[\cos\theta=\sin(90^\circ-\theta)\]\\
    \item \[e^{i\theta}=\cos\theta+i\sin\theta\]\\
    \item \[\lim_{\theta\rightarrow\infty}\frac{\sin\theta}{\theta}=1\]\\
    \item \[\lim_{x \rightarrow\infty}\frac{\pi(x)}{x/\log x}=1\]\\
    \item \[\int_{-\infty}^{\infty}e^{-x^2}dx = \sqrt{\pi}\]
  \end{itemize}
\end{frame}
\begin{frame}{Question 5}
\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 > a$, and  $c+a > b$.\\
    \item The area of a triangle with side lengths a, b, c is given by \emph{Heron's forumla}:
    \[\mathbf{A}= \sqrt{s(s-a)(s-b)(s-c)},\]
    where \emph{s} is the semiperimeter (a+b+c)/2.
    \item The volume of a regular tetrahedron of edge length 1 is $\sqrt{2}/12$.\\
    \item The quadratic equation $ ax^2+bx+c $ = 0 has roots \[r_1,r_2=\frac{-b\pm \sqrt{b^2-4ac}}{2a}.\]
\end{itemize}
\end{frame}
\begin{frame}{Remaining parts of Ques.5}
    \begin{itemize}
        \item The \emph{derivative} of a function \emph{f} , denoted \emph{$f'$} , is defined by \[f'(x)=\lim_{h\rightarrow 0} \frac{f(x+h)-f(x)}{h}.\]\\
        \item A real-valued function \emph{f} is \emph{convex} on an interval \emph{I} if \[f(\lambda x + (1-\lambda)y)\le\lambda f(x)+(1-\lambda)f(y),\]
        for all $x,y$ \(\in I\: and\) \( 0\le\lambda\le 1\).\\
        \item The general solution to the differnetial equation \[y''-3y'+2y=0\] is\[y=C_1e^x+C_2e^{2x}.\]
    \end{itemize}
\end{frame}
```

```latex
\begin{frame}{Remaining parts of Ques.5}
  \begin{itemize}
      \item The \emph{Fermat number} $F_n$ is defined as \[F_n=2^{2^n} ,n \ge 0.\]
  \end{itemize}
\end{frame}
\begin{frame}{Question 6}
\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 \[\begin{vmatrix}a & b\\c & d \end{vmatrix}= ad-bc\]
    \item \[R_\theta = \begin{bmatrix} \cos\theta & -\sin\theta\\ \sin\theta & \quad\cos\theta\end{bmatrix}\]
\end{itemize}
\end{frame}
\begin{frame}{ Remaining parts of Ques.6}
\begin{itemize}
    \item \[\begin{vmatrix}\textbf{i}&\textbf{j}&\textbf{k}\\a_1&a_2&a_3\\b_1&b_2&b_3\end{vmatrix}=\begin{vmatrix}a_2&a_3\\b_2&b_3\end{vmatrix}\textbf{i}-\begin{vmatrix}a_1&a_3\\b_1&b_3\end{vmatrix}\textbf{j}+\begin{vmatrix}a_1&a_2\\b_1&b_2\end{vmatrix}\textbf{k}\]
    \item \[\begin{bmatrix}a_{11}&a_{12}\\a_{21}&a_{22}\end{bmatrix}\begin{bmatrix}b_{11}&b_{12}\\b_{21}&b_{22}\end{bmatrix}=\begin{bmatrix}a_{11}b_{11}+a_{12}b_{22}&a_{11}b_{12}+a_{12}b_{22}\\a_{21}b_{11}+a_{22}b_{21}&a_{21}b_{12}+a_{22}b_{22}\end{bmatrix}\]
\item $$f(x)= \left\{\begin{array}{lc}
    -x^2 & x < 0\\
    x^2 ,& 0\leq x \leq 2\\
    4, & x > 2
\end{array}\right.$$
\end{itemize}
\end{frame}
\begin{frame}{Question 7(1)}
    \begin{align*}
     1+2 &=3\\
```

```latex
    \begin{align*}
     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{align*}
\end{frame}
\begin{frame}{Question 7(2)}
   \begin{align*}
       (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{align*}
\end{frame}
\begin{frame}{Question 7(3)}
\begin{align*}
    \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{align*}
     \end{frame}
     \begin{frame}{Question 7(4)}
     \begin{align*}
         \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}\\
```

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\end{frame}
\begin{frame}{Question 7(3)}
\begin{align*}
    \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{align*}
     \end{frame}
     \begin{frame}{Question 7(4)}
     \begin{align*}
         \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{align*}
     \end{frame}
     \begin{frame}
     \vfill
     \centering
     \shadowbox{
      \fontsize{45}{42}\selectfont\rotatebox{0}{\color{red}Thank You!}}
\includegraphics[angle=10,width=1.5in,height=1.5in]{smiley.png}
     \end{frame}
\end{document}
```

Document

Shveta

College Roll no. - MAT/20/132
University Roll no. - 20044563057

Mata Sundri College for Women
(University of Delhi)

1. Let $\mathbf{x} = (x_1, \ldots, x_n)$, where the x_i are non-negative 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

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

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

Claim:

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

2. Define

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

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

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

- $$3^3 + 4^3 + 5^3 = 6^3$$

- $$\sqrt{100} = 10$$

- $$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

- $$\sum_{k=1}^{n} k = \frac{n(n+1)}{2}$$

- $$\frac{\pi}{4} = \frac{1}{1} - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} + \dots$$

Remaining parts of Ques.4

- $$\cos\theta = \sin(90^\circ - \theta)$$
- $$e^{i\theta} = \cos\theta + i\sin\theta$$
- $$\lim_{\theta\to\infty} \frac{\sin\theta}{\theta} = 1$$
- $$\lim_{x\to\infty} \frac{\pi(x)}{x/\log x} = 1$$
- $$\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}$$

Question 5

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

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

  where s is the semiperimeter (a+b+c)/2.
- The volume of a regular tetrahedron of edge length 1 is $\sqrt{2}/12$.
- The quadratic equation $ax^2 + bx + c = 0$ has roots

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

Remaining parts of Ques.5

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

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

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

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

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

- The general solution to the differnetial equation

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

  is

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

Remaining parts of Ques.5

- The *Fermat number* F_n is defined as

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

Question 6

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

Remaining parts of Ques.6

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

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

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

Question 7(1)

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

Question 7(2)

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

Question 7(3)

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

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

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

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

$$= \frac{6}{\pi^2}$$

Thank You!