```latex
\documentclass{beamer}
\usepackage[utf8]{inputenc}
\usepackage{graphicx}
\usetheme{Berlin}
\title{Assignment2}
\author{\textbf{Shalini Singla\\
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\institute{\textbf{\textbf{{MATA SUNDRI COLLEGE FOR WOMEN}}\\
\textbf{UNIVERSITY OF DELHI}}}
\date{}
\usecolortheme{beaver}
\begin{document}
\begin{frame}
\begin{center}
\titlepage
\end{center}
\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 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
    \[M_0(\mathbf{x})=\left(x_1x_2 \ldots x_n\right)^{1/n}.\]
    We call $M_r(\mathbf{x})$ the \emph{$r$th power mean} of $\mathbf{x}$.\\
    Claim:
    $$\lim_{r\rightarrow \infty}M_r(\mathbf{x})= M_0(\mathbf{x}).$$

\end{itemize}
\end{frame}
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\begin{frame}{EXAMPLE-9.5 PART-2}
\begin{itemize}
    \item 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{Vandermonde matrix} of order $n$.
Claim:
\[
\det V_n = \prod_{1 \leq i < j \leq n}(x_j-x_i).
\]

\end{itemize}

\end{frame}

\begin{frame}{QUESTION-4 Make the following equations.}
\begin{itemize}
     \item \[3^3+4^3+5^3=6^3 \]
     \item \[\sqrt{100}=10 \]
     \item \[(a+b)^3=a^3+3a^2b+3ab^2+b^3 \]
     \item \[\sum^{n}_{k=1} k=\frac{n(n+1)}{2} \]
     \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}{Question-4 Remaining parts}
\begin{itemize}
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\end{frame}

\begin{frame}{Question-4 Remaining parts}
\begin{itemize}
    \item \[\cos\theta=\sin(90^\circ-\theta) \]
    \item \[e^{i\theta}=cos\theta+isin\theta \]
    \item \[\lim_{\theta\rightarrow0}\frac{sin\theta}{\theta}=1 \]
    \item \[\lim_{x\rightarrow\infty}\frac{\pi(x)}{\frac{x}{logx}}=1 \]
    \item \[\int_{-\infty}^{\infty} e^{-x^2}dx=\sqrt{\pi} \]
\end{itemize}
\end{frame}

\begin{frame}{QUESTION-5:Typeset the following equations}
\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 formula}:
    \[A=\sqrt{s(s-a)(s-b)(s-c)}, \]
    where $s$ is the semiperimeter $\frac{(a+b+c)}{2}$.
    \item The volume of a regular tetrahedron of edge length 1 is $\frac{\sqrt{2}}{12}.$
\end{itemize}
\end{frame}

\begin{frame}{QUESTION-5: Remaining parts}
\begin{itemize}
    \item The quadratic equation $ax^2+bx+c=0$ has roots
    \[r_1,r_2=\frac{-b\pm\sqrt{b^2-4ac}}{2a}.
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```latex
    \]
    \item The \emph{derivative} of a function \emph{f}, denoted \emph{f'}, is defined by
    \[f'(x)=\lim_{h\rightarrow0}\frac{f(x+h)-f(x)}{h}.\]
    \item A real-valued function \emph{f} is \emph{convex} on an interval \emph{I} if
    \[f(\lambda x+(1-\lambda)y)\leq \lambda f(x)+(1-\lambda)f(y),\]
    for all $x$ , $y \in I$ and $0\leq \lambda\leq1.$
\end{itemize}
\end{frame}

\begin{frame}{QUESTION-5: Remaining parts}
\begin{itemize}
    \item The general solution to the differential equation
    \[y"-3y'+2y=0\]
    is
    \[y=C_1e^x+C_2e^{2x}.\]
    \item The \emph{Fermat number} $F_n$ is defined as\\
   \[F_n=2^{2^n},n\geq0.\]
\end{itemize}
\end{frame}

\begin{frame}{QUESTION-6 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 \[R_\theta=\left[\begin{array}{cc}
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        cos\theta&-sin\theta \\
        sin\theta& cos\theta
    \end{array}\right]\]
\end{itemize}
\end{frame}

\begin{frame}{QUESTION-6:Remaining parts}
\begin{itemize}
    \item \[\left|\begin{array}{ccc}
\textbf{i}   &\textbf{j}  &\textbf{k}\\
        a_1&b_1&c_1\\
        a_2&b_2&c_2
    \end{array}\right|=\left|\begin{array}{cc}
        a_2 & a_3 \\
        b_2 & b_3
    \end{array}\right|\textbf{i}-\left|\begin{array}{cc}
       a_1 & a_3 \\
       b_1 & b_3
    \end{array}\right|\textbf{j}+\left|\begin{array}{cc}
       a_1 & a_2 \\
       b_1 & b_2
    \end{array}\right|\textbf{k}\]
    \item \[\left[\begin{array}{cc}
        a_{11} & a_{12}\\
        a_{21} & a_{22}
    \end{array}\right]\left[\begin{array}{cc}
        b_{11} & b_{12}\\
        b_{21} & b_{22}
    \end{array}\right]=\left[\begin{array}{cc}
        a_{11}b_{11}+a_{12}b_{21} & a_{11}b_{12}+a_{12}b_{22} \\
        a_{21}b_{11}+a_{22}b_{21} & a_{21}b_{21}+a_{22}b_{22}
    \end{array}\right]\]
    \item \[f(x)=\left\{\begin{array}{ccc}
        -x^2, & x<0 \\
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            -x^2, & x<0 \\
            x^2, & 0\leq x \leq 2\\
            4, & x>2
    \end{array}\right.\]
\end{itemize}
\end{frame}
\begin{frame}{QUESTION-7}
\begin{block}{Part-1}
\end{block}
\begin{eqnarray*}
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{eqnarray*}
\end{frame}
\begin{frame}{Question-7}
\begin{block}{Part-2}
\end{block}
\begin{eqnarray*}
(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{eqnarray*}
\end{frame}

\begin{frame}{QUESTION-7}
\begin{block}{Part-3}
\end{block}
\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
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&=&\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{frame}

\begin{frame}{QUESTION-7}
\begin{block}{Part-4}
\end{block}
\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{frame}

\begin{frame}
\includegraphics[width=10cm,height=7cm]{IMG_20211020_102749.jpg}
\end{frame}

\end{document}

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# Assignment2

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**MATA SUNDRI COLLEGE FOR WOMEN**
**UNIVERSITY OF DELHI**

# EXAMPLE-9.5: PART-1

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

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

and

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

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

$$\lim_{r \to \infty} M_r(\mathrm{x}) = M_0(\mathrm{x}).$$

# EXAMPLE-9.5 PART-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 *Vandermonde 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.

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

# Question-4 Remaining parts

- $$\cos\theta = \sin(90^\circ - \theta)$$
- $$e^{i\theta} = cos\theta + isin\theta$$
- $$\lim_{\theta\to 0}\frac{sin\theta}{\theta} = 1$$
- $$\lim_{x\to\infty}\frac{\pi(x)}{\frac{x}{logx}} = 1$$
- $$\int_{-\infty}^{\infty} e^{-x^2}dx = \sqrt{\pi}$$

# QUESTION-5:Typeset the following equations

- 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 formula*:

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

  where $s$ is the semiperimeter $\frac{(a+b+c)}{2}$.
- The volume of a regular tetrahedron of edge length 1 is $\frac{\sqrt{2}}{12}$.

## QUESTION-5: Remaining parts

- 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 $f'$, 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 $0 \leq \lambda \leq 1$.

# QUESTION-5: Remaining parts

- The general solution to the differential equation

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

is

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

- 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.

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

# QUESTION-6:Remaining parts

- $$\begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \end{vmatrix} = \begin{vmatrix} a_2 & a_3 \\ b_2 & b_3 \end{vmatrix} \mathbf{i} - \begin{vmatrix} a_1 & a_3 \\ b_1 & b_3 \end{vmatrix} \mathbf{j} + \begin{vmatrix} a_1 & a_2 \\ b_1 & b_2 \end{vmatrix} \mathbf{k}$$

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

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

# QUESTION-7

## Part-1

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

# Question-7

## Part-2

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

# QUESTION-7

## Part-3

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

## QUESTION-7

### Part-4

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


Thank you