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1 \documentclass{beamer}
2 \usepackage[utf8]{inputenc}
3 \usepackage{graphicx}
4 \usetheme{Berlin}
5 \title{Assignment2}
6 \author{\textbf{Shalini Singla}\
7 College Rollno.-MAT/20/66\
8 University Rollno.-20044563012}}
9 \institute{\textbf{\textbf{MATA SUNDRI
COLLEGE FOR WOMEN}}}\
10 \textbf{UNIVERSITY OF DELHI}}
11 \date{}
12 \usecolortheme{beaver}
13 \begin{document}
14 \begin{frame}
15 \begin{center}
16 \titlepage
17 \end{center}
18 \end{frame}
19 \begin{frame}{EXAMPLE-9.5: PART-1}
20 \begin{itemize}
21 \item Let
22 \mathbf{x}=(x_{1}, \ldots, x_{n}), where
23 the $x_i$ are non-negative real numbers.
24 Set
25 \mathbf{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\}, \}
26 and
27 \mathbf{M}_0(\mathbf{x})=\left(x_1x_2 \cdots
x_n\right)^{1/n}. \}
28 We call $\mathbf{M}_r(\mathbf{x})$ the \emph{$r$th
power mean} of $\mathbf{x}$. \}
29 Claim:
30 \lim_{r \rightarrow
\infty} \mathbf{M}_r(\mathbf{x})=
\mathbf{M}_0(\mathbf{x}). \}
31 \end{itemize}
32 \end{frame}

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31 ▾ \begin{frame}{EXAMPLE-9.5 PART-2}
32 ▾ \begin{itemize}
33     \item Define
34     \[V_n=\left[\begin{array}{ccccc}
35     1 & 1 & 1 & \ldots & 1\\
36     x_1 & x_2 & x_3 & \ldots & x_n\\
37     x_1^2 & x_2^2 & x_3^2 & \ldots & x_n^2\\
38     \vdots & \vdots & \vdots & \ddots & \vdots\\
39     x_1^{n-1} & x_2^{n-1} & x_3^{n-1} & \ldots & x_n^{n-1}
40     \end{array}\right]\]
41 We call  $V_n$  the Vandermonde matrix
42 of order  $n$ .
43 Claim:
44 \[
45 \det V_n = \prod_{1 \leq i < j \leq n} (x_j - x_i).
46 \]
47 \end{itemize}
48
49 \end{frame}
50
51 ▾ \begin{frame}{QUESTION-4 Make the following
52 equations.}
53 \begin{itemize}
54 \item \[3^3+4^3+5^3=6^3 \]
55 \item \[\sqrt{100}=10 \]
56 \item \[(a+b)^3=a^3+3a^2b+3ab^2+b^3 \]
57 \item \[\sum_{k=1}^n k=\frac{n(n+1)}{2} \]
58 \item \[\frac{\pi}{4}=\frac{1}{1}-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\frac{1}{9}
59 -\frac{1}{11}+\cdots \]
60 \end{itemize}
61 \end{frame}
62 ▾ \begin{frame}{Question-4 Remaining parts}
63 \begin{itemize}

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59 \end{frame}
60
61 \begin{frame}{Question-4 Remaining parts}
62 \begin{itemize}
63 \item  $\cos\theta = \sin(90^\circ - \theta)$ 
64 \item  $e^{i\theta} = \cos\theta + i\sin\theta$ 
65 \item  $\lim_{\theta \rightarrow 0} \frac{\sin\theta}{\theta} = 1$ 
66 \item  $\lim_{x \rightarrow \infty} \frac{\pi(x)}{\frac{x}{\log x}} = 1$ 
67 \item  $\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}$ 
68 \end{itemize}
69 \end{frame}
70
71 \begin{frame}{QUESTION-5: Typeset the following equations}
72 \begin{itemize}
73 \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  $c+a > b$ .
74 \item The area of a triangle with side lengths  $a$ ,  $b$ ,  $c$  is given by Heron's formula:
75  $A = \sqrt{s(s-a)(s-b)(s-c)}$ ,
76 where  $s$  is the semiperimeter  $\frac{a+b+c}{2}$ .
77 \item The volume of a regular tetrahedron of edge length 1 is  $\frac{\sqrt{2}}{12}$ .
78 \end{itemize}
79 \end{frame}
80
81 \begin{frame}{QUESTION-5: Remaining parts}
82 \begin{itemize}
83 \item The quadratic equation  $ax^2 + bx + c = 0$  has roots
84  $r_1, r_2 = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ .

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\]
85 \item The \emph{derivative} of a function
\emph{f}, denoted \emph{f'}, is defined
by
86 \[f'(x)=\lim_{h\rightarrow 0}\frac{f(x+h)-
f(x)}{h}.\]
87 \item A real-valued function \emph{f} is
\emph{convex} on an interval \emph{I} if
88 \[f(\lambda x+(1-\lambda)y)\leq \lambda
f(x)+(1-\lambda)f(y),\]
89 for all  $x, y \in I$  and  $0 \leq
\lambda \leq 1$ .
90 \end{itemize}
91 \end{frame}
92
93 \begin{frame}{QUESTION-5: Remaining parts}
94 \begin{itemize}
95 \item The general solution to the
differential equation
96 \[y''-3y'+2y=0\]
97 is
98 \[y=C_1e^x+C_2e^{2x}.\]
99 \item The \emph{Fermat number}  $F_n$  is
defined as\
100 \[F_n=2^{2^n}, n \geq 0.\]
101 \end{itemize}
102 \end{frame}
103
104 \begin{frame}{QUESTION-6 Make the following
equations. Notice the large delimiters.}
105 \begin{itemize}
106 \item \[\frac{d}{dx}\left(\frac{x}{x+1}\r
ight)=\frac{1}{(x+1)^2}\]
107 \item \[\lim_{n \rightarrow \infty}\left(1+
\frac{1}{n}\right)^n=e\]
108 \item \[\left|\begin{array}{cc}
109 a&b\
110 c&d
111 \end{array}\right|=ad-bc\]
112 \item \[R_{\theta}=\left[\begin{array}{cc}
113 \cos\theta&\sin\theta
\end{array}\right]\]

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113     cos\theta&-sin\theta \\
114     sin\theta& cos\theta
115     \end{array}\right] \\
116 \end{itemize}
117 \end{frame}
118
119 \begin{frame}{QUESTION-6:Remaining parts}
120 \begin{itemize}
121     \item \left[\begin{array}{ccc}
122 \textbf{i} & \textbf{j} & \textbf{k} \\
123 a_1&b_1&c_1 \\
124 a_2&b_2&c_2 \\
125 \end{array}\right]=\left[\begin{array}{cc}
126 a_2 & a_3 \\
127 b_2 & b_3 \\
128 \end{array}\right]\textbf{i}-\left[\begin{array}{cc}
129 a_1 & a_3 \\
130 b_1 & b_3 \\
131 \end{array}\right]\textbf{j}+\left[\begin{array}{cc}
132 a_1 & a_2 \\
133 b_1 & b_2 \\
134 \end{array}\right]\textbf{k} \\
135 \item \left[\begin{array}{ccc}
136 a_{11} & a_{12} \\
137 a_{21} & a_{22} \\
138 \end{array}\right]\left[\begin{array}{cc}
139 b_{11} & b_{12} \\
140 b_{21} & b_{22} \\
141 \end{array}\right]=\left[\begin{array}{cc}
142 a_{11}b_{11}+a_{12}b_{21} & \\
143 a_{11}b_{12}+a_{12}b_{22} \\
144 a_{21}b_{11}+a_{22}b_{21} & \\
145 a_{21}b_{21}+a_{22}b_{22} \\
146 \end{array}\right] \\
147 \item \left[f(x)=\begin{array}{ccc}
148 -x^2, & & x < 0 \\
149 \end{array}\right]

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146         -x^2, & x<0 \\
147         x^2, & 0\leq x \leq 2\\
148         4, & x>2
149     \end{array}\right.\\
150 \end{itemize}
151 \end{frame}
152 \begin{frame}{QUESTION-7}
153 \begin{block}{Part-1}
154 \end{block}
155 \begin{eqnarray*}
156 1+2 & = & 3\\
157 4+5+6 & = & 7+8\\
158 9+10+11+12 & = & 13+14+15\\
159 16+17+18+19+20 & = & 21+22+23+24\\
160 25+26+27+28+29+30 & = & 31+32+33+34+35
161 \end{eqnarray*}
162 \end{frame}
163 \begin{frame}{Question-7}
164 \begin{block}{Part-2}
165 \end{block}
166 \begin{eqnarray*}
167 (a+b)^2 & = & (a+b)(a+b) \\
168 & = & (a+b)a + (a+b)b \\
169 & = & a(a+b) + b(a+b) \\
170 & = & a^2 + ab + ba + b^2 \\
171 & = & a^2 + ab + ab + b^2 \\
172 & = & a^2 + 2ab + b^2
173 \end{eqnarray*}
174 \end{frame}
175
176 \begin{frame}{QUESTION-7}
177 \begin{block}{Part-3}
178 \end{block}
179 \begin{eqnarray*}
180 \tan(\alpha + \beta
+ \gamma) = \frac{\tan(\alpha
+ \beta) + \tan\{\gamma\}}{1 - \tan(\alpha
+ \beta)\tan\{\gamma\}} \\
181 & = & \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\}} \\

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182 &=&\frac{\tan{\alpha}+\tan{\beta}+(1-\tan{\alpha}\tan{\beta})\tan{\gamma}}{1-\tan{\alpha}\tan{\beta}-\tan{\alpha}\tan{\beta}\tan{\gamma}}\frac{1-\tan{\alpha}\tan{\beta}-\tan{\alpha}\tan{\beta}\tan{\gamma}}{1-\tan{\alpha}\tan{\beta}-\tan{\alpha}\tan{\beta}\tan{\gamma}}\\
183 &=&\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}}
184 \end{eqnarray*}
185 \end{frame}
186
187 \begin{frame}{QUESTION-7}
188 \begin{block}{Part-4}
189 \end{block}
190 \begin{eqnarray*}
191 \prod_{p}\left(1-\frac{1}{p^2}\right)&=&\prod_{p}\frac{1}{1+\frac{1}{p^2}+\frac{1}{p^4}+\dots}\\
192 &=&\left(\prod_{p}\left(1+\frac{1}{p^2}+\frac{1}{p^4}+\dots\right)\right)^{-1}\\
193 &=&\left(1+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+\dots\right)^{-1}\\
194 &=&\frac{6}{\pi^2}
195 \end{eqnarray*}
196 \end{frame}
197
198 \begin{frame}
199 \includegraphics[width=10cm,height=7cm]{IMG_20211020_102749.jpg}
200 \end{frame}
201
202 \end{document}
203

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## Assignment2

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## EXAMPLE-9.5: PART-1

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

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

and

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

We call  $M_r(x)$  the *r*th power mean of  $x$ .

Claim:

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

## 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.



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



$$\sqrt{100} = 10$$



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



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



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



## Question-4 Remaining parts



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



$$e^{i\theta} = \cos\theta + i\sin\theta$$



$$\lim_{\theta \rightarrow 0} \frac{\sin\theta}{\theta} = 1$$



$$\lim_{x \rightarrow \infty} \frac{\pi(x)}{\frac{x}{\log x}} = 1$$



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

## 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

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

- 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.



$$\frac{d}{dx} \left( \frac{x}{x+1} \right) = \frac{1}{(x+1)^2}$$



$$\lim_{n \rightarrow \infty} \left( 1 + \frac{1}{n} \right)^n = e$$



$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$



$$R_\theta = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$$

## QUESTION-6:Remaining parts



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



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



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



## QUESTION-7

### Part-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

### 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

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

## QUESTION-7

### Part-4

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

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Thank  
you