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1 \documentclass[aspectratio=1610]{beamer}
2 \usepackage[utf8]{inputenc}
3 \usepackage{Bergen}
4 \usecolortheme{spruce}
5
6 \usepackage{xcolor}
7 \usepackage{graphicx}
8 \usepackage[T1]{fontenc}
9 \usepackage{tgtermes}
10 \title{\textbf{ASSIGNMENT}}
11 \institute{\large \textcolor{olive}{Mata Sundri College For Women}}{\small \textcolor{red}{University of Delhi}}
12 \author{\Large \textcolor{teal}{\fontfamily{qtm}\selectfont \Ishita}}{\small \textcolor{violet}{MAT/20/98}} \and{\small \textcolor{violet}{20044563024}}
13 \date{}
14 \begin{document}
15 \begin{frame}
16 \titlepage
17 \end{frame}
18 \begin{frame}
19 1. Let  $x=(x_1, \dots, x_n)$ , where the  $x_i$  are non negative real numbers. Set
    
$$M_r(x) = \left( \frac{x_1^r + x_2^r + \dots + x_n^r}{n} \right)^{1/r}, r \in \mathbb{R} \setminus \{0\}$$
, and  $M_0(x) = (x_1 x_2 \dots x_n)^{1/n}$ .
    20 We call  $M_r(x)$  the  $r$ th power mean of  $x$ .
    21 Claim :  $\lim_{r \rightarrow 0} M_r(x) = M_0(x)$ .
    22 \end{frame}
    23 \begin{frame}
    24 2. Define
    25 
$$V_n = \begin{pmatrix} 1 & & & \\ & \ddots & & \\ & & \ddots & \\ & & & \ddots & \\ & & & & 1 \end{pmatrix}$$

    26 We call  $V_n$  the Vandermonde matrix of order  $n$ .
    27 Claim:
    28 
$$\det V_n = \prod_{1 \leq i < j \leq n} (x_j - x_i)$$

    29 \end{frame}
    30 \begin{frame}{Q4. Make the following equations.}
    31 \begin{itemize}
    32 \item  $3^3 + 4^3 + 5^3 = 6^3$ 
    33 \item  $\sqrt{100} = 10$ 
    34 \item  $(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$ 
    35 \item  $\sum_{k=1}^n k = \frac{n(n+1)}{2}$ 
    36 \item  $\frac{d}{dx} \int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}$ 
    37 \end{itemize}
    38 \end{frame}
    39 \begin{frame}{Remaining parts of Q4}
    40 \begin{itemize}
    41 \item  $\cos \theta = \sin(90^\circ - \theta)$ 
    42 \item  $e^{i\theta} = \cos \theta + i \sin \theta$ 
    43 \item  $\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$ 
    44 \item  $\lim_{x \rightarrow \infty} \frac{\pi(x)}{x \log x} = 1$ 
    45 \item  $\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}$ 
    46 \end{itemize}
    47 \end{frame}
    48 \begin{frame}{Q5. TypeSet the following sentences.}
    49 \begin{itemize}
    50 \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  $c+a > b$ .
    51 \item The area of a triangle with side lengths  $a, b, c$  is given by Heron's formula :
    52 
$$S = \sqrt{s(s-a)(s-b)(s-c)}$$

    53 where  $s$  is the semi-perimeter  $(a+b+c)/2$ .
    54 \item The volume of a regular tetrahedron of edge length 1 is  $\frac{\sqrt{2}}{12}$ .
    55 \item The Quadratic equation  $ax^2 + bx + c = 0$  has roots
    56 
$$r_1, r_2 = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

    57 \end{itemize}
    58 \end{frame}
    59 \begin{frame}{Remaining parts of Q5}
    60 \begin{itemize}
    61 \item The derivative of a function  $f$ , denoted  $f'$ , is defined by  $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ 
    62 \item A real-valued function  $f$  is convex on interval  $I$  if  $f(\lambda x + (1-\lambda)y) \leq \lambda f(x) + (1-\lambda)f(y)$  for all  $x, y \in I$  and  $0 \leq \lambda \leq 1$ 
    63 \item The general solution to the differential equation
    64 
$$y'' - 3y' + 2y = 0$$

    65 is  $y = C_1 e^{2x} + C_2 e^{x}$ 
    66 \item The Fermat Number  $F_n$  is defined as  $F_n = 2^{2^n} + 1, n \geq 0$ 
    67 \end{itemize}
    68 \end{frame}
    69 \begin{frame}{Q6. Make the following equations. Notice the large delimiters.}
    70 \begin{itemize}
    71 \item  $\frac{d}{dx} \left( \frac{x}{x+1} \right) = \frac{1}{(x+1)^2}$ 
    72 \item  $\lim_{n \rightarrow \infty} \left( 1 + \frac{1}{n} \right)^n = e$ 
    73 \item  $\left| \begin{matrix} a & b \\ c & d \end{matrix} \right| = ad - bc$ 
    74 \item  $R_\theta = \begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix}$ 
    75 \end{itemize}
    76 \end{frame}
    77 \begin{frame}{Remaining parts of Q6}
    78 \begin{itemize}
    79 \end{itemize}
    80 \end{frame}

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79 \item $$\frac{d}{dx}\left(\frac{x}{x+1}\right)=\frac{1}{(x+1)^2}$$
80 \item $$\lim_{n\rightarrow\infty}\left(1+\frac{1}{n}\right)^n=e$$
81 \item $$\left|\begin{array}{cc}
82 a&b\\
83 c&d\end{array}\right|=ad-bc$$
84 \item $$R_{\theta}=\left(\begin{array}{cc}
85 \cos\theta&-\sin\theta\\
86 \sin\theta&\cos\theta
87 \end{array}\right)$$
88 \end{itemize}
89 \end{frame}
90 \begin{frame}{Remaining parts of Q6}
91 \begin{itemize}
92 \item $$\left|\begin{array}{ccc}
93 \text{tbf}{i}&\text{tbf}{j}&\text{tbf}{k}\\
94 a_1&a_2&a_3\\
95 b_1&b_2&b_3\end{array}\right|=\left|\begin{array}{cc}
96 a_2&a_3\\
97 b_2&b_3\end{array}\right|\text{tbf}{i}-\left|\begin{array}{cc}
98 a_1&a_3\\
99 b_1&b_3\end{array}\right|\text{tbf}{j}+\left|\begin{array}{cc}
100 a_1&a_2\\
101 b_1&b_2\end{array}\right|\text{tbf}{k}$$
102
103 \item $$\left(\begin{array}{cc}
104 a_{11}&a_{12}\\
105 a_{21}&a_{22}\end{array}\right)\left(\begin{array}{cc}
106 b_{11}&b_{12}\\
107 b_{21}&b_{22}\end{array}\right)=\left(\begin{array}{cc}
108 a_{11}b_{11}+a_{12}b_{21}&a_{11}b_{12}+a_{12}b_{22}\\
109 a_{21}b_{11}+a_{22}b_{21}&a_{21}b_{12}+a_{22}b_{22}\end{array}\right)$$
110
111 \item $$f(x)=\left(\begin{array}{l}
112 x^2, \ 0 \leq x \leq 2 \\
113 4-x, \ x > 2\end{array}\right)$$
114 \end{itemize}
115 \end{frame}
116 \begin{frame}{Q7. Make the following multi-line equations.}
117 \begin{eqnarray*}
118 1+2=3 \\
119 4+5+6=7+8 \\
120 9+10+11+12=13+14+15 \\
121 16+17+18+19+20=21+22+23+24 \\
122 25+26+27+28+29+30=31+32+33+34+35
123 \end{eqnarray*}
124 \end{frame}
125 \end{frame}
126 \begin{frame}{Q7 contd...}
127 \begin{eqnarray*}
128 (a+b)^2=(a+b)(a+b) \\
129 =a(a+b)+b(a+b) \\
130 =a^2+ab+ba+b^2 \\
131 =a^2+2ab+b^2 \\
132 \end{eqnarray*}
133 \end{frame}
134 \begin{frame}{Q7 contd...}
135 \begin{eqnarray*}
136 \tan(\alpha+\beta)=\frac{\tan\alpha+\tan\beta}{1-\tan\alpha\tan\beta} \\
137 \cot(\alpha+\beta)=\frac{\cot\alpha\cot\beta-1}{\cot\alpha+\cot\beta} \\
138 \tan(\alpha-\beta)=\frac{\tan\alpha-\tan\beta}{1+\tan\alpha\tan\beta} \\
139 \cot(\alpha-\beta)=\frac{\cot\alpha\cot\beta+1}{\cot\alpha-\cot\beta} \\
140 \tan\alpha\tan\beta=\frac{\tan(\alpha+\beta)-\tan\alpha-\tan\beta}{1-\tan\alpha\tan\beta} \\
141 \cot\alpha\cot\beta=\frac{\cot(\alpha+\beta)+\cot\alpha+\cot\beta}{1-\cot\alpha\cot\beta} \\
142 \end{eqnarray*}
143 \end{frame}
144 \begin{frame}{Q7 contd...}
145 \begin{eqnarray*}
146 \prod_{p=1}^n p! = \prod_{p=1}^n p^{1+2+\dots+n} \\
147 = \prod_{p=1}^n p^{\frac{n(n+1)}{2}} \\
148 = \prod_{p=1}^n p^{\frac{n(n+1)}{2}} \\
149 \end{eqnarray*}
150 \end{frame}
151 \end{frame}
152 \begin{frame}
153 \includegraphics[scale=1.2]{images.png}
154 \end{frame}
155 \end{document}
156

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ASSIGNMENT

Who?

Ishita

MAT/20/98

20044563024

From?

Mata Sundri College For Women
University of Delhi

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

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

and

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

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

Claim :

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

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 *Vandermonde matrix* of order n .

Claim:

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

Q4. Make the following equations.

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

$$\sqrt{100} = 10$$

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

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

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

Remaining parts of Q4

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

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

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

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

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

Q5. TypeSet the following sentences.

- Positive numbers $a, b,$ and c are the side lengths of a triangle if and only if $a + b > c, b + c > a,$ 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 the semi-perimeter $(a+b+c)/2.$

- 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 Q5

- 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 interval I if

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

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

- The general solution to the differential equation

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

is

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

- 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.

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

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

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

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

Remaining parts of Q6

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

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

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

Q7. Make the following multi-line equations.

$$1 + 2 = 3$$

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

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

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

$$25 + 26 + 27 + 28 + 29 + 30 = 31 + 32 + 33 + 34 + 35$$

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

Q7 cntd...

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

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



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