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Assignment

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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:

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

■ 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:

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

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QUESTION 4:

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

$$\sqrt{100} = 10$$

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

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

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

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

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

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

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

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

QUESTION 5:

Positive numbers a , b and c are 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 length 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 $\frac{\sqrt{2}}{12}$.

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

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

The 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 $0 \leq \lambda \leq 1$.

The general solution of a differential equation

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

is

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

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The *Fermat* number F_n is defined as $F_n = 2^{2^n}$, $n \geq 0$

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QUESTION 6:

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

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

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

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

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

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

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

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QUESTION 7 :

$$1 + 2 = 3$$

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

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

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

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

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

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

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

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Assignment

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1 \documentclass{beamer}
2 \usepackage[utf8]{inputenc}
3 \usepackage{xcolor}
4 \usepackage{framed}
5 \usepackage{fancybox}
6 \usepackage{graphicx}
7
8 \title{Assignment}
9 \author{Name:Ritika Phore\University Roll No.-20044563028}
10 \institute{Mata Sundri College For Women\University of Delhi}
11 \date{}
12 \usetheme{Berlin}
13 %\usecolortheme{beaver}
14 \begin{document}
15 \begin{frame}
16 \titlepage
17 \end{frame}
18
19 \begin{frame}{EXAMPLE-9.5}
20 \begin{framed}
21 \begin{block}{Part 1}
22 %\renewcommand{\labelenumi}{\Alph{enumi}}
23 \begin{itemize}
24 \item Let  $\mathbf{x}=(x_1,\dots,x_n)$ ,
25 where the  $x_i$ s are non-negative real numbers.
26 Set
27 \[
28 M_r(\mathbf{x}) = \left(\frac{x_1^r+x_2^r
29 +\dots+x_n^r}{n}\right)^{1/r},
30 \quad \forall r \in \mathbf{R} \setminus \{0\};

```

```
31 \end{itemize}
32 \end{block}
33 \end{framed}
34 \end{frame}
35 - \begin{frame}{}
36 - \begin{framed}
37 %\begin{enumerate}
38 and
39 \[
40 M_0(\mathbf{x}) = \left( x_1 x_2 \dots x_n \right)^{1/n}.
41 \]
42 We call  $M_r(\mathbf{x})$  the rth power mean
43 of  $\mathbf{x}$ .
44 Claim:
45  $\lim_{r \rightarrow 0} M_r(\mathbf{x}) = M_0(\mathbf{x})$ .
46 %\end{enumerate}
47 \end{framed}
48 \end{frame}
49 - \begin{frame}{}
50 - \begin{framed}
51 %\renewcommand{\labelenumi}{\Alph{enumi}}
52 - \begin{itemize}
53 \item Define
54 \[
55 V_n =
56 \left[
57 - \begin{array}{cccc}
58 1 & 1 & 1 & \dots & 1 \\
59 x_1 & x_2 & x_3 & \dots & x_n \\
60 x_1^2 & x_2^2 & x_3^2 & \dots & x_n^2 \end{array}

```

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EXAMPLE

Part

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```
57 - \begin{array}{ccccc}
58 1 & 1 & 1 & \dots & 1 \\
59 x_1 & x_2 & x_3 & \dots & x_n \\
60 x_1^2 & x_2^2 & x_3^2 & \dots & x_n^2 \\
61 \vdots & \vdots & \vdots & \ddots & \vdots \\
62 x_1^{n-1} & x_2^{n-1} & x_3^{n-1} & \dots & x_n^{n-1} \\
63 \end{array} \\
64 \right]. \\
65 \\
66 We call  $V_n$  the Vandermonde matrix of order  $n$ . \\
67 Claim: \\
68 \\
69  $\det V_n = \prod_{1 \leq i < j \leq n} (x_j - x_i)$ . \\
70 \\
71 \end{itemize} \\
72 \end{framed} \\
73 \end{frame} \\
74 - \begin{frame}{QUESTION 4:} \\
75 - \begin{framed} \\
76 - \begin{center} \\
77  $3^3+4^3+5^3=6^3$  \\
78 \end{center} \\
79 \end{framed} \\
80 - \begin{framed} \\
81 - \begin{center} \\
82  $\sqrt{100}=10$  \\
83 \end{center} \\
84 \end{framed} \\
85 - \begin{framed} \\
86 - \begin{center}
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EXAMPL

Part

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```
84 \end{framed}
85 \begin{framed}
86 \begin{center}
87 \item  $(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$ 
88 \end{center}
89 \end{framed}
90 \end{frame}
91 \begin{frame}{}
92 \begin{framed}
93 
$$\sum_{k=1}^n k = \frac{n(n+1)}{2}$$

94 \end{framed}
95 \begin{framed}
96 
$$\frac{\pi}{4} = \frac{1}{1} - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} + \dots$$

97 \end{framed}
98 \begin{framed}
99 \begin{center}
100 
$$\cos \theta = \sin(90^\circ - \theta)$$

101 \end{center}
102 \end{framed}
103 \end{frame}
104 \begin{frame}{}
105 \begin{framed}
106 \begin{equation}
107 e^{i\theta} = \cos \theta + i \sin \theta
108 \end{equation}
109 \end{framed}
110 \begin{framed}
111 
$$\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$$

112 \end{framed}
```

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```
111 
$$\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$$

112 \end{framed}
113 \begin{framed}
114 
$$\lim_{x \rightarrow \infty} \frac{\pi(x)}{x \log x} = 1$$

115 \end{framed}
116 \end{frame}
117 \begin{frame}{}
118 \begin{framed}
119 
$$\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}$$

120 \end{framed}
121 \end{frame}
122 \begin{frame}(QUESTION 5:)
123 \begin{framed}
124 Positive numbers  $a, b, c$  are side lengths of a triangle if and only if
 $a + b > c$ ,  $b + c > a$ , and  $c + a > b$ .
125 \end{framed}
126 \begin{framed}
127 The area of a triangle with side length  $a, b, c$  is given by Heron's Formula :  $A = \sqrt{s(s-a)(s-b)(s-c)}$  where  $s$  is the semiperimeter  $\frac{a+b+c}{2}$ .
128 \end{framed}
129 \begin{framed} The volume of a regular tetrahedron of edge length 1 is  $\frac{\sqrt{2}}{12}$ .
130 \end{framed}
131 \end{frame}{}
132 \begin{frame}{}
133 \begin{framed}
134 The quadratic equation  $ax^2 + bx + c = 0$  has roots  $r_1, r_2 = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ .
135 \end{framed}
136 \end{frame}
```

Navigation icons

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136 - \begin{framed}
137 The derivative of a function  $f$ , denoted  $f'$ , is defined by
138 
$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

139 \end{framed}
140 - \begin{frame}{}
141 - \begin{framed}
142 The 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  $0 \leq \lambda \leq 1$ .
143 \end{framed}
144 - \begin{framed}
145 The general solution of a differential equation  $yy' - 3y^2 + 2y = 0$  is  $y = C_1 e^x + C_2 e^{2x}$ .
146 \end{framed}
147 \end{frame}
148 - \begin{frame}{}
149 - \begin{framed}
150 The \length{Fermat} number  $F_n$  is defined
151 as  $F_n = 2^{2^n} + 1$ ,  $n \geq 0$ .
152 \end{framed}
153 \end{frame}
154 - \begin{frame}{QUESTION 6;}
155 - \begin{framed}
156 - \begin{center}
157 
$$\frac{d}{dx} \left( \frac{x}{x-1} \right) = \frac{1}{(x-1)^2}$$

158 \end{center}
159 \end{framed}
160 - \begin{framed}
161 - \begin{center}

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162 $$\lim_{n \rightarrow \infty} (1 + \frac{1}{n})^n = e$$\n163 \end{center}\n164 \end{framed}\n165 \end{frame}\n166 \begin{frame}{}\n167 \begin{framed}\n168 \begin{center}\n169 \left[ \begin{array}{lr}\n170 a&b \\ \n171 c&d\n172 \end{array} \right] \text{right} = ad - bc \n173 \end{center}\n174 \end{framed}\n175 \begin{framed}\n176 R_{\theta} = \left[ \begin{array}{lr}\n177 \cos \theta & -\sin \theta \\ \n178 \sin \theta & \cos \theta\n179 \end{array} \right]\n180 \end{framed}\n181 \end{frame}\n182 \begin{frame}{}\n183 \begin{framed}\n184 \left[ \begin{array}{ccc}\n185 i&j&k \\ \n186 a_1&a_2&a_3 \\ \n187 b_1&b_2&b_3\n188 \end{array} \right] \text{right} = \left[ \begin{array}{cc}\n189 a_2&a_3 \\ \n190 b_2&b_3\n191 \end{array} \right] - \left[ \begin{array}{cc}\n
```

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```
189 a_2&a_3\\
190 b_2&b_3
191 \end{array}\right| i - \left| \begin{array}{cc}
192 a_1&a_3\\
193 b_1&b_3
194 \end{array}\right| j + \left| \begin{array}{cc}
195 a_1&a_2\\
196 b_1&b_2
197 \end{array}\right| k \rfloor \\
198 \end{framed}
199 \begin{framed}
200 \left[ \begin{array}{r}
201 a_{11}&a_{12}\\
202 a_{21}&a_{22}
203 \end{array}\right]
204 \left[ \begin{array}{r}
205 b_{11}&b_{12}\\
206 b_{21}&b_{22}
207 \end{array}\right] = \left[ \begin{array}{r}
208 a_{11}b_{11}+a_{12}b_{21}&a_{11}b_{12}+a_{12}b_{22}\\
209 a_{21}b_{11}+a_{22}b_{21}&a_{21}b_{12}+a_{22}b_{22}
210 \end{array}\right] \\
211 \end{framed}
212 \end{frame}
213 \begin{frame}{}
214 \begin{framed}
215 \left[ \left[ \begin{array}{r}
216 -x^2&0 \\
217 x^4&0 \end{array}\right] \leq x \leq 2 \\
218 4&x > 2
```



```
215 \left[\begin{array}{l}
216 -x^2, 0 < x \\
217 x^4, 0 \leq x \leq 2 \\
218 4x, x > 2
219 \end{array}\right.
220 \end{framed}
221 \end{frame}
222 \end{frame}
223 \begin{frame}{QUESTION 7 :}
224 \begin{framed}
225 \begin{eqnarray}
226 1+2&=3 \\
227 4+5+6&=27+8 \\
228 9+10+11+12&=613+14+15 \\
229 16+17+18+19+20&=621+22+23+24 \\
230 25+26+27+28+29+30&=831+32+33+34+35
231 \end{eqnarray}
232 \end{framed}
233 \end{frame}
234 \begin{frame}{}
235 \begin{framed}
236 \begin{eqnarray}
237 (a+b)^2&=(a+b)(a+b) \\
238 &=a(a+b)+b(a+b) \\
239 &=a^2+ab+ba+b^2 \\
240 &=a^2+ab+ab+b^2 \\
241 &=a^2+2ab+b^2 \\
242 \end{eqnarray}
243 \end{framed}
244 \end{frame}
```

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Navigation sidebar with arrows and a partial view of a document page on the right.

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```

245 \end{frame}
246 \begin{frame}{}
247 \begin{framed}
248 \begin{eqnarray}
249 \tan(\alpha+\beta+\gamma)&=&\frac{\tan(\alpha+\beta)+\tan\gamma}{1-\tan(\alpha+\beta)\tan\gamma} \\
250 &=&\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} \\
251 &=&\frac{\tan\alpha+\tan\beta+(1-\tan\alpha\tan\beta)\tan\gamma}{1-\tan\alpha\tan\beta-(\tan\alpha+\tan\beta)\tan\gamma} \\
252 &=&\frac{\tan\alpha+\tan\beta+\tan\gamma-\tan\alpha\tan\beta\tan\gamma}{1-\tan\alpha\tan\beta-\tan\beta\tan\gamma-\tan\gamma\tan\alpha} \\
253 \end{eqnarray}
254 \end{framed}
255 \end{frame}
256 \begin{frame}{}
257 \begin{framed}
258 \begin{eqnarray}
259 \prod_p(1-\frac{1}{p^2})&=&\prod_p\frac{1}{1+\frac{1}{p^2}+\frac{1}{p^4}+\dots} \\
260 &=&\prod_p(1+\frac{1}{p^2}+\frac{1}{p^4}+\dots)^{-1} \\
261 &=&1+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+\dots^{-1} \\
262 &=&\frac{6}{\pi^2} \\
263 \end{eqnarray}
264 \end{framed}
265 \end{frame}
266 \begin{frame}{}
267 \begin{center}
268 \Huge{\textcolor{brown}{\underline{\textbf{\shadowbox{THANK YOU}}}}}
269 \end{center}

```

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```

248 + \begin{eqnarray*}
249 \tan(\alpha+\beta+\gamma)&=&\frac{\tan(\alpha+\beta)+\tan\gamma}{1-\tan(\alpha+\beta)\tan\gamma} \\
250 &=&\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} \\
251 &=&\frac{\tan\alpha+\tan\beta+(1-\tan\alpha\tan\beta)\tan\gamma}{1-\tan\alpha\tan\beta-(\tan\alpha+\tan\beta)\tan\gamma} \\
252 &=&\frac{\tan\alpha+\tan\beta+\tan\gamma-\tan\alpha\tan\beta\tan\gamma}{1-\tan\alpha\tan\beta-\tan\alpha\tan\beta\tan\gamma-\tan\gamma\tan\alpha} \\
253 \end{eqnarray*}
254 \end{framed}
255 \end{frame}
256 + \begin{frame}{}
257 + \begin{frame}{}
258 + \begin{eqnarray*}
259 \prod_p (1-\frac{1}{p^2})&=&\prod_p \frac{1}{1+\frac{1}{p^2}+\frac{1}{p^4}+\dots} \\
260 &=&(\prod_p (1+\frac{1}{p^2}+\frac{1}{p^4}+\dots))^{-1} \\
261 &=&(1-\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+\dots)^{-1} \\
262 &=&\frac{6}{\pi^2} \\
263 \end{eqnarray*}
264 \end{framed}
265 \end{frame}
266 + \begin{frame}{}
267 + \begin{center}
268 \Huge{\textcolor{brown}{\underline{\textbf{\shadowbox{THANK YOU}}}}} \\
269 \end{center}
270 \end{frame}
271 \end{document}
272
273

```

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