Chapter # 08

Mathematical Induction and Binomial Theorem

Following short questions are selected from previous 5 years papers of different boards. Solve these at your own to perform well in annual exams.

1. Show that $4^n > 3^n + 2^{n-1}$ is true for $n = 2, 3$.

1. Show that $n! > n^2$ is true for $n = 4, 5$.

1. Show that $3^n < n!$ for integral values $n = 7, 8$.

1. Show that $\frac{n^3 + 2n}{3}$ represents an integer for $n = 1, 2$.

1. Show that $2 + 4 + 6 + ... + 2n = n(n+1)$ for $n = 2, 3$.

1. Prove by mathematical induction that $1 \times 2 + 3 \times 4 + 5 \times 6 + ... + (2n - 1) \times 2n = \frac{n(n+1)(4n-1)}{3}$ is true for every positive integer $n$.

1. Prove by mathematical induction that $1 + 5 + 9 + ... + (4n - 3) = n(2n - 1)$ for all positive integers $n$.

1. Expand $(2 - i)^5$.

1. Expand $(8 - 2x)^{-1}$ up to 2 terms.

1. Expand $(1 + x)^{-\frac{1}{2}}$ up to 4 terms.

1. Expand $(1 - x)^{\frac{1}{2}}$ up to 4 terms.

1. Expand $(1 + 2x)^{-1}$ up to 3 terms.

1. Expand $(2 - 3x)^{-2}$ up to 4 terms.

1. Expand $(2 + x - x^2)^4$ by binomial theorem.

1. Calculate $(0.97)^3$ by binomial theorem.

1. Calculate $(2.02)^4$ by binomial theorem.

1. Find the general term of $(3 - 2x)^7$.

1. Find the sixth term in the expansion of $(x - \frac{2}{x})^{10}$.

1. Find the sixth term in the expansion of $(x^2 - \frac{3}{2x})^{10}$.

1. Find the term involving $x^{-2}$ in the expansion of $(x - \frac{2}{x})^{13}$.

1. Find the middle term in the expansion of $(\frac{1}{x} - \frac{x^2}{2})^{12}$.
1. Find the term involving $y^3$ in the expansion of $(x - \sqrt{y})^{11}$.

1. If $x$ is so small that $x^2$ and higher powers can be neglected, then show that $\frac{\sqrt{1+x}}{(1-x)^2} \approx 2 + \frac{25}{4}x$.

1. If $x$ is so small that its square and higher powers can be neglected, show that $\frac{1-x}{\sqrt{1-x}} \approx 1 - \frac{3}{2}x$.

1. If $x$ is so small that its square and higher powers can be neglected then show that $\frac{(1+x)^{1/2}(4-3x)^{3/2}}{8+5x} \approx 4(1 - \frac{5x}{6})$.

_Alfred Rnyi_

**Best of Luck**

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_A mathematician is a device for turning coffee into theorems.  Alfrd Rnyi_