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## MATHS

## BOOKS - KC SINHA MATHS (HINGLISH)

## BINOMIAL THEOREM - FOR BOARDS

Solved Examples

1. Expand of the expression : $\left(x+\frac{1}{x}\right)^{6}$

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2. Expand: $\left(x-\frac{1}{y}\right)^{11}, y \neq 0$

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3. Expand $(2 x-3 y)^{4}$ by binomial theorem.

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4. Expand $\left(x^{2}+2 a\right)^{5}$ by binomial theorem.

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5. Expand, $\left(1+x+x^{2}\right)^{3}$

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6. Expand: $\left(1-x+x^{2}\right)^{4}$
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7. Expand $(a+b)^{6}-(a-b)^{6}$. Hence find the value of $(\sqrt{2}+1)^{6}-(\sqrt{2}-1)^{6}$.

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8. Simplify: $(x+\sqrt{x-1})^{6}+(x-\sqrt{x-1})^{6}$

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9. Find the expansion of $\left(3 x^{2}-2 a x+3 a^{2}\right)^{3}$ using binomial theorem.

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10. If $n$ be a positive integer and the sums of the odd terms and even terms in the expansion of $(a+x)^{n}$ be $A$ and $B$ respectively,
prove that, $A^{2}-B^{2}=\left(a^{2}-x^{2}\right)^{n}$

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11. If $o$ be the sum of odd terms and $E$ that of even terms in the expansion of $(x+a)^{n}$ prove that: $O^{2}-E^{2}=\left(x^{2}-a^{2}\right)^{n}$
$4 O E=(x+a)^{2 n}-(x-a)^{2 n}$
$2\left(O^{2}+E^{2}\right)=(x+a)^{2 n}+(x-a)^{2 n}$

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12. The first three terms in the expansion of a binomial are 1,10 and 40 . Find the expansion.

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13. Using binomial theorem compute the following: $(99)^{5}$
14. Using binomial theorem compute the following: $(10.1)^{5}$

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15. Which number is larger $(1.2)^{4000}$ or 800

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16. Using binomial theorem, indicate which number is larger
$(1.1)^{10000}$ or 1000.

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17. (iv) Using binomial theorem prove that $(101)^{\wedge} 50>(100)^{\wedge} 50+$ (99)^50`

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18. prove that $\sum_{r=0}^{n} 3^{r} n C_{r}=4^{n}$

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19. Find the $4^{\text {th }}$ term in the expansion of $(x-2 y)^{12}$.

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20. Find the $13^{\text {th }}$ term in the expansion of $\left(9 x-\frac{1}{3 \sqrt{x}}\right)^{18}, x \neq 0$
21. Find the 5 th term from the end in the expansion of $\left(\frac{x^{3}}{2}-\frac{2}{x^{2}}\right)^{9}$

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22. Write the general term in the expansion of $\left(x^{2}-y\right)^{6}$.

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23. If the third term in the expansion of $\left(\frac{1}{x}+{ }_{x}(\log )_{10 x}\right)^{5}$ is 1000 , then find $x$.

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24. The 21st and 22nd terms in the expansion of $(1+x)^{44}$ are equal. Then x :

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25. In the binomial expansion $(a-b)^{n}, n \geq 5$ the sum of 5 th and 6th terms is zero. Then find $\frac{a}{b}$

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26. The number of rational terms in the expansion $\left(2^{\frac{1}{5}}+3^{\frac{1}{10}}\right)^{45}$ is

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27. Find the middle term in the expansion of : $\left(\frac{x}{3}+9 y\right)^{10}$
28. Find the middle term in the expansion of $\left(x-\frac{1}{2 x}\right)^{12}$

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29. Find the middle term in the expansion of $\left(2 x^{2}-\frac{1}{x}\right)^{7}$

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30. Find the middle term in the expansion of : $\left(1-2 x+x^{2}\right)^{n}$

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31. Prove that the middle term in the expansion of $\left(x+\frac{1}{x}\right)^{2 n}$ is (1.3.5...(2n-1)/(n! $2^{n}$

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32. Show that the greatest coefficient in the expansion of $\left(x+\frac{1}{x}\right)^{2} n i s \frac{1.3 .5 \ldots(2 n-1) .2^{n}}{n!}$

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33. Show that the coefficient of the middle term in the expansion of
$(1+x)^{2 n}$ is equal to the sum of the coefficients of two middle terms in the expansion of $(1+x)^{2 n-1}$.

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34. Find the coefficient of $\frac{1}{y^{2}}$ in $\left(y+\frac{c^{3}}{y^{2}}\right)^{10}$
35. Find the coefficient of $x^{9}$ in $\left(1+3 x+3 x^{2}+x^{3}\right)^{15}$.

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36. Find the coefficient of $x^{40}$ in the expansion of $\left(1+2 x+x^{2}\right)^{54}$

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37. Find the term independent of x in $\left(\frac{3}{2} x^{2}-\frac{1}{3 x}\right)^{9}$

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38. The term independent of x in $(1+x)^{m}\left(1+\frac{1}{x}\right)^{n}$ is
39. If the fourth term in the expansion of $\left(p x+\frac{1}{x}\right)^{n}$ is $\frac{5}{2}$, then $(n, p)=$

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40. Find the value of a so that the term independent of $x$ in $\left(\sqrt{x}+\frac{a}{x^{2}}\right)^{10}$ is 405 .

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41. If $(1+a x)^{n}=1+8 x+24 x^{2}+\ldots$. . then the value of $a$ and $n$ is
42. In the binomial expansion of $(1+a)^{m+n}$, prove that the coefficient of $a^{m}$ and $a^{n}$ are equal.

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43. Find a if the coefficient of $x^{2}$ and $x^{3}$ in the expansion of $(3+a x)^{9}$ are equal

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44. If in the expansion of $(1+x)^{m}(1-x)^{n}$, the coefficients of $x$ and $x^{2}$ are 3 and -6 respectively, then $m$ is:

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45. If the coefficients of $a^{r-1}, a^{r} a n d a^{r+1}$ in the binomial expansion of $(1+a)^{n}$ are in A.P., prove that $n^{2}-o n(4 r+1)+4 r^{2}-2=0$.

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46. Find the coefficient of $x^{5}$ in the expansioin of the product $(1+2 x)^{6}(1-x)^{7}$.

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47. Find the coefficient of $x^{-1}$ in $\left(1+3 x^{2}+x^{4}\right)\left(1+\frac{1}{x}\right)^{8}$
48. If in the expansion of $(1-x)^{2 n-1} a_{r}$ denotes the coefficient of $x^{r}$ then prove that $a_{r-1}+a_{2 n-r}=0$

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49. Show that there will be no term containing $x^{2 r}$ in the expansion of $\left(x+x^{-2}\right)^{n-3}$ if $n-2 r$ is a positive integer but not a multiple of 3 .

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50. Show that there wil be a term independent of $x$ in the expansion of $\left(x^{a}+x^{-b}\right)^{n}$ only if an is a multiple of $(a+b)$.

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51. Find n if the coefficients of 4th the 13th terms in the expansion of $(a+b)^{n}$ are equal.

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52. If in the expansion of $(1+x)^{43}$ the coefficient of $(2 r+1)$ th term is equal to the coefficietn of $(r+2)$ th term, find $r$.

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53. The value of $m$, for which the coefficients of the $(2 m+1)$ th terms in the expansion of $(1+x)^{10}$ are equal is 3 b .1 c .5 d .8
54. Find the greatest term in the expansion of $(7-5 x)^{11}$ when $x=\frac{2}{3}$.

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55. Show that it the greatest term in the expansion of $(1+x)^{2 n}$ has also the greatest coefficient, then x lies between and $\frac{n}{n+1}$ and $\frac{n+1}{n}$.

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56. If n be a positive integer, then prove that $6^{2 n}-35 n-1$ is divisible by 1225 .

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57. Show that: $2^{4 n}-2^{n}(7 n+1)$ is some multiple of the square of

14 , where n is a positive integer.

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58. Using binomial theorem show that $3^{4 n+1}+16 n-3$ is divisible by 256 if n is a positive integer.

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59. Using binomial theorem, prove that $6^{n}-5$ nalways leaves remainder 1 when divided by 25 .

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60. Write down the binomial expansion of $(1+x)^{n+1}$, when $x=8$. deduce that $9^{n+1}-8 n-9$ is divisible 64 where $n$ is a positive integer.

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61. If and $b$ are distinct integers, prove that $a-b$ is a factor of $a^{n}-b^{n}$, whenever n is a positive integer.

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62. If three consecutive coefficients in the expansion of $(1+x)^{n}$ be 165,330 and 462 , find $n$ and the position of the coefficeint.

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63. If $a_{1}, a_{2}, a_{3}$ and $a_{4}$ be any four consecutive coefficients in the expansion of $(1+x)^{n}$, prove that $\frac{a_{1}}{a_{1}+a_{2}}+\frac{a_{3}}{a_{3}+a_{4}}=\frac{2 a_{2}}{a_{2}+a_{3}}$

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64. If $2 \mathrm{nd}, 3 \mathrm{rd}$ and 4 th tems in the expansion of $(x+y)^{n}$ be 240,720 and 1080 respectively, find $x, y$ and $n$.

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65. If the coefficients of three consecutive terms in the expansion of
$(1+x)^{n}$ are in the ratio 1:7:42, then find the value of $n$.

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66. If three consecutive coefficients in the expansion of $(1+x)^{n}$ are in the ratio 6:33:110, find n and r .

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67. If $a, b, c$ be the three consecutive coefficients in the expansion of a power oif $(1+x)$, prove that the index power is $\left(2 a c+b \frac{a+c}{b^{2}-a c}\right)$

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68. If in the binomial expansion of $(1+x)^{n}$, the coefficient of $14 t h, 15 t h$ and $16 t h$ terms are in $A . P .$, then find n .

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1. Expand the following by binomial theorem: $(x+y)^{5}$

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2. Expand the following by binomial theorem: $(1-x)^{6}$

## D Watch Video Solution

3. Expand the following by binomial theorem: $\left(x+\frac{1}{x}\right)^{7}$

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4. Expand the following by binomial theorem: $\left(x^{2}+\frac{2}{x}\right)^{4}, x \neq 0$
5. Expand the following by binomial theorem: $\left(\frac{2 x}{3}-\frac{3}{2 x}\right)^{6}$

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6. Expand the following by binomial theorem: $\left(1+2 x+x^{2}\right)^{3}$

## - Watch Video Solution

7. Expand the following by binomial theorem: $\left(x^{2}+\frac{3}{x}\right)^{5}, x \neq 0$

## - Watch Video Solution

8. Expand the following by binomial theorem: $(2 x-3)^{6}$
9. Expand the following by binomial theorem: $(1-2 x)^{5}$

## - Watch Video Solution

10. Expand the following by binomial theorem: $\left(\frac{x}{3}+\frac{1}{x}\right)^{5}$

## - Watch Video Solution

11. Expand using Binomial Theorem $\left(1+\frac{x}{2}-\frac{2}{x}\right)^{4}, x \neq 0$.

## D Watch Video Solution

12. Expand the following: $\left(1+x+x^{2}\right)^{4}$
13. Express: $\left(\left(x+\sqrt{x^{2}+1}\right)^{6}+\left(x-\sqrt{x^{2}+1}\right)^{6}\right)$ as a polynomial in $x$

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14. Find the value of $\left(a^{2}+\sqrt{a^{2}-1}\right)^{4}+\left(a^{2}-\sqrt{a^{2}-1}\right)^{4}$.

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15. Using binomial theorem, expand $\left\{(x+y)^{5}+(x-y)^{5}\right\}$. and hence find the value of $\left\{(\sqrt{2}+1)^{5}+(\sqrt{2}-1)^{5}\right\}$.

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16. Find $(a+b)^{4}-(a-b)^{4}$. Hence evaluate
$(\sqrt{3}+\sqrt{2})^{4}-(\sqrt{3}-\sqrt{2})^{4}$

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17. Evaluate the following: $(\sqrt{3}+1)^{5}-(\sqrt{3}-1)^{5}$

## - Watch Video Solution

18. Evaluate the following: $(\sqrt{2}+1)^{6}+(\sqrt{2}-1)^{6}$

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19. Evaluate the following expressions $(\sqrt{3}+\sqrt{2})^{3}+(\sqrt{3}-\sqrt{2})^{3}$
20. Evaluate: $(\sqrt{3}+\sqrt{2})^{6}+(\sqrt{3}+\sqrt{2})^{6}$

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21. Find the number of terms in the following expansion:
$\left(1-2 x+x^{2}\right)^{30}$

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22. Find the number of terms in the expansions of the following: $(\sqrt{x}+\sqrt{y})^{10}+(\sqrt{x}-\sqrt{y})^{10}$

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23. If $A$ be the sum of odd terms and $B$ the sum of even terms in the expnsion of $(x+a)^{n}$, show that 4AB $=(x+a)^{2 n}-(x-a)^{2 n}$
24. Find the value of $(0.99)^{10}$ correct of 4 places of decimal.

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25. Using Binomial theorem, evaluate $(0.99)^{15}$ correct to fur places of decimal.

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26. Using binomial theorem, evaluate : (101) ${ }^{4}$

## - Watch Video Solution

27. Using binomial theorem, evaluate : (102) ${ }^{5}$
28. Evaluate: $(999)^{5}$

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29. Evaluate: $(102)^{6}$

## - Watch Video Solution

30. Evaluate: $(51)^{6}$

## - Watch Video Solution

31. Evaluate: $(98)^{4}$
32. Using binomial theorem evaluate each of the following: $(96)^{3}$

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33. Evaluate: $(98)^{5}$

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34. Find the value of $(1.01)^{10}+(0.99)^{10}$ correct 7 places of decimal.

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35. Find the greater of the two number: $(1.01)^{1000000}$ and 10000
36. Using binomial theorem, indicate which number is larger
$(1.1)^{10000}$ or 1000 .

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37. Prove that: . $\mathrm{n}{ }^{\wedge} C_{0}+2 .{ }^{n} C_{1}+\ldots .2^{n} \cdot{ }^{n} C_{n}=3^{n}$ for every natural number n .

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38. 

Prove
that:
$\wedge(2 n) C_{0}-3 .{ }^{2 n} C_{1}+3^{2} \cdot{ }^{2 n} C_{2}-\ldots+(-1)^{2 n} . .3^{2 n}{ }^{\wedge}(2 n) C_{2 n}=4^{n}$
for all value of $\mathrm{N}^{`}$

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39. (iii) Find an approximate value of $(0.99)^{5}$ using the first three terms of its expansion.

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40. Find the 7th term in the expansion of $\left(\frac{4 x}{5}-\frac{5}{2 x}\right)^{9}$.

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41. Find the 9th term in the expansion of $\left(\frac{x}{a}-\frac{3 a}{x^{2}}\right)^{12}$.

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42. Find the 5th term of (i) $\left(\frac{a}{3}-3 b\right)^{7}$
43. Find the 5 term of $\left(2 x^{2}-\frac{1}{3 x^{3}}\right)^{10}$

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44. Find $a$ if the 7th and 18th terms of the expansion $(2+a)^{50}$ are equal.

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45. Find the $r^{t h}$ term from the end in the expansion of $(x+a)^{n}$.

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46. Find the 4 th term from the end in $\left(\frac{x^{3}}{2}-\frac{2}{x^{2}}\right)^{9}$

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47. Find $n$, if the ratio of the fifth term from the beginning to the fifth term from the end in the expansion of $\left(24+\frac{1}{34}\right)^{n}$ is $\sqrt{6}: 1$.

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48. Write the general term in the following expansions $\left(1-x^{2}\right)^{12}$

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49. Write the general term in the following expansion:
$\left(x-\frac{3}{x^{2}}\right)^{10}$

- Watch Video Solution

50. Write the general term in the following expansion: $\left(x^{2}-\frac{1}{x}\right)^{12}, x \neq 0$

## - Watch Video Solution

51. Find the middle term in $\left(\frac{2 x}{3}-\frac{3 y}{2}\right)^{20}$

## - Watch Video Solution

52. Find the middle term in the expansion of $\left(\frac{2 x}{3}-\frac{3}{2 x}\right)^{6}$

## - Watch Video Solution

53. Find the middle term in the expansion of $\left(\frac{x}{y}-\frac{y}{x}\right)^{7}$
54. Find the middle term in the expansion of $(1+x)^{2 n}$

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55. Find the middle term in the expansion of : $\left(1-2 x+x^{2}\right)^{n}$

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56. Find the middle term in the expansion of $\left(3-\frac{x^{3}}{6}\right)^{7}$

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57. Find the general and middle term in the expansion of $\left(\frac{x}{y}+\frac{y}{x}\right)^{2 n+1} ; \mathrm{n}$ being a positive integer and show that there is no term free from $\frac{x}{y}$.
58. Show that the middle term in the expansion of
$(1+x)^{2 n} i s \frac{(1.3 .5(2 n-1))}{n!} 2^{n} x^{n}$, wheren is a positive integer.

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59. Show that the middle term in the expansion $\left(x-\frac{1}{x}\right)^{2 n}$ is 1. $3.5(2 n-1)$
$n$

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60.) Find the coefficient of x in the expansion of $\left(2 x-\frac{3}{x}\right)^{9}$.
61. Find the coefficient of $x^{7}$ in the expansion of $\left(3 x^{2}+\frac{1}{5 x}\right)^{11}$

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62. Find the coefficient of $x^{7}$ in the expansion of $\left(2 x^{2} \pm \frac{1}{x}\right)^{20}$

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63. Find the coefficient of $x^{24}$ in the expansion of $\left(x^{2}-3 \frac{a}{x}\right)^{15}$.

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64. Find the coefficient of $x^{9}$ in the expansion of $\left(x^{2}-\frac{1}{3 x}\right)^{9}$.
65. Find the coefficient of $x^{-7}$ in the expansion of $\left(2 x-\frac{1}{3 x^{2}}\right)^{11}$.

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66. Find the coefficient of $x^{5} \in(x+3)^{8}$

## - Watch Video Solution

67. Find the coefficient of $x^{5}$ in the expansion of $(x+3)^{9}$

## D Watch Video Solution

68. Find the coefficient of $a^{5} b^{7} \in(a-2 b)^{12}$

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69. Find the coefficient of $x^{6} y^{3}$ in $(x+y)^{9}$

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70. Find a positive value of $m$ for which the coefficient of $x^{2}$ in the expansion of $(1+x)^{m}$ is 6 .

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71. Prove that the coefficients of $x^{n}$ in $(1+x)^{2 n}$ is twice the coefficient of $x^{n}$ in $(1+x)^{2 n-1}$.

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72. Find the coefficients of $x^{7}$ in
$\left(a x^{2}+\frac{1}{b x}\right)^{11} a n d x^{-7} \in\left(a \frac{x^{-1}}{b x^{2}}\right)^{11}$ and find the relation
between $a a n d b$ so that coefficients are equal.

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73. if the coefficients of $x, x^{2}$ and $x^{3}$ in the binomial expansion $(1+x)^{2 n}$ are in arithmetic progression then prove that $2 n^{2}-9 n+7=0$

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74. Find the term independent of x in $\left(x+\frac{1}{x}\right)^{2 n}$

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75. Find the term independent of x in the expression $\left(x-\frac{1}{x}\right)^{14}$
76. Find the term independent of $x$ in the following binomial expansions $(x \neq 0):\left(2 x^{2}+\frac{1}{x}\right)^{13}$

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77. Find the term independent of $x$ in the following binomial expansions $(x \neq 0):\left(x^{2}+\frac{1}{x}\right)^{12}$

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78. Find the term independent of $x$ in the following binomial expansions $(x \neq 0):\left(\sqrt{\frac{x}{3}}+\frac{3}{2 x^{2}}\right)^{10}$

## - Watch Video Solution

79. Find the term independent of $x$ in the following binomial
expansions $(x \neq 0):\left(2 x^{2}-\frac{1}{x}\right)^{12}$

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80. Find the term independent of $x$ in the following binomial expansions $(x \neq 0):\left(2 x^{2}-\frac{3}{x^{3}}\right)^{25}$

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81. Find the term independent of $x$ in the expansion off the
following expression: $\left(\frac{3}{2} x^{2}-\frac{1}{3 x}\right)^{6}$

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82. Which term in the expansion of $\left(x^{3}-\frac{3}{x^{2}}\right)^{15}$ is independent of $x$ ?

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83. Find the term independent of $x$ in the following binomial expansions $(x \neq 0):\left(x^{2}-\frac{3}{x^{3}}\right)^{10}$

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84. Find the term independent of x in the expansion of the following expressions: $\quad\left(\frac{1}{2} x^{\frac{1}{3}}+x^{-\frac{1}{5}}\right)^{8} \quad$ and
$\left(1+x+2 x^{3}\right)\left(\frac{3}{2} x^{2}-\frac{1}{3 x}\right)^{9}$
85. Find the term independent of $x$ in the expansion of: $\left(x-\frac{1}{x}\right)^{12}$.

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86. Find the term independent of $x$ in the following binomial
expansions $(x \neq 0):\left(\sqrt[3]{x}+\frac{1}{2 \cdot \sqrt[3]{x}}\right)^{18}$

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87. If there is a term independent of x in $\left(x+\frac{1}{x^{2}}\right)^{n}$, show that it is equal to $\frac{n!}{\left(\frac{n}{3}\right)!\left(\frac{2 n}{3}\right)!}$

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88. If $x^{p}$ occurs in the expansion of $\left(x^{2}+1 / x\right)^{2 n}$, prove that its coefficient is $\frac{(2 n)!}{\left[\frac{1}{3}(4 n-p)\right]!\left[\frac{1}{3}(2 n+p)\right]!}$.

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89. Find the coefficient of $a^{4}$ in the product $(1+2 a)^{4}(2-a)^{5}$ using binomial theorem.

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90. If the rth term in the expansion of $(1+x)^{20}$ has its coefficient equal to that of the $(r+4)$ th term, find $r$

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91. If the co-efficient of $(2 r+4)$ th term and $(r-2)$ th term in expansion of $(1+x)^{18}$ are equal,find $r$

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92. If the coefficients of $(r-5)^{t h}$ and $(2 r-1)^{t h}$ terms in the expansion of $(1+x)^{34}$ are equal, find $r$.

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93. If the coefficient of $(2 r+5)$ th term and $(r-6)$ th term in the expansion $(1+x)^{39}$ are equal, find. ${ }^{n} C_{12}$

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94. Given positive integers $r>1, n>2, n$ being even and the coefficient of $(3 r)$ th term and $(r+2)$ th term in the expansion of $(1+x)^{2 n}$ are equal; find $r$

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95. If the coefficient of $(p+1)$ th term in the expansion of ${ }^{( }(1+$ $x)^{\wedge}(2 n)$ be equal to that of the $(p+3)$ th term, show that $p=n-1$

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96. Find the two consecutive cocfficients in the expansion of $(3 x-2)^{75}$ whose values are equal
97. how that the coefficient of $(r+1)$ th in the expansion of $(1+x)^{n+1}$ is equal to the sum of the coefficients of the $r$ th and $(\mathrm{r}+1)$ th term in the expansion of $(1+x)^{n}$

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98. Find the greatest term in the expansion $(2+3 x)^{10}$, when $x=\frac{3}{5}$

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99. Find the greastest term in the expansion of
$(4-3 x)^{7}$, when $x=\frac{2}{3}$

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100. Find the greatest term in the expansion of $(a+x)^{13}, w h e n a=5, x=2$

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101. Find the limits between which $x$ must lie in order that the greatest term in the expansion of $(1+x)^{30}$ may have the greatest coefficient.

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102. If n is a positive integer, show that: $4^{n}-3 n-1$ is divisible by 9
103. Find remainder if, $2^{5 n+6}-31 n-32$ is divisible by 961 if $n>1$

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104. Show that $9^{n+1}-8 n-9$ is divisible by 64 , where $n$ is a positive integer.

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105. Find remainder if, $2^{5 n+6}-31 n-32$ is divisible by 961 if $n>1$

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106. If n is a positive integer, show that: $3^{2 n}-1+24 n-32 n^{2}$ is divisible by 512 if $n>2$
107. If three consecutive coefficients in the expansion of $(1+x)^{n}$ be 56,70 and 56 , find n and the position of the coefficients.

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108. If three successive coefficients in the expansion of $(1+x)^{n}$ be 220,495 and 972, find n.

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109. If 3 rd, 4th, 5th terms in the expansion of $(a+x)^{n}$ be 84,280 and 560 , Find x , a and n .
110. Find $\mathrm{a}, \mathrm{b}$ and n in the expansion of $(a+b)^{n}$ if the first three terms of the expansion are 729,7290 and 30375, respectively.

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111. If the 6 th, 7 th, 8 th terms in the expansion of $(x+y)^{n}$ be 112,7 and $1 / 4$ find $\mathrm{x}, \mathrm{y}$ and n .

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112. The coefficient of the $(r-1)$ th, $r$ th and $(r+1)$ th terms in the expansion of $(x+1)^{n}$ are in the ratio 1:3:5. Find both n and r

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113. If in any binomial expansion $\mathrm{a}, \mathrm{b}, \mathrm{c}$ and d be the 6th, 7th, 8th and 9th terms respectively, prove that $\frac{b^{2}-a c}{c^{2}-b d}=\frac{4 a}{3 c}$

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114. If the four consecutive coefficients in any binomial expansion be a, b, c, d, then prove that (i) $\frac{a+b}{a}, \frac{b+c}{b}, \frac{c+d}{c}$ are in H.P. (ii) $(b c+a d)(b-c)=2\left(a c^{2}-b^{2} d\right)$

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115. If the four consecutive coefficients in any binomial expansion be a, b, c, d, then prove that (i) $\frac{a+b}{a}, \frac{b+c}{b}, \frac{c+d}{c}$ are in H.P. (ii) $(b c+a d)(b-c)=2\left(a c^{2}-b^{2} d\right)$

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116. If a. b, c and d are the coefficients of $2 \mathrm{nd}, 3 \mathrm{rd}, 4$ th and 5 th terms respectively in the binomial expansion of $(1+x)^{n}$, then prove that
$\frac{a}{a+b}+\frac{c}{c+d}=2 \frac{b}{b+c}$

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117. The coefficient of 5th, 6th and 7th terms in the expansion of $(1+x)^{n}$ are in A.P. Find the value of n .

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118. 17. If the coefficients of $2 \mathrm{nd}, 3 \mathrm{rd}$ and 4 th terms in the expansion of $(1+x)^{2 n}$ are in A.P.. Show that $2 n^{2}-9 n+7=0$

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119. In the coefficients of $r$ th, $(r+1) t h, \operatorname{and}(r+2) t h$ terms in the binomial expansion of $(1+y)^{m}$ are in A.P., then prove that $m^{2}-m(4 r+1)+4 r^{2}-2=0$.
120. The coefficients of three consecutive terms in the expansion of
$(1+x)^{n}$ are in the ratio $182: 84: 30$. prove that $n=18$

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121. The sum of the coefficients of the first three terms in the expansion of $\left(x-\frac{3}{x^{2}}\right)^{m}, x \neq 0, \mathrm{~m}$ being a natural number, is 559 .
Find the term of the expansion containing $x^{3}$.

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