$(-3x^4-2y^7)^5 \longleftarrow$ Expand & Simplify

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
$\boxed{1 \quad 5 \quad 10 \quad 10 \quad 5 \quad 1}$

-243 5x81x-2 10x-27x4

$1(-3x^4)^5(-2y^7)^0 + 5(-3x^4)^4(-2y^7)^1 + 10(-3x^4)^3(-2y^7)^2 +$

$10(-3x^4)^2(-2y^7)^3 + 5(-3x^4)^1(-2y^7)^4 + 1(-3x^4)^0(-2y^7)^5$

10x9x-8 5x-3x16 -32

$= -243x^{20} - 810x^{16}y^7 - 1080x^{12}y^{14} - 720x^8y^{21}$

$-240x^4y^{28} - 32y^{35}$

Return to the Binomial Theorem...

Binomial	Pascal's Triangle in Binomial Expansion	Row
$(x+y)^0$	1	1
$(x+y)^1$	$1x + 1y$	2
$(x+y)^2$	$1x^2 + 2xy + 1y^2$	3
$(x+y)^3$	$1x^3 + 3x^2y + 3xy^2 + 1y^3$	4
$(x+y)^4$	$1x^4 + 4x^3y + 6x^2y^2 + 4xy^3 + 1y^4$	5

Have a look at this neat connection...

$_6C_3$

Combinations

Pascal's Triangle	Combinations
1	$_0C_0$
1 1	$_1C_0$ $_1C_1$
1 2 1	$_2C_0$ $_2C_1$ $_2C_2$
1 3 3 1	$_3C_0$ $_3C_1$ $_3C_2$ $_3C_3$
1 4 6 4 1	$_4C_0$ $_4C_1$ $_4C_2$ $_4C_3$ $_4C_4$
1 5 10 10 5 1	$_5C_0$ $_5C_1$ $_5C_2$ $_5C_3$ $_5C_4$ $_5C_5$

$_nC_r$

You can use the **binomial theorem** to expand any power of a binomial expression.

$$(x+y)^n = {}_nC_0(x)^n(y)^0 + {}_nC_1(x)^{n-1}(y)^1 + {}_nC_2(x)^{n-2}(y)^2 + \cdots + {}_nC_{n-1}(x)^1(y)^{n-1} + {}_nC_n(x)^0(y)^n$$

$(x+y)^8$

$${}_8C_0(x)^8(y)^0 + {}_8C_1(x)^7(y)^1 + {}_8C_2(x)^6(y)^2$$
$$+ {}_8C_3(x)^5(y)^3 + {}_8C_4(x)^4(y)^4 + {}_8C_5(x)^3(y)^5$$
$$+ {}_8C_6(x)^2(y)^6 + {}_8C_7(x)^1(y)^7 + {}_8C_8(x)^0(y)^8$$

Given the binomial expansion $\left(2x-y^{2}\right)^{13}$

Determine the numerical coefficient of the term that has the variable parts...

(a) $x^{4}y^{18}$

$_{13}C_{9}(2x)^{4}(-y^{2})^{9}$

$715(16x^{4})(-y^{18})$

$= -11440x^{4}y^{18}$

(b) $x^{7}y^{12}$

$_{13}C_{6}(2x)^{7}(-y^{2})^{6}$

$= 1716(128x^{7})(y^{12})$

$= 219648x^{7}y^{12}$

Sum & Difference of Cubes

a^3+b^3 $\quad$ x^3-y^3

$(a+b)(a^2-ab+b^2)$ $\quad$ $(x-y)(x^2+xy+y^2)$

ex. 1) w^3+27

$(w+3)(w^2-3w+9)$

cube Root:

$\sqrt[3]{x^{27}}$

$(x^{27})^{1/3}$

2) $x^{27}-1$

$(x^9-1)(x^{18}+x^9+1)$

$(x^3-1)(x^6+x^3+1)(x^{18}+x^9+1)$

$\boxed{(x-1)(x^2+x+1)(x^6+x^3+1)(x^{18}+x^9+1)}$

3) $8x^6-64$

$8(x^6-8)$

$8(x^2-2)(x^4+2x^2+4)$

4) $w^{30}-y^{12}$

$(w^{10}-y^4)(w^{20}+w^{10}y^4+y^8)$

$(w^5-y^2)(w^5+y^2)(w^{20}+w^{10}y^4+y^8)$

$(w^{15}-y^6)(w^{15}+y^6)$

$(w^5-y^2)(w^{10}+w^5y^2+y^4)(w^5+y^2)(w^{10}-w^5y^2+y^4)$

Find the polynomial p(x)
such that it's zeros are x=-1, 4 and -2

$$(x+1)(x-4)(x+2)=0$$

$$(x^2-3x-4)(x+2)=0$$

$$x^3+2x^2-3x^2-6x-4x-8=0$$

$$\boxed{x^3-x^2-10x-8=0}$$

ex. 2) $x=\frac{3}{4}$, $x=-2$, $x=\frac{1}{3}$

$4x=\frac{3}{4}(4)$ $x=-2$ $x=\frac{1}{3}$

$4x=3$ $x+2=0$ $3x=1$

$4x-3=0$ $3x-1=0$

$$(4x-3)(x+2)(3x-1)=0$$

$$(4x^2+8x-3x-6)(3x-1)$$

$$(4x^2+5x-6)(3x-1)$$

$$12x^3-4x^2+15x^2-5x-18x+6$$

$$12x^3+11x^2-23x+6=0$$

Polynomials Review

- Factoring Techniques
- Dividing Polynomials
- Remainder Theorem
- Factor Theorem
- Sum and Difference of Cubes
- Solving Polynomial Equations
- Permutations and Combinations
- Binomial Theorem

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