1.4 Binomial Theorem

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Compute the following

- $(x+y)^0 = 1$
- $(x+y)^1 = x+y$
- $(x+y)^2 = x^2 + 2xy + y^2$
- $(x+y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$
- $(x+y)^4 = x^4 + 4x^3y^1 + 6x^2y^2 + 4xy^3 + y^4$
- $(x+y)^5$
- $(x+y)^6$

$$(a+b)^0 = 1$$

$$(a+b)^1 = a^1b^0 + a^0b^1$$

$$(a+b)^2 = a^2b^0 + 2a^1b^1 + a^0b^{\cancel{1}\,2}$$

$$(a+b)^3 = a^3b^0 + 3a^2b^1 + 3a^1b^2 + a^0b^3$$

$$(a+b)^4 = a^4b^0 + 4a^3b^1 + 6a^2b^2 + 4a^1b^3 + a^0b^4$$

$$(a+b)^5 = a^5b^0 + 5a^4b^1 + 10a^3b^2 + 10a^2b^3 + 5a^1b^4 + a^0b^5$$

1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

1 5 10 10 5 1

1 6 15 20 15 6 1

35 35 21 7 1

1 7 21 35 35 21 7 1

$(2x+4)^3$ 1 3 3 1

$1(2x)^3(4)^{\cancel{0}} + 3(2x)^2(4)^1 + 3(2x)^1(4)^2 + 1(2x)^{\cancel{0}}(4)^3$

$= \boxed{8x^3 + 48x^2 + 96x + 64}$

$3(2)^2(4)^1$

$$(3x \boxed{- 2y})^5$$

$$1(3x)^5\cancel{(-2y)^0} + 5(3x)^4(-2y)^1 + 10(3x)^3(-2y)^2 + 10(3x)^2(-2y)^3$$

$$+ 5(3x)^1(-2y)^4 + 1\cancel{(3x)^0}(-2y)^5$$

$$= 243x^5 - 810x^4y + 1080x^3y^2 - 720x^2y^3$$

$$+ 240xy^4 - 32y^5$$