The Binomial Theorem

$$(x+4)^4 = (x+4)(x+4)(x+4)(x+4)$$

$$= (x^2+8x+16)(x^2+8x+16)$$

$$= x^4 + 8x^3 + 16x^2 + 8x^3 + 64x^2 + 128x + 16x^2 + 128x + 256$$

$$= x^4 + 16x^3 + 96x^2 + 256x + 256$$

$$(x+4)^4 = (x+4)(x+4)(x+4)(x+4)$$

$$= x^4 + (4)4x^3 + (6)16x^2 + (4)64x + 256$$

$$\binom{4}{4} \quad \binom{4}{3} \quad \binom{4}{2} \quad \binom{4}{1} \quad \binom{4}{0}$$

Rules

$$\binom{n}{n} = \binom{n}{0} = 1 \qquad \binom{n}{r} = \binom{n}{n-r}$$

$$\binom{n}{1} = \binom{n}{n-1} = 5$$

$$\boxed{\binom{n}{r} = \frac{n!}{r!\,(n-r)!}}$$

$$\frac{5 \cdot \cancel{4}^{2}\ \cancel{5!}}{\cancel{3!}\ \cancel{2!}}$$

$(2x-3y)^5 = (2x-3y)(2x-3y)(2x-3y)(2x-3y)(2x-3y)$

$= (2x)^5 + \overset{5\,\cdot}{\binom{\cancel{5}}{4}}\overset{16\,\cdot}{(2x)^4}\overset{-3}{(-3y)^1} + \overset{10\,\cdot}{\binom{\cancel{5}}{\cancel{3}}}\overset{8\,\cdot}{(2x)^3}\overset{9}{(-3y)^2}$

$+ \overset{10\,\cdot}{\binom{\cancel{5}}{\cancel{2}}}\overset{4\,\cdot}{(2x)^2}\overset{-27}{(-3y)^3} + \overset{5\,\cdot}{\binom{5}{1}}\overset{2\,\cdot}{(2x)^1}\overset{81}{(-3y)^4} + (-3y)^5$

$= 32x^5 - 240x^4y + 720x^3y^2 - 1080x^2y^3$

$+ 810xy^4 - 243y^5$

HW ① $(3x-2y)^6$

② $\left(4x^2 - \frac{3}{x^3}\right)^{10}$ —— $\frac{1}{x^{10}}$