1.1 Binomial Theorem.

$(a+b)^2 = a^2 + 2ab + b^2$

$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

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

$(a+b)^n$

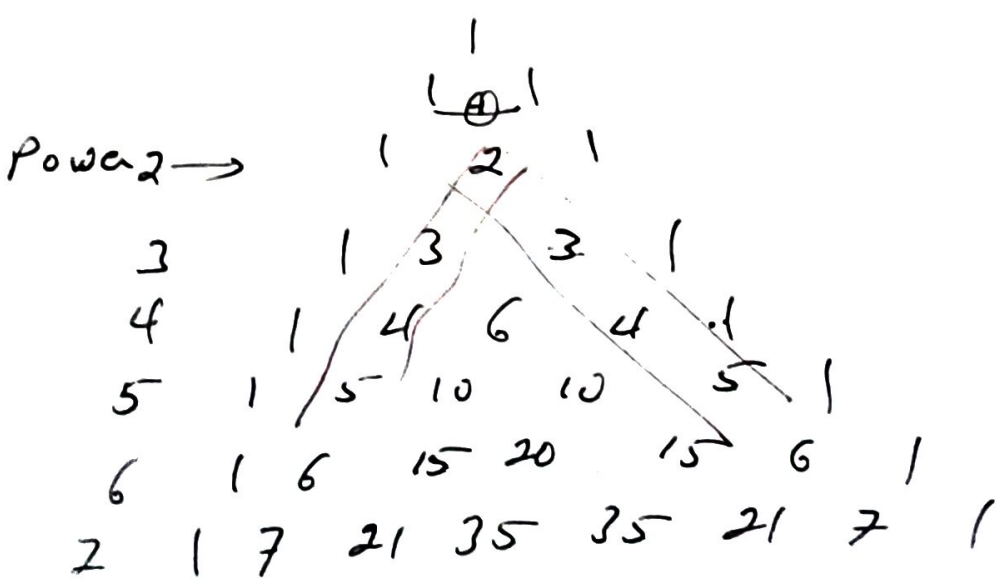
1. $(n+1)$ terms
2. a starts w/ n decrease each term by 1
3. b increases by 1

Factorial: $n! = n.(n-1).\ldots.2.1$

$5! = 5.4.3.2.1 = 120$

$6! = 1.2.3.4.5.6$

Pascal Δ (Triangle) ΔABC



1 3 3 1

5x

#3 $(4x-y)^3 = (4x)^3 - 3(4x)^2 y + 3(4x)y^2 - y^3$

$= 64x^3 - 48x^2y + 12xy^2 - y^3$

1 4 6 4 1

#8 $(3t-5x)^4 = (3t)^4 - 4(3t)^3(5x) + 6(3t)^2(5x)^2$

$- 4(3t)(5x)^3 + 1(5x)^4$

27
20
25
54
100
125

$= 81t^4 - 540t^3x + 1350t^2x^2$

$- 12 \times 5^3 t x^3 + 5^4 x^4$

1 5 10 10 5 1

9/ $\left(\frac{1}{3}x + y^2\right)^5 = \left(\frac{1}{3}x\right)^5 + 5\left(\frac{1}{3}x\right)^4(y^2) + 10\left(\frac{1}{3}x\right)^3(y^2)^2$

$+ 10\left(\frac{1}{3}x\right)^2(y^2)^3 + 5\left(\frac{1}{3}x\right)(y^2)^4 + (y^2)^5$

$= \frac{x^5}{3^5} + \frac{5}{81}x^4y^2 + \frac{10}{27}x^3y^4$

$+ \frac{10}{9}x^2y^6 + \frac{5}{3}xy^8 + y^{10}$

1 6 15 20 15 6 1

10/ $\left(\frac{1}{x^2} + 3x\right)^6 = \left(\frac{1}{x^2}\right)^6 + 6\left(\frac{1}{x^2}\right)^5(3x) + 15\left(\frac{1}{x^2}\right)^4(3x)^2$ $\frac{y^2}{x^8}$

$+ 20\left(\frac{1}{x^2}\right)^3(3x)^3 + 15\left(\frac{1}{x^2}\right)^2(3x)^4$

$+ 6\left(\frac{1}{x^2}\right)(3x)^5 + (3x)^6$

$= \frac{1}{x^{12}} + 18\frac{1}{x^9} + 135\frac{1}{x^6} + 180\frac{1}{x^6}x^3$

$+ 15 \times 3^4 \frac{1}{x^4}x^4 + 6 \times 3^5 \frac{1}{x^2}x^5 + 3^6 x^6$

1 3 3 1

5x

#3 $(4x-y)^3 = (4x)^3 - 3(4x)^2 y + 3(4x)y^2 - y^3$

$= 64x^3 - 48x^2y + 12xy^2 - y^3$

1 4 6 4 1

#8 $(3t-5x)^4 = (3t)^4 - 4(3t)^3(5x) + 6(3t)^2(5x)^2$

$- 4(3t)(5x)^3 + 1(5x)^4$

27
20
25
54
100
125

$= 81t^4 - 540t^3x + 1350t^2x^2$

$- 12 \times 5^3 t x^3 + 5^4 x^4$

1 5 10 10 5 1

9/ $\left(\frac{1}{3}x + y^2\right)^5 = \left(\frac{1}{3}x\right)^5 + 5\left(\frac{1}{3}x\right)^4(y^2) + 10\left(\frac{1}{3}x\right)^3(y^2)^2$

$+ 10\left(\frac{1}{3}x\right)^2(y^2)^3 + 5\left(\frac{1}{3}x\right)(y^2)^4 + (y^2)^5$

$= \frac{x^5}{3^5} + \frac{5}{81}x^4y^2 + \frac{10}{27}x^3y^4$

$+ \frac{10}{9}x^2y^6 + \frac{5}{3}xy^8 + y^{10}$

1 6 15 20 15 6 1

10/ $\left(\frac{1}{x^2} + 3x\right)^6 = \left(\frac{1}{x^2}\right)^6 + 6\left(\frac{1}{x^2}\right)^5(3x) + 15\left(\frac{1}{x^2}\right)^4(3x)^2$ $\frac{y^2}{x^8}$

$+ 20\left(\frac{1}{x^2}\right)^3(3x)^3 + 15\left(\frac{1}{x^2}\right)^2(3x)^4$

$+ 6\left(\frac{1}{x^2}\right)(3x)^5 + (3x)^6$

$= \frac{1}{x^{12}} + 18\frac{1}{x^9} + 135\frac{1}{x^6} + 180\frac{1}{x^6}x^3$

$+ 15 \times 3^4 \frac{1}{x^4}x^4 + 6 \times 3^5 \frac{1}{x^2}x^5 + 3^6 x^6$

1 4 6 4 1

17. $(\sqrt{x} - \sqrt{3})^4 = (\sqrt{x})^4 - 4(\sqrt{x})^3(\sqrt{3})$
$+ 6(\sqrt{x})^2(\sqrt{3})^2 - 4(\sqrt{x})(\sqrt{3})^3 + (\sqrt{3})^4$

$= x^2 - 4\sqrt{3} \times \sqrt{x} + 18x - 12\sqrt{3}\sqrt{x} + 9$