

## Chapter 2 Binomial Theorem

### Let's Practise

(a) 1, 6, 15, 20, 15, 6, 1

(b) 1, 7, 21, 35, 35, 21, 7, 1

### FOLLOW-UP

2.1 (a) 
$$\sum_{r=0}^2 \binom{2}{r} (2+5)$$

$$= \binom{2}{0}(2+5) + \binom{2}{1}(2+5) + \binom{2}{2}(2+5)$$

$$= 30$$

(b) 
$$\sum_{r=0}^6 \binom{6}{r} r^2$$

$$= 1^2 + 2^2 + 3^2 + 4^2 + 5^2 + 6^2$$

$$= 91$$

2.2 Let  $T(r)$  be the general term of the sequence 1, 8, 27, ..., 512.

Note that

$$T(1) = 1 = 1^3,$$

$$T(2) = 8 = 2^3,$$

$$T(3) = 27 = 3^3$$

$$\therefore T(n) = n^3$$

$$\therefore 1 + 8 + 27 + \dots + 512 = \sum_{r=1}^8 r^3$$

2.3 (a) 
$$(2a+3b)^4$$

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

$$+ 4(2a)(3b)^3 + 1 \cdot (3b)^4$$

$$= \underline{16a^4 + 96a^3b + 216a^2b^2 + 216ab^3 + 81b^4}$$

(b) 
$$\left(x - \frac{1}{2}\right)^5$$

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

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

$$= x^5 - \frac{5}{2}x^4 + \frac{5}{2}x^3 - \frac{5}{4}x^2 + \frac{5}{16}x - \frac{1}{32}$$

2.4 
$$\left(\frac{x}{2} + 4\right)^7$$

$$= \left(4 + \frac{x}{2}\right)^7$$

$$= C_0^7 4^7 + C_1^7 (-4)^6 \left(\frac{x}{2}\right) + C_2^7 (-4)^5 \left(\frac{x}{2}\right)^2$$

$$+ C_3^7 (-4)^4 \left(\frac{x}{2}\right)^3 + \dots$$

$$= 1 \cdot (-4)^7 + 7(-4)^6 \left(\frac{x}{2}\right) + 10(-4)^5 \left(\frac{x}{2}\right)^2$$

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

$$= \underline{1024 + 640x + 160x^2 + 20x^3 + \dots}$$

2.5 (a) The 4th term =  $C_3^5 (2)^2 (-3x)^3$ 

$$= 56 \cdot 8 \cdot (-243x^3)$$

$$= \underline{-108864x^3}$$

(b) The term containing  $x^2 = C_2^5 (3x)^2 (4)^3$ 

$$= (35)(27x^2)(256)$$

$$= \underline{241920x^2}$$

(c) General term =  $C^r (2x)^{6-r} \left(\frac{1}{3x}\right)^r$ 

$$= C^r (2^r x^{6-r}) \left(\frac{1}{3}\right)^r x^{-r}$$

For the constant term, the power of  $x$  is 0,  
i.e.,  $6 - 2r = 0$   
 $r = 3$

$$\therefore \text{The constant term} = C_3^6 (2^3) \left(\frac{1}{3}\right)^3$$

$$= \underline{\frac{160}{27}}$$

2.6 
$$(p-q)^7 = C_0^7 p^7 + C_1^7 p^6 (-q) + \dots$$

$$= p^7 - 7p^6q + \dots$$

$$\therefore p^7 = 128$$

$$= 2^7$$

$$p = 2$$

$$-7p^6q = -672$$

$$-7(2)^6q = -672$$

$$q = \frac{672}{7(2)^6}$$

$$= \frac{1}{2}$$

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