

BINOMIAL THEOREM

$$1. (1+4x)^9 \approx 1 + {}^9C_1(4x) + {}^9C_2(4x)^2 + {}^9C_3(4x)^3$$

$$= \underline{1 + 36x + 576x^2 + 5376x^3}$$

$$2. (i) (2x^2 + 5x - 7)(x^2 - 6x + 4)$$

$$x^2: 2x^2 \times 4 + 5x(-6x) + (-7)x^2$$

$$= -29x^2$$

$$\text{coefficient} = \underline{-29}$$

$$(ii) (2+5x)^{10}$$

$$x^2: {}^{10}C_2 2^8 (5x)^2 = 288000x^2 \quad \text{coefficient} = \underline{288000}$$

$$3. (i) (2+3x)^4 = 2^4 + {}^4C_1 2^3(3x) + {}^4C_2 2^2(3x)^2 + {}^4C_3 2(3x)^3 + (3x)^4$$

$$= \underline{16 + 96x + 216x^2 + 216x^3 + 81x^4}$$

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

$$x^2: \frac{x^2}{4} \times 16 + (-x)96x + 1 \times 216x^2$$

$$= 124x^2$$

$$\text{coefficient} = \underline{124}$$

$$4. (i) (1-4x)^6 \approx 1 + {}^6C_1(-4x) + {}^6C_2(4x)^2$$

$$= 1 - 24x + 240x^2$$

$$c = \underline{-24} \quad d = \underline{240}$$

$$(ii) (2-3x-x^2)(1-4x)^6 \approx (2-3x-x^2)(1-24x+240x^2)$$

$$x^2: 2 \times 240x^2 + (-3x)(-24x) + (-x^2)(1)$$

$$= 551x^2$$

$$\text{coefficient} = \underline{551}$$

$$5. (i) (2+3x)^6 \approx 2^6 + {}^6C_1(2^5)(3x) + {}^6C_2(2^4)(3x)^2$$

$$= \underline{64 + 576x + 2160x^2}$$

$$(ii) (1+ax)(2+3x)^6 \approx (1+ax)(64+576x+2160x^2)$$

$$x^2: (1)(2160x^2) + (ax)(576x)$$

$$\Rightarrow 2160x^2 + 576ax^2 = 2304x^2$$

$$576a = 144$$

$$a = \underline{0.25}$$

$$6. (i) (1+3x)^8 \approx 1 + {}^8C_1(3x) + {}^8C_2(3x)^2 + {}^8C_3(3x)^3$$

$$= \underline{1 + 24x + 252x^2 + 1512x^3}$$

$$(ii) (1-3x)^8 \approx 1 - 24x + 252x^2 - 1512x^3$$

$$(1+3x)^8 + (1-3x)^8 \approx \underline{2 + 504x^2}$$

$$(iii) 1.000003^8 + 0.999997^8 \quad \text{let } x = 0.000003$$

$$\approx 2 + 504 \times 0.000003^2$$

$$= \underline{2.000000004536}$$