Exercise walk-through

2.5
Binomial expansion

Pearson Edexcel · International A-Level · Pure Mathematics

Check yourself

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Exhaustion with complete cases; counterexamples; factor/remainder theorems with $(ax - b)$; circles from any form plus the three properties; both series families with proofs and logs; binomial coefficients; log laws with domain checks; identity-reduced trig equations in either unit; stationary points classified and modelled; areas by definite integral and by the trapezium rule with the error direction.

Exercises 2.1·2.3

2.1 Expand $(1+3x)^4$ in ascending powers of x. [4]

2.2 Write down the first three terms of $(2+x)^5$ in ascending powers of x. [3]

2.3 Find the coefficient of x^2 in $(1-2x)^6$. [2]

Exercises 2.1·2.3

2.1 Expand $(1+3x)^4$ in ascending powers of x. [4]

2.1 $1+4(3x)+6(3x)^2+4(3x)^3+(3x)^4 = 1+12x+54x^2+108x^3+81x^4$.

2.2 Write down the first three terms of $(2+x)^5$ in ascending powers of x. [3]

2.2 $32+5(16)x+10(8)x^2 = 32+80x+80x^2$.

2.3 Find the coefficient of x^2 in $(1-2x)^6$. [2]

2.3 $\binom{6}{2}(-2x)^2 = 15\times 4x^2 = 60x^2$, so the coefficient is 60.

Exercises 2.4·2.5

2.4 Find the coefficient of x^3 in $(3+x)^5$. [3]

2.5 Find the coefficient of x^2 in $\left(1+\frac{x}{2}\right)^8$. [3]

Exercises 2.4·2.5

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2.4 $\binom{5}{3}(3)^2(x)^3 = 10 \times 9 = 90$.

2.5 Find the coefficient of x^2 in $\left(1+\dfrac{x}{2}\right)^8$. [3]

2.5 $\binom{8}{2}\left(\frac{x}{2}\right)^2 = 28 \times \frac{x^2}{4} = 7x^2$, coefficient 7.

Exercise 3.1

3.1 *(Adapted from Edexcel IAL WMA12 June 2025 Q1.)*

(a) Find the first four terms, in ascending powers of x, of the binomial expansion of $(1-3x)^5$, giving each term in simplest form.

(b) In the expansion of $(2+15x)(1-3x)^5$, the coefficient of the term in x^2 is -45. Use the answer to part (a) to verify this. [6]

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3.1 (a) Coefficients $1, 5, 10, 10$:

$$(1-3x)^5 = 1 - 15x + 90x^2 - 270x^3 + \cdots$$

(b) The x^2 contributions: $2(90x^2) + 15x(-15x) = 180x^2 - 225x^2 = -45x^2$ ✓ – the stated coefficient is correct.

Exercise 3.2

3.2 Use the first three terms of the expansion of $(1+2x)^6$ to estimate $(1.02)^6$, and compare your estimate with the exact value. [5]

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3.2 Expand first: $(1+2x)^6 = 1 + 6(2x) + 15(2x)^2 + \cdots = 1 + 12x + 60x^2 + \cdots$. For $(1.02)^6$ set $1 + 2x = 1.02$, so $x = 0.01$:

$$1 + 12(0.01) + 60(0.01)^2 = 1 + 0.12 + 0.006 = 1.126$$

Exact: $1.02^6 = 1.126162\ldots$ – the three-term estimate agrees to 3 decimal places ✓. (Take care to match x to the bracket: here $2x = 0.02$, not $x = 0.02$.)

Local review guidance: correct binomial coefficient with the right power of bx; simplified terms; coefficient equation set up from both contributions, or the substitution matched to the bracket. This is authored classroom guidance.