

MATHEMATICS – GRADE 9
CYCLE TEST 2 (ADVANCED CHALLENGE)
Time: 60 minutes
Total: 50 marks

Instructions

- Answer all questions.
- Show full working – method marks are awarded.
- Simplify answers where possible.

QUESTION 1: Exponents & Laws (20 marks)

1.1 Simplify completely (no negative exponents) (12 marks)

1.1.1

$$\frac{2^4 \times 8^2}{2^3}$$

(3)

1.1.2

$$\frac{3^5 \times 27}{9^2}$$

(3)

1.1.3

$$(2^3 \times 4^2)^2$$

(3)

1.1.4

$$\frac{5^{-2} \times 5^4}{5}$$

(3)

1.2 Mixed exponent reasoning (4 marks)

1.2.1

$$16^x = 2^8$$

Solve for x . (2)

1.2.2

$$9^{x+1} = 81$$

Solve for x . (2)

1.3 Application problem (4 marks)

A bacteria culture doubles every hour. If the initial amount is represented as 2^3 , express the amount after 4 hours as a power of 2.

$$2^3 \times 2^4$$

1.3.1 Simplify the expression. (2)

1.3.2 State the final answer as a single power of 2. (2)

QUESTION 2: Scientific Notation (8 marks)

2.1 Convert (4 marks)

2.1.1

$$0.00000672 \text{ (2)}$$

2.1.2

$$9\,540\,000 \text{ (2)}$$

2.2 Multi-step operations (4 marks)

2.2.1

$$(4 \times 10^2)(5 \times 10^5)$$

(2)

2.2.2

$$\frac{8 \times 10^6}{4 \times 10^3}$$

(2)

QUESTION 3: Number Patterns & Generalisation (12 marks)

3.1 Investigate pattern (7 marks)

Sequence:

3, 7, 13, 21, 31, ...

3.1.1 Find the first differences. (2)

3.1.2 Explain why this is not a linear pattern. (2)

3.1.3 Show that the rule is:

$$T_n = n^2 + n + 1$$

(3)

3.2 Reverse reasoning (5 marks)

Given:

$$T_n = 2n + 5$$

3.2.1 Determine which term is equal to 57. (3)

3.2.2 Is 60 a term in the sequence? Justify. (2)

QUESTION 4: Algebraic Expressions (10 marks)

4.1 Simplify (5 marks)

4.1.1

$$2x + 3(2x - 1) - 4(x - 2)$$

(3)

4.1.2

$$6a - [3a - (2a - 5)]$$

(2)

4.2 Factorisation & structure (5 marks)

4.2.1

$$8x + 12$$

(2)

4.2.2

$$x^2 + 3x + x + 3$$

Factorise by grouping. (3)

TOTAL: 50 MARKS

Why this is more difficult

This paper deliberately increases rigor by:

- Requiring **base conversion before applying exponent laws**
- Including **non-linear pattern recognition**
- Introducing **proof-style reasoning** ("show that...")
- Testing **reverse logic** (is a number in a sequence?)
- Using **nested algebraic structures and grouping factorisation**