The Laws of Exponents: Complete Exam Guide

MARKING GUIDELINE

MARKS	DURATION	QUESTIONS
31	50 minutes	3

Name: _____ Class: _____

Date: _____

MARK _____ / 31

INSTRUCTIONS AND INFORMATION

1. Answer **ALL** the questions in this question paper.
2. Answer QUESTION 1 by **circling** the letter (A–D) in the answer grid at the end of that section.
3. Show **ALL** calculations clearly.
4. Show all units where applicable.
5. Number the answers correctly according to the numbering system used in this question paper.
6. A non-programmable calculator may be used, unless stated otherwise.
7. Write neatly and legibly.

QUESTION 1 [10 MARKS]

Four options are given as possible answers to the following questions. Choose the correct answer and circle the letter (A–D) in the grid at the end of this section. If you want to change your choice, put a cross through the wrong letter and circle your new choice.

1.1 $3^4 \times 3^2 = \ldots$ (1)

A) 3^6 ✓ **B)** 3^8

C) 9^6 **D)** 3^2

Answer: A — Same base, multiplying: ADD the exponents.

- **B** — multiplied the exponents
- **C** — the BASE must not be multiplied too
- **D** — subtracted the exponents

1.2 $(2x^3)^4 = \ldots$ (1)

A) $8x^{12}$ **B)** $16x^{12}$ ✓

C) $16x^7$ **D)** $2x^{12}$

Answer: B — Everything inside is raised to the 4th: $2^4 = 16$ and $(x^3)^4 = x^{12}$.

- **A** — used 2^3 instead of 2^4
- **C** — added the exponents instead of multiplying
- **D** — forgot to raise the 2

1.3 $\frac{15x^7}{3x^2} = \ldots$ (1)

A) $5x^{3,5}$ **B)** $12x^5$

C) $5x^9$ **D)** $\mathbf{5x^5}$ ✓

> **Answer: D** — $15 \div 3 = 5$ and $x^7 \div x^2 = x^5$.
> - **A** — divided the exponents
> - **B** — SUBTRACTED the coefficients instead of dividing
> - **C** — ADDED the exponents

1.4 If $x \neq 0$, then $x^0 + 2^0 = \ldots$ (1)

A) 0 **B)** 1

C) 3 **D)** $\mathbf{2}$ ✓

> **Answer: D** — Each term is 1, and $1 + 1 = 2$.
> - **A** — a zero exponent gives 1, not 0
> - **B** — only one of the two terms was counted
> - **C** — treated 2^0 as 2

1.5 Which one of the following is EQUAL to $2^3 \times 4^2$? (1)

A) 8^5 **B)** 2^6

C) $\mathbf{2^7}$ ✓ **D)** 8^6

> **Answer: C** — $4^2 = (2^2)^2 = 2^4$, so the product is 2^{3+4}.
> - **A** — multiplied the bases as well
> - **B** — used $4^2 = 2^3$
> - **D** — multiplied the exponents

1.6 $(a^2b^3)^2 = \ldots$ (1)

A) $\mathbf{a^4b^6}$ ✓ **B)** $2a^2b^3$

C) a^4b^5 **D)** a^2b^6

> **Answer: A** — Multiply each exponent by 2.
> - **B** — multiplied the whole term by 2
> - **C** — added 2 to the exponent of b instead of doubling it
> - **D** — forgot to double the exponent of a

1.7 $5x^3 + 5x^3 = \ldots$ (1)

A) $\mathbf{10x^3}$ ✓ **B)** $25x^6$

C) $5x^6$ **D)** $10x^6$

> **Answer: A** — These are LIKE terms, so the exponent does not change.
> - **B** — multiplied the coefficients too
> - **C** — forgot to add the coefficients
> - **D** — added the exponents as if multiplying

1.8 $\dfrac{x^3 \times x^5}{x^2 \times x^4} = \ldots$ (1)

A) x^4 **B)** x^{14}

C) x^0 **D)** x^2 ✓

> **Answer: D** — Top: x^8. Bottom: x^6. So $x^{8-6} = x^2$.
> - **A** — used $8 - 4$, ignoring the x^2 below
> - **B** — added all four exponents
> - **C** — the exponents do not cancel completely

1.9 If $2^x = 32$, then $x = \ldots$ (1)

A) 16 **B)** 5 ✓

C) 4 **D)** 6

> **Answer: B** — $2^5 = 32$.
> - **A** — halved 32
> - **C** — $2^4 = 16$
> - **D** — $2^6 = 64$

1.10 $(-3)^2 \times (-3)^3 = \ldots$ (1)

A) 3^5 **B)** 9^5

C) $(-3)^5$ ✓ **D)** $(-3)^6$

> **Answer: C** — Same base, so add the exponents: $2 + 3 = 5$. (The value is -243.)
> - **A** — the base is -3, not 3, and an odd power stays negative
> - **B** — the base must not be squared as well
> - **D** — multiplied the exponents

ANSWER GRID — MARKING GUIDELINE

1.1	(A)	B	C	D
1.2	A	(B)	C	D
1.3	A	B	C	(D)
1.4	A	B	C	(D)
1.5	A	B	(C)	D
1.6	(A)	B	C	D
1.7	(A)	B	C	D
1.8	A	B	C	(D)
1.9	A	(B)	C	D
1.10	A	B	(C)	D

QUESTION 2 [11 MARKS]

Simplify the following. Leave your answers with positive exponents.

2.1 $\dfrac{12a^5b^2}{4a^2b^6}$ **(4)**

$12 \div 4 = 3$ *(1)*
$a^{5-2} = a^3$ *(1)*
$b^{2-6} = b^{-4}$ *(1)*
$= \mathbf{\dfrac{3a^3}{b^4}}$ *(1)*

2.2 $(2x^2y^3)^3 \times 3x^{-4}$ **(4)**

$(2x^2y^3)^3 = 8x^6y^9$ *(2)*
$\times 3x^{-4} = 24x^{6-4}y^9$ *(1)*
$= \mathbf{24x^2y^9}$ *(1)*

2.3 Calculate WITHOUT a calculator: $(-3^2)(3)^{-2}$ **(3)**

$-3^2 = -9$ *(the exponent applies to the 3 only)* *(1)*
$(3)^{-2} = \dfrac{1}{9}$ *(1)*
$-9 \times \dfrac{1}{9} = \mathbf{-1}$ *(1)*

QUESTION 3 [10 MARKS]

Answer the following WITHOUT using a calculator.

3.1 Calculate: $4^2 - [6 \div (-2)]^3$ **(4)**

$6 \div (-2) = -3$ *(1)*
$(-3)^3 = -27$ *(1)*
$16 - (-27)$ *(1)*
$= \mathbf{43}$ *(1)*

3.2 Calculate: $12 \times 7^0 + (5y)^0$, where $y \neq 0$ **(3)**

$7^0 = 1$, so $12 \times 7^0 = 12$ *(1)*
$(5y)^0 = 1$ — the zero exponent applies to the WHOLE bracket, not just the y *(1)*
$= \mathbf{13}$ *(1)*

3.3 Show that 2^{-3} can be written as a common fraction, and give its value. **(3)**

$2^{-3} = \dfrac{1}{2^3}$ *(1)*
$= \dfrac{1}{8}$ *(2)*

TOTAL: 31 marks

This question paper consists of 3 questions.

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