



KS3.M-N12 Indices and the Index Laws

AQA KS3.M-N12 · Calculators not allowed · about 60 minutes

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

1 Write down the value of each power.

(a) 2^4 (1)

(b) 5^2 _____ (1)

(c) 10^1 _____ (1)

(d) 1^5 _____ (1)

2 Write down the value of each expression with zero or negative indices.

(a) 7^0 (1)

(b) 2^{-2} _____ (1)

(c) $(-3)^0$ _____ (1)

3 Use index laws to simplify each product. Give your answer as a single power.

(a) $x^3 \times x^4$ (1)

(b) $2^3 \times 2^5$ (1)

(c) $a^1 \times a^6$ (1)

4 Use index laws to simplify each quotient. Give your answer as a single power or a number.

(a) x^7 / x^2 (1)

(b) $3^5 / 3^3$ (1)

(c) b^4 / b^4 (1)

5 Calculate the value. Show a short method.

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

6 Use the power-of-a-power rule to simplify. Give your answer as a single power.

(a) $(x^3)^4$ (2)

7 Simplify fully. Expand brackets where needed and give a final single-term answer.

(a) $(2x^2)^3$ (3)

8 Simplify each expression. Give answers as single powers or numbers.

(a) $(3x^2)^2$ (2)

9 Calculate and write each answer as an exact number. Show the index law step.

(a) $(2^3)^2$ (3)

10 Use index laws to simplify each expression. Give answers in simplest form.

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

(b) $5^4 / 5^2$ (2)

11 Rewrite each expression using index laws and then evaluate if possible.

(a) $x^0 x^5$ (2)

(b) $6^0 \times 2^3$ (2)

12 A small electronic device uses power in units proportional to 2^n , where n is the version number. Version 0 uses 1 unit of power. Version 4 uses 16 units. A technician compares Version 4 to Version -1.

(a) State the power used by Version -1, showing your method using index laws. (3)

(b) How many times greater is the power of Version 4 compared to Version -1? (3)
Show your working.

13 Fully simplify each expression. Show index steps where helpful.

(a) $p^5 / p^2 \times p^0$ (2)

(b) $4^3 / (2^3)$ (2)

14 Challenge problem. Simplify the expression fully and give the answer as a single number or single power.

(a) $(2^3 \times 2^{-2}) \times (4^2 / 2^3)$

(5)

Mark scheme · KS3.M-N12 Indices and the Index Laws

Question 1

- (a) **B1** 16 cao
- (a) Answer: **16**
- (b) **B1** 25 cao
- (b) Answer: **25**
- (c) **B1** 10 cao
- (c) Answer: **10**
- (d) **B1** 1 cao
- (d) Answer: **1**

Question 2

- (a) **B1** 1 cao
- (a) Answer: **1**
- (b) **B1** $\frac{1}{4}$ or 0.25 cao
- (b) Answer: **$\frac{1}{4}$**
- (c) **B1** 1 cao
- (c) Answer: **1**

Question 3

- (a) **B1** x^7 cao
- (a) Answer: **x^7**
- (b) **B1** 2^8 or 256 cao
- (b) Answer: **2^8**
- (c) **B1** a^7 cao
- (c) Answer: **a^7**

Question 4

- (a) **B1** x^5 cao
- (a) Answer: **x^5**
- (b) **B1** 3^2 or 9 cao
- (b) Answer: **3^2**
- (c) **B1** 1 cao
- (c) Answer: **1**

Question 5

- (a) **M1** uses index law correctly to get 3^5 or shows $3^2 \times 3^3 = 9 \times 27$
- (a) **A1** 243 cao
- (a) Answer: **243**

Question 6

- (a) **M1** multiplies powers: $3 \times 4 = 12$
- (a) **A1** x^{12} cao
- (a) Answer: **x^{12}**

Question 7

- (a) **M1** cube 2 to get 8 or shows 2^3 and multiplies powers for x
- (a) **M1** multiply the index on x: $2 \times 3 = 6$
- (a) **A1** $8x^6$ cao
- (a) Answer: **$8x^6$**

Question 8

- (a) **M1** square 3 to get 9 and multiply index of x: $2 \times 2 = 4$
- (a) **A1** $9x^4$ cao
- (a) **Answer: $9x^4$**

Question 9

- (a) **M1** uses power-of-a-power rule: $(2^3)^2 = 2^{3 \times 2}$
- (a) **M1** evaluates $2^6 = 64$
- (a) **A1** 64 cao
- (a) **Answer: 64**

Question 10

- (a) **M1** add indices of a and b separately: a^{3+2} and b^{2+4}
- (a) **A1** $a^5 b^6$ cao
- (a) **Answer: $a^5 b^6$**
- (b) **M1** subtract indices: $4 - 2 = 2$
- (b) **A1** 25 cao
- (b) **Answer: 25**

Question 11

- (a) **M1** recognises $x^0 = 1$ and multiplies to get x^5
- (a) **A1** x^5 cao
- (a) **Answer: x^5**
- (b) **M1** use $6^0 = 1$ then evaluate 2^3
- (b) **A1** 8 cao
- (b) **Answer: 8**

Question 12

- (a) **M1** uses index rule $2^{-1} = 1/2$ or writes $2^{-1} = 1/2$
- (a) **M1** states the numerical value $1/2$
- (a) **A1** $1/2$ unit cao
- (a) **Answer: $1/2$**
- (b) **M1** uses division: $2^4 / 2^{-1} = 2^{4 - (-1)}$ or recognises 16 divided by $1/2$
- (b) **M1** evaluates 2^5 or $16 \times 2 = 32$
- (b) **A1** 32 times greater cao
- (b) **Answer: 32**

Question 13

- (a) **M1** uses $p^0 = 1$ and subtracts indices: p^{5-2}
- (a) **A1** p^3 cao
- (a) **Answer: p^3**
- (b) **M1** recognises $4 = 2^2$ or evaluates powers: $4^3 = 64$ and $2^3 = 8$
- (b) **A1** 8 cao
- (b) **Answer: 8**

Question 14

- (a) **M1** simplifies inside first bracket: $2^3 + (-2) = 2^1$ or shows $8 \times 1/4 = 2$
- (a) **M1** rewrites 4^2 as $(2^2)^2 = 2^4$ and simplifies second bracket: $2^4 / 2^3 = 2^{4-3} = 2^1$
- (a) **M1** multiplies results from brackets: $2 \times 2 = 4$
- (a) **M1** shows numerical evaluation leading to final value
- (a) **A1** 4 cao
- (a) **Answer: 4**