Indices and Standard Form

GCSE Mathematics • **Foundation Tier** • Grades 4–5 • Non-calculator

WORKED SOLUTIONS

Name: worked example Class: ..... Total: 46 / 46

Show all your working. Marks are given for correct method as well as the final answer.

1. Simplify $x^4 \times x^3$. **[1 mark]**

ADD the powers when multiplying

Answer: x^7

2. Simplify $y^9 \div y^4$. **[1 mark]**

SUBTRACT the powers when dividing

Answer: y^5

3. Simplify $(a^3)^4$. **[2 marks]**

MULTIPLY the powers
not a^7

Answer: a^{12}

4. Simplify $3x^2 \times 4x^5$. **[2 marks]**

numbers: $3 \times 4 = 12$
letters: x^{2+5}

Answer: $12x^7$

5. Simplify $\dfrac{20x^6}{5x^2}$. **[2 marks]**

$20 \div 5 = 4$
$x^{6-2} = x^4$

Answer: $4x^4$

6. Work out 5^0. **[1 mark]**

anything to the power 0 is 1

Answer: 1

7. Work out 2^{-3}. **[2 marks]**

negative power means one over
$\frac{1}{2^3} = \frac{1}{8}$

Answer: $\frac{1}{8}$

8. Work out $16^{\frac{1}{2}}$. **[2 marks]**

power $\frac{1}{2}$ means square root
$\sqrt{16} = 4$

Answer: 4

9. Work out $27^{\frac{1}{3}}$. **[2 marks]**

cube root of 27

Answer: 3

10. Simplify $(2x^3)^4$. **[3 marks]**

$2^4 = 16$
$(x^3)^4 = x^{12}$
the power hits the 2 as well

Answer: $16x^{12}$

11. Write 4 600 in standard form. **[2 marks]**

move the point 3 places left

Answer: 4.6×10^3

12. Write 0.00072 in standard form. **[2 marks]**

move the point 4 places right
small number → negative power

Answer: 7.2×10^{-4}

13. Write 3.5×10^4 as an ordinary number. **[2 marks]**

move the point 4 places right

Answer: 35000

14. Write 8.1×10^{-3} as an ordinary number. **[2 marks]**

move the point 3 places left

Answer: 0.0081

15. Explain why 43×10^5 is not in standard form. **[2 marks]**

the front number must be $1 \leq a < 10$
correct form: 4.3×10^6

Answer: 43 is not between 1 and 10

16. Work out $(3 \times 10^4) \times (2 \times 10^3)$, giving your answer in standard form. **[3 marks]**

$3 \times 2 = 6$
add the powers: 10^7

Answer: 6×10^7

17. Work out $(8 \times 10^9) \div (4 \times 10^2)$, giving your answer in standard form. **[3 marks]**

$8 \div 4 = 2$
subtract the powers: 10^7

Answer: 2×10^7

18. Work out $(5 \times 10^3) \times (4 \times 10^6)$, giving your answer in standard form. **[4 marks]**

$5 \times 4 = 20$
20×10^9
20 is too big -- renormalise
$= 2 \times 10^{10}$

Answer: 2×10^{10}

19. Work out $(6 \times 10^5) + (3 \times 10^4)$, giving your answer in standard form. **[3 marks]**

600000 + 30000 = 630000

you cannot just add the powers
$= 6.3 \times 10^5$

Answer: 6.3×10^5

20. The mass of a grain of sand is about 5×10^{-5} kg.

(a) Work out the mass of 2×10^6 grains, in standard form. **[3 marks]**

$5 \times 2 = 10$

powers: $-5 + 6 = 1$

$10 \times 10^1 = 1 \times 10^2$

(b) Write that mass as an ordinary number. **[2 marks]**

$= 100$ kg

Answer: 1×10^2 kg $= 100$ kg