



**eClassroom**

GCSE Mathematics

# Indices

**Worked Solutions**

---

Pearson Edexcel GCSE & iGCSE Mathematics



## Section A — Foundation — Worked Solutions

### [Fluency] Question 1

---

$$3^4 = 3 \times 3 \times 3 \times 3 = 81$$

$$\therefore 81$$

### [Fluency] Question 2

---

Add the indices:  $2^3 \times 2^4 = 2^{3+4} = 2^7$

$$\therefore 2^7 (= 128)$$

### [Fluency] Question 3

---

Subtract the indices:  $5^6 \div 5^2 = 5^{6-2} = 5^4$

$$\therefore 5^4 (= 625)$$

### [Fluency] Question 4

---

$2^1=2, 2^2=4, 2^3=8, 2^4=16, 2^5=32, 2^6=64$

$$\therefore 2^6$$

### [Fluency] Question 5

---

Any non-zero number raised to the power 0 = 1.

$$\therefore 1$$

### [Fluency] Question 6

---

Multiply the indices:  $(3^2)^4 = 3^{2 \times 4} = 3^8$

$$\therefore 3^8 (= 6561)$$

### [Reasoning] Question 7

---

A negative index means reciprocal:  $a^{-n} = 1/a^n$

$$5^{-2} = 1/5^2 = 1/25$$

$$\therefore 1/25$$

**[Reasoning] Question 8**

---

A fractional index  $1/3$  means cube root.

$$27^{1/3} = \sqrt[3]{27} = 3, \text{ because } 3^3 = 27.$$

$$\therefore \mathbf{3}$$

**[Problem Solving] Question 9**

---

Write 32 as a power of 2:  $32 = 2^5$

$$\text{So } 2^x = 2^5 \rightarrow x = 5$$

$$\therefore \mathbf{x = 5}$$

**[Problem Solving] Question 10**

---

$$2^3 = 8, \quad 3^3 = 27, \quad 8 \times 27 = 216$$

$$6^6 = 46\,656 \neq 216, \text{ so Amy is wrong.}$$

$$\text{Correct simplification: } 2^3 \times 3^3 = (2 \times 3)^3 = 6^3 = 216$$

$$\therefore \mathbf{\text{Amy is wrong. } 2^3 \times 3^3 = 6^3 = 216}$$



## Section B — Higher — Worked Solutions

### [Fluency] Question 1

$$125^{1/3} = \text{cube root of } 125 = 5 \text{ (since } 5^3 = 125)$$

$$\therefore 5$$

### [Fluency] Question 2

$$8^{2/3} = (8^{1/3})^2 = 2^2 = 4$$

(cube root of 8 = 2, then square it)

$$\therefore 4$$

### [Fluency] Question 3

$$\text{Numerator: } x^3 \times x^5 = x^{3+5} = x^8$$

$$\text{Then divide: } x^8 \div x^4 = x^{8-4} = x^4$$

$$\therefore x^4$$

### [Fluency] Question 4

$$16^{-3/4} = 1 \div 16^{3/4}$$

$$16^{1/4} = 2 \text{ (since } 2^4 = 16), \text{ so } 16^{3/4} = 2^3 = 8$$

$$\text{Therefore: } 16^{-3/4} = 1/8$$

$$\therefore 1/8$$

### [Reasoning] Question 5

$$4^{3/2} = (4^{1/2})^3$$

$$4^{1/2} = \sqrt{4} = 2$$

$$\text{So: } 2^3 = 8 \quad \checkmark$$

$$\therefore 4^{3/2} = 8$$

### [Reasoning] Question 6

$$9^{5/2} = (9^{1/2})^5$$

$$9^{1/2} = \sqrt{9} = 3$$

$$3^5 = 3 \times 3 \times 3 \times 3 \times 3 = 243 \quad \checkmark$$

$$\therefore 9^{5/2} = 243$$

**[Reasoning] Question 7**

---

$$81 = 3^4, \text{ so: } 3^{2x+1} = 3^4$$

$$\text{Equate indices: } 2x + 1 = 4 \rightarrow 2x = 3$$

$$\therefore x = 3/2$$

**[Problem Solving] Question 8**

---

$$\text{Write 4 as a power of 2: } 4 = 2^2$$

$$\text{So } 4^{x+2} = 2^{2(x+2)} = 2^{2x+4}$$

$$\text{Equation becomes: } 2^{3x} = 2^{2x+4}$$

$$\text{Equate indices: } 3x = 2x + 4 \rightarrow x = 4$$

$$\therefore x = 4$$

**[Problem Solving] Question 9**

---

$$5^{3a-1} = 5^{3a} \div 5^1$$

$$= (5^a)^3 \div 5$$

$$= 3^3 \div 5 \quad (\text{since } 5^a = 3)$$

$$= 27 \div 5$$

$$\therefore 27/5$$

**[Problem Solving] Question 10**

---

Write everything as powers of 2:

$$4^n = (2^2)^n = 2^{2n}$$

$$2^{n+2} = 2^{n+2}$$

$$8^{n-1} = (2^3)^{n-1} = 2^{3n-3}$$

$$\text{Numerator: } 2^{2n} \times 2^{n+2} = 2^{3n+2}$$

$$\text{Divide: } 2^{3n+2} \div 2^{3n-3} = 2^{(3n+2)-(3n-3)} = 2^5 = 32 \quad \checkmark$$

$$\therefore (4^n \times 2^{n+2}) \div 8^{n-1} = 32 \text{ for all integer } n.$$