

## OCR 03 Indices and surds (Foundation)

1. Work out  $4^3$ .
2. Write  $\frac{1}{5}$  using indices.
3. Simplify  $\sqrt{36}$ .
4. Calculate  $7^3 \times 7^{-2}$ .
5. Write the number 245 in standard form.
6. Simplify  $\frac{10^{-4}}{10^3}$ .
7. Simplify  $(2.2 \times 10^5) \times (3 \times 10^{-2})$ .
8. The circumference  $C$  of a circle with radius  $r$  is given by the formula  $C = 2\pi r$ .  
Calculate the circumference of a circle with radius 4 cm, giving your answer in terms of  $\pi$ .
9. Calculate  $\frac{1}{2} \times \frac{2}{5} \times 3$ . Give your answer in the form  $\frac{a}{b}$ .
10. Work out  $\frac{3^{-5}}{3^{-4}} \times \frac{2^2}{2^{-1}}$ .
11. Sam writes  $3^2 \times 3^4 = 3^6$ . Is Sam correct? Explain your answer.
12. Show that  $(\sqrt{64})^{-2} = \frac{1}{64}$ .
13. Which of the following numbers is the smallest? Show how you decide.  
 $1^{-5}$      $15^0$      $0.5$      $(0.5)^{-1}$
14. Venus is  $1.1 \times 10^8$  km from the Sun. Mars is  $2.3 \times 10^8$  km from the Sun.  
Zoe says “ $2.3 \times 10^8$  take away  $1.1 \times 10^8$  is  $1.2 \times 10^0$ , so Mars is 1.2 km further away from the Sun than Venus is”. Explain why Zoe’s calculation is wrong.
15. Show that  $(2^3)^4 = (2^4)^3$ .
16. A tank in the shape of a cube holds  $125 \text{ m}^3$  of water when full. What are the dimensions of the tank?

17. 32 g of sulphur contains approximately  $4 \times 10^{23}$  atoms.  
What is the mass of one atom of sulphur?
18. Ebru's digital camera has  $1 \times 10^9$  bytes of storage. She takes photos that each need  $2 \times 10^6$  bytes of storage.  
How many photos can she store on her camera? Give your answer in standard form.
19. A square has an area of  $12.25 \text{ m}^2$ . Find the perimeter of the square.
20. Chen thinks of a number. He finds the cube root of the number and then squares this answer. He now has the number 81. What number did Chen first think of?

**Answers**

1. 64

2.  $5^{-1}$

3.  $(\pm)6$

4. 7

5.  $2.45 \times 10^2$

6.  $-4 - 3 = -7$   
 $10^{-7}$  or 0.0000001

7.  $2.2 \times 3 = 6.6$ ,  $10^5 \times 10^{-2} = 10^3$   
 $6.6 \times 10^3$  or 6600

8.  $2 \times 4 \times \pi$   
 $8\pi$  (cm)

9.  $\frac{2}{10} \times 3 = \frac{6}{10}$  or  $\frac{3}{5}$

10.  $\frac{3^{-5}}{3^{-4}} \times \frac{2^2}{2^{-1}} = 3^{-1} \times 2^3$   
 $= \frac{8}{3}$

11. Yes with correct explanation. For example,  $3^2 \times 3^4 = 3 \times 3 \times 3 \times 3 \times 3 \times 3$ , or “the rule is when you multiply you add the indices”.

12.  $(\sqrt{64})^{-2} = (8)^{-2} = \frac{1}{8^2} = \frac{1}{64}$

13. 0.5 because  $1^{-5} = 1$ ,  $15^0 = 1$  and  $(0.5)^{-1} = 2$ .14. The answer should be  $1.2 \times 10^8$ . If correct answer not given, explanation should include the fact that she should not have subtracted the indices.15. Both equal  $2^{12}$  or  
 $(2 \times 2 \times 2)(2 \times 2 \times 2)(2 \times 2 \times 2)(2 \times 2 \times 2) = (2 \times 2 \times 2 \times 2)(2 \times 2 \times 2 \times 2)(2 \times 2 \times 2 \times 2)$ 16.  $\sqrt[3]{125} = 5$  so tank is  $5 \times 5 \times 5$  m.

17.  $\frac{32}{4 \times 10^{23}} = 8 \times 10^{-23} \text{ g}$

18.  $\frac{1 \times 10^9}{2 \times 10^6} = 0.5 \times 10^3$   
 $= 5 \times 10^2$

19. Side length =  $\sqrt{12.25} = 3.5 \text{ m}$  so perimeter = 14 m.

20.  $\sqrt{81} = 9$   
 $9^3 = 729$

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Assessment Objective	Qu.	Topic	R	A	G
AO1	1	Use positive integer indices			
AO1	2	Use negative indices to represent reciprocals			
AO1	3	Calculate exact roots			
AO1	4	Calculate with integer powers			
AO1	5	Convert numbers to and from standard form			
AO1	6	Calculate with integer powers			
AO1	7	Know and apply laws of indices			
AO1	8	Use multiples of $\pi$ in exact calculations			
AO1	9	Use fractions in exact calculations			
AO1	10	Calculate with integer powers			
AO2	11	Know and apply the laws of indices			
AO2	12	Calculate with integer powers and roots			
AO2	13	Interpret indices			
AO2	14	Subtract numbers in standard form			
AO2	15	Know and apply laws of indices			
AO3	16	Recognise simple powers			
AO3	17	Calculate with numbers in standard form			
AO3	18	Divide numbers in standard form			
AO3	19	Calculate with roots			
AO3	20	Calculate positive integer powers and exact roots			

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