

OCR 01 Number Operations and Integers (Higher)

1. Find the cube root of 729.
2. List the prime numbers that are also factors of 28.
3. Calculate the product of 6, 8 and -10.
4. Calculate $15 - \sqrt[3]{8} \times 5 + 3$.
5. Calculate $\sqrt[3]{32} \times \sqrt[3]{32} \times \sqrt[3]{32}$.
6. Calculate $\sqrt{\frac{5^2 \times (6-3)^2}{-1+2 \times 5}}$.
7. What number can be expressed as $2^4 \times 3^2 \times 5^3$?
8. Express 1352 as a product of its prime factors.
9. Find the Highest Common Factor and the Lowest Common Multiple of 324 and 729.
10. Put one or more pairs of brackets in the following statement to make it true.

$$48 \div 3^2 - 5 - 2 + 6 = 30$$

11. Explain why it is impossible for a prime number to be a square number.
12. Shamina tries to find the Lowest Common Multiple (LCM) of 36, 80 and 150 and writes down the following.

$$36 = 2^2 \times 3^3$$

$$80 = 2^4 \times 5$$

$$150 = 2 \times 3 \times 5^2$$

$$\text{LCM} = 2^2 \times 3^3 \times 5^2 = 2700.$$

Explain what she has done wrong and find the correct LCM.

13. Alex says that the cube of any integer is always bigger than the square of the same integer. Is he correct? Explain your answer.
14. Eamonn thinks of an integer. He squares it and then subtracts the starting integer and he gets an answer of 12. John says the original number can only be 4. Is he correct? Explain your answer.
15. Show that the difference between any two consecutive square numbers is always an odd number.

16. Alexander writes 355 765 500 as the product of its prime factors, as shown below.

$$2^2 \times 3^2 \times 5^3 \times 19 \times 57 \times 73$$

State, with a reason, whether he is correct or not.

17. Teams in a competition are awarded 6 points for each game they win, 3 points for a draw and -2 points for a loss. One team has played seven games and has 17 points. They have won two games. How many games has this team drawn and lost?
18. Lucia wants to fill party bags each with 1 balloon and 1 pen. She has £12.50 to spend on balloons and pens. Balloons are sold in packs of 15 that cost £1.25. Pens are sold in packs of 6 that cost £1.75. She does not want any balloons or pens left over. How many packs of balloons and how many packs of pens should she buy?
19. A carpenter has two pieces of wood, one is 144 cm long and the other is 252 cm long. He wants to cut each piece into shelves, using all of the wood. All shelves must be the same length and made from a single piece of wood. What is the maximum shelf length, and how many shelves will this give?
20. Two consecutive square numbers have a product of 900. Which two square numbers are they?

Answers

1. 9

2. 2 and 7

3. -480

4. 2

5. 32

6. $\sqrt{\frac{5^2 \times 3^2}{-1+2 \times 5}} = \sqrt{\frac{225}{9}} = \sqrt{25} = (\pm)5$

7. $16 \times 9 \times 125 = 18000$

8. $2^3 \times 13^2$

9. $324 = 2^2 \times 3^4$ and $729 = 3^6$

Highest Common Factor = $3^4 = 81$

Lowest Common Multiple = $2^2 \times 3^6 = 2916$

10. $48 \div (3^2 - 5 - 2) + 6 = 30$

11. The definition of a prime number is that it only has one and itself as factors. A square number is an integer squared, so it has the integer as an additional factor and therefore cannot be a prime number.

12. Shamina has found the correct prime factors for all three numbers but has not selected the highest power of each factor when calculating the LCM. She should have written $\text{LCM} = 2^4 \times 3^3 \times 5^2 = 10800$ as her answer.

13. No, Alex is not correct as $1^3 = 1$ and $1^2 = 1$ which are equal or $(-1)^3 = -1$ which is smaller than $(-1)^2 = 1$.

14. Using inverse operations the original value could be 4 or -3, so John is not correct.

15. Two consecutive square numbers are $(n)^2$ and $(n+1)^2$. The difference between them would be $(n+1)^2 - n^2$. This gives $n^2 + 2n + 1 - n^2 = 2n + 1$. The value of $2n$ is always even and so $2n + 1$ is always odd.

16. No, he is not right, as 57 is not a prime number. It should be $2^2 \times 3^3 \times 5^3 \times 19^2 \times 73$.

MATHEMATICS

Section Check In

17. $17 - (6 \times 2) = 5$

Possible scores in remaining five games					Total
3	3	3	3	3	15
3	3	3	3	-2	10
3	3	3	-2	-2	5
3	3	-2	-2	-2	0
3	-2	-2	-2	-2	-5
-2	-2	-2	-2	-2	-10

They have drawn 3 games and lost 2.

18. To ensure no balloons or pens are left over, find the LCM of 6 and 15:

- Prime factors of 6 are 2 and 3. Prime factors of 15 are 3 and 5.
- LCM is $2 \times 3 \times 5 = 30$.
- Number of packs of balloons = $30 \div 15 = 2$.
- Number of packs of pens = $30 \div 6 = 5$.

Check Lucia can afford these:

- Cost of balloons = $2 \times 1.25 = \text{£}2.50$.
- Cost of pens = $5 \times 1.75 = \text{£}8.75$.
- Total cost = $2.50 + 8.75 = \text{£}11.25$.

19. $144 = 2^4 \times 3^2$ and $252 = 2^2 \times 3^2 \times 7$

HCF is $2^2 \times 3^2 = 36$ cm which is maximum shelf length.

4 shelves can be made from the first piece and 7 from the second to give 11 shelves in total.

20. $\sqrt{900} = 30$ and the nearest square numbers to 30 are 25 and 36.

$$25 \times 36 = 900$$

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Assessment Objective	Qu.	Topic	R	A	G
AO1	1	Find the cube root			
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AO1	7	Use power notation in expressing a whole number as a product of its prime factors			
AO1	8	Use power notation in expressing a whole number as a product of its prime factors			
AO1	9	Find the HCF and LCM of two whole numbers			
AO1	10	Perform calculations using priority of operations			
AO2	11	Understand and explain prime numbers and square numbers			
AO2	12	Interpret calculations			
AO2	13	Understand and explain square numbers and cube numbers			
AO2	14	Use and explain inverse operations			
AO2	15	Present a proof with square numbers			
AO3	16	Evaluate an answer involving prime factors			
AO3	17	Solve a number problem in context			
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