

Class 8 - Mathematics

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A Square and A Cube

CBSE NOTES

A Square and A Cube - Mastery Worksheet

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Solve the following questions. Write your answers in the space provided.

1. Explain why only square numbers have an odd number of factors. Provide examples and illustrate your reasoning using a factor tree diagram.

Hint: List out the factors and group them into pairs.

2. Demonstrate how to determine whether a number is a perfect square using prime factorization. Is 156 a perfect square? Show your calculations.

Hint: Break the number down into its prime factors.



Solve the following questions. Write your answers in the space provided.

3. Analyze the numbers 1 to 100. List all perfect squares and examine the range between two consecutive perfect squares. How many integers lie in those ranges?

Hint: Count the numbers lying between $\sqrt{n^2}$ and $\sqrt{(n+1)^2}$.

4. Given a perfect square's area is 49 cm^2 , deduce the side length and explain why the square root process yields the answer.

Hint: Use the formula for area of a square: $\text{Area} = \text{side} \times \text{side}$.



Solve the following questions. Write your answers in the space provided.

5. Prove that the sum of the first n odd numbers equals n^2 . Show the mathematical induction based on this theory.

Hint: Derive from known odd numbers.

6. Identify the first five prime numbers and explain why each is toggled exactly twice based on their factors using a diagram if necessary.

Hint: Show a visual representation with factor trees.



Solve the following questions. Write your answers in the space provided.

7. Analyze the number 9408. What is the minimum factor to multiply it by to get a perfect square? Find the square root of the resulting product.

Hint: Identify odd powers in prime factorization.

8. Examine the property of cubic numbers based on the number of zeros they end with. Provide examples to illustrate your reasoning.

Hint: Check how the factorization translates into the end zeros.



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Solve the following questions. Write your answers in the space provided.

9. Consider a number that is three times a perfect square. What are the potential outcomes? Provide integer examples and explore if it could yield another perfect square.

Hint: Explore through integers by substitution.

10. Demonstrate how to calculate the cube roots of the numbers 27000 and 10648, elaborating your process.

Hint: Build on the factorization method.



Check your answers with the solutions below.

1. Explain why only square numbers have an odd number of factors. Provide examples and illustrate your reasoning using a factor tree diagram.

Solution: A square number, such as 36, has factors: 1, 2, 3, 4, 6, 9, 12, 18, 36. The factor pairs are (1,36), (2,18), (3,12), and (4,9) plus the middle factor 6, counted once. Non-square numbers do not have this middle factor, resulting in an even count.

2. Demonstrate how to determine whether a number is a perfect square using prime factorization. Is 156 a perfect square? Show your calculations.

Solution: The prime factorization of $156 = 2 \times 2 \times 3 \times 13$. Since 13 cannot be paired, it's not a perfect square. A perfect square's bases must be even in pairs.

3. Analyze the numbers 1 to 100. List all perfect squares and examine the range between two consecutive perfect squares. How many integers lie in those ranges?

Solution: Perfect squares from 1 to 100 are 1, 4, 9, 16, 25, 36, 49, 64, 81, 100. For each pair like 1 and 4, there are 2 integers (2, 3) in between. The pattern can be summarized: each pair gives progressively more integers: e.g., between 36 (6^2) and 49 (7^2), there are 6 integers: 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48.

4. Given a perfect square's area is 49 cm^2 , deduce the side length and explain why the square root process yields the answer.

Solution: The length of the side is $\sqrt{49} = 7 \text{ cm}$. The inverse operation of squaring gives the original number, just like finding the area back to side length.



Check your answers with the solutions below.

5. Prove that the sum of the first n odd numbers equals n^2 . Show the mathematical induction based on this theory.

Solution: Base case: For $n=1$, $1 = 1^2$. Induction hypothesis: Assume true for $n=k$, then for $n=k+1$: $(1 + 3 + \dots + (2k-1)) + (2(k+1) - 1) = k^2 + (2k + 1) = (k + 1)^2$.

6. Identify the first five prime numbers and explain why each is toggled exactly twice based on their factors using a diagram if necessary.

Solution: The prime numbers are 2, 3, 5, 7, 11. They only have two factors, namely 1 and themselves, thus are toggled twice. Toggling occurs for both factors.

7. Analyze the number 9408. What is the minimum factor to multiply it by to get a perfect square? Find the square root of the resulting product.

Solution: The prime factorization gives: $9408 = 2^4 \times 3^1 \times 7^1$. To balance odd powers, multiply by $3 \times 7 = 21$ to get $9408 \times 21 = 20,304$ which is a perfect square. The square root $= \sqrt{(20,304)} = 142$.

8. Examine the property of cubic numbers based on the number of zeros they end with. Provide examples to illustrate your reasoning.

Solution: Cubic numbers can have an even number of zeros. For instance, $1000 (10^3) = 1000$ has three zeros. But, $8 (2^3)$ has none. Zero counts depend on underlying factors from original numbers.



Check your answers with the solutions below.

9. Consider a number that is three times a perfect square. What are the potential outcomes? Provide integer examples and explore if it could yield another perfect square.

Solution: Possible outcomes include 3, 12, 27, ... Not all formations yield another square, e.g., $3 \times 1^2 = 3$ (not square). Assess whether $3n^2$ could yield square values.

10. Demonstrate how to calculate the cube roots of the numbers 27000 and 10648, elaborating your process.

Solution: For 27000, since $30^3 = 27000$, cube root is 30. For 10648, $22^3 = 10648$, thus cube root is 22. The method leverages recognition of cubes.



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