

Squares and Square Roots

Question Paper, Set 10

Time: 1 hour 30 minutes

Maximum marks: 50

Name: _____ Class: _____ Date: _____

1. Answer all 20 questions. The marks for each question are shown in brackets.
2. Show your working for the 2, 3 and 5 mark questions.
3. The key sheet and worked solutions are at the end of this paper.

1. Write $q \times q$ in power form. [1 mark]
2. Find 13^2 . [1 mark]
3. Find the value of $28^2 - 21^2$. [2 marks]
4. Which number, when squared, gives 10000? [1 mark]
5. Using the rule for numbers ending in 5, find 115^2 . [2 marks]
6. Given $216^2 = 46656$, write the square root of 46656. [1 mark]
7. Find the value of $\sqrt{576} - \sqrt{361}$. [2 marks]
8. Using the prime factorization method, find the square root of 2304. [3 marks]
9. Using the long division method, find the square root of 2809. [3 marks]
10. Find $\sqrt{1089}$ by (i) the prime factorization method (ii) the long division method. [5 marks]
11. Using the long division method, find the square root of 104976. [5 marks]
12. Simplify $\sqrt{5} \times \sqrt{45}$. [2 marks]
13. Find the value of $\sqrt{14} \times \sqrt{14}$. [1 mark]
14. Simplify $\frac{\sqrt{54}}{\sqrt{96}}$. [2 marks]
15. Show that $\frac{21}{\sqrt{21}} = \sqrt{21}$. [1 mark]
16. Verify that $\sqrt{36} + \sqrt{25} \neq \sqrt{36 + 25}$. [3 marks]
17. If $a = 25$ and $b = 20$, show that (i) $\sqrt{a^2 - b^2} \neq a - b$ (ii) $\sqrt{(a - b)^2} = a - b$. [5 marks]
18. Find the square root of 0.0144. [2 marks]
19. Find the square root of 0.004096. [3 marks]
20. Find the square root of 24.01. [5 marks]

Key sheet

Q	Answer
1	q^2
2	169
3	343
4	100
5	13225
6	216
7	5
8	48
9	53
10	33
11	324
12	15
13	14
14	$\frac{3}{4}$
15	$\sqrt{21}$
16	LHS = $11 = \sqrt{121}$, RHS = $\sqrt{61}$; LHS $\neq$ RHS
17	(i) $15 \neq 5$ (ii) $5 = 5$
18	0.12
19	0.064
20	4.9

Solutions

1. Write $q \times q$ in power form. [1]

q is multiplied by itself 2 times.

$$\therefore q \times q = q^2 \text{ (read as 'q squared')}$$

Ans: q^2

2. Find 13^2 . [1]

$$13^2 = 13 \times 13$$

$$= 169$$

Ans: 169

3. Find the value of $28^2 - 21^2$. [2]

$$28^2 - 21^2 = 784 - 441$$

$$= 343$$

Ans: 343

4. Which number, when squared, gives 10000? [1]

$$100^2 = 100 \times 100 = 10000$$

$\therefore$ the number is 100

Ans: 100

5. Using the rule for numbers ending in 5, find 115^2 . [2]

The number before 5 is 11: $11 \times 12 = 132$

Write 25 after it.

$$\therefore 115^2 = 13225$$

Ans: 13225

6. Given $216^2 = 46656$, write the square root of 46656. [1]

$$a^2 = b \Rightarrow \sqrt{b} = a$$

$$216^2 = 46656 \Rightarrow \sqrt{46656} = 216$$

Ans: 216

7. Find the value of $\sqrt{576} - \sqrt{361}$. [2]

From the table, $\sqrt{576} = 24$ and $\sqrt{361} = 19$

$$\sqrt{576} - \sqrt{361} = 24 - 19 = 5$$

Ans: 5

8. Using the prime factorization method, find the square root of 2304. [3]

Prime factorization method:

Divide by primes: $2304 \div 2 = 1152$, $1152 \div 2 = 576$, $576 \div 2 = 288$, $288 \div 2 = 144$, $144 \div 2 = 72$, $72 \div 2 = 36$, $36 \div 2 = 18$, $18 \div 2 = 9$, $9 \div 3 = 3$

$$\begin{aligned}\sqrt{2304} &= \sqrt{(2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (3 \times 3)} \\ &= 2 \times 2 \times 2 \times 2 \times 3 \\ &= 48\end{aligned}$$

Ans: 48

9. Using the long division method, find the square root of 2809. [3]

Long division method:

Pair the digits from the right: $\overline{28} \overline{09}$

$5 \times 5 = 25 \leq 28$: first digit 5, and $28 - 25 = 3$

Bring down 09: we get 309. New divisor: $5 \times 2 = 10$; $103 \times 3 = 309$ ($104 \times 4 = 416$ is too big); $309 - 309 = 0$

Remainder 0. $\therefore \sqrt{2809} = 53$

Ans: 53

10. Find $\sqrt{1089}$ by (i) the prime factorization method (ii) the long division method. [5]

(i) Prime factorization method:

Divide by primes: $1089 \div 3 = 363$, $363 \div 3 = 121$, $121 \div 11 = 11$

$$\begin{aligned}\sqrt{1089} &= \sqrt{(3 \times 3) \times (11 \times 11)} \\ &= 3 \times 11 \\ &= 33\end{aligned}$$

(ii) Long division method:

Pair the digits from the right: $\overline{10} \overline{89}$

$3 \times 3 = 9 \leq 10$: first digit 3, and $10 - 9 = 1$

Bring down 89: we get 189. New divisor: $3 \times 2 = 6$; $63 \times 3 = 189$ ($64 \times 4 = 256$ is too big); $189 - 189 = 0$

Remainder 0. $\therefore \sqrt{1089} = 33$

Ans: 33

11. Using the long division method, find the square root of 104976. [5]

Long division method:

Pair the digits from the right: $\overline{10} \overline{49} \overline{76}$

$3 \times 3 = 9 \leq 10$: first digit 3, and $10 - 9 = 1$

Bring down 49: we get 149. New divisor: $3 \times 2 = 6$; $62 \times 2 = 124$ ($63 \times 3 = 189$ is too big); $149 - 124 = 25$

Bring down 76: we get 2576. New divisor: $32 \times 2 = 64$; $644 \times 4 = 2576$ ($645 \times 5 = 3225$ is too big); $2576 - 2576 = 0$

Remainder 0. $\therefore \sqrt{104976} = 324$

Ans: 324

12. Simplify $\sqrt{5} \times \sqrt{45}$. [2]

$$\sqrt{a} \times \sqrt{b} = \sqrt{a \times b}$$

$$\begin{aligned}\sqrt{5} \times \sqrt{45} &= \sqrt{5 \times 45} = \sqrt{225} \\ &= \sqrt{15 \times 15} = 15\end{aligned}$$

Ans: 15

13. Find the value of $\sqrt{14} \times \sqrt{14}$. [1]

$$\begin{aligned}(\sqrt{a})^2 &= \sqrt{a} \times \sqrt{a} = \sqrt{a^2} = a \\ \therefore \sqrt{14} \times \sqrt{14} &= \sqrt{14^2} = 14\end{aligned}$$

Ans: 14

14. Simplify $\frac{\sqrt{54}}{\sqrt{96}}$. [2]

$$\begin{aligned}\frac{\sqrt{a}}{\sqrt{b}} &= \sqrt{\frac{a}{b}} \\ \frac{\sqrt{54}}{\sqrt{96}} &= \sqrt{\frac{54}{96}} = \sqrt{\frac{6 \times 9}{6 \times 16}} \\ &= \sqrt{\frac{9}{16}} = \frac{3}{4}\end{aligned}$$

Ans: $\frac{3}{4}$

15. Show that $\frac{21}{\sqrt{21}} = \sqrt{21}$. [1]

$$\begin{aligned}21 &= \sqrt{21} \times \sqrt{21} \\ \frac{21}{\sqrt{21}} &= \frac{\sqrt{21} \times \sqrt{21}}{\sqrt{21}} = \sqrt{21}\end{aligned}$$

Ans: $\sqrt{21}$

16. Verify that $\sqrt{36} + \sqrt{25} \neq \sqrt{36 + 25}$. [3]

$$\text{LHS} = \sqrt{36} + \sqrt{25} = 6 + 5 = 11 = \sqrt{121}$$

$$\text{RHS} = \sqrt{36 + 25} = \sqrt{61}$$

$\therefore \text{LHS} \neq \text{RHS}$

Ans: $\text{LHS} = 11 = \sqrt{121}$, $\text{RHS} = \sqrt{61}$; $\text{LHS} \neq \text{RHS}$

17. If $a = 25$ and $b = 20$, show that (i) $\sqrt{a^2 - b^2} \neq a - b$ (ii) $\sqrt{(a - b)^2} = a - b$. [5]

$$\text{(i) LHS} = \sqrt{25^2 - 20^2} = \sqrt{625 - 400} = \sqrt{225} = 15$$

$$\text{RHS} = a - b = 25 - 20 = 5$$

$$15 \neq 5, \text{ so } \sqrt{a^2 - b^2} \neq a - b$$

$$\text{(ii) LHS} = \sqrt{(25 - 20)^2} = \sqrt{5^2} = 5$$

$$\text{RHS} = 25 - 20 = 5$$

$$\text{LHS} = \text{RHS}, \text{ so } \sqrt{(a - b)^2} = a - b$$

Ans: (i) $15 \neq 5$ (ii) $5 = 5$

18. Find the square root of 0.0144. [2]

$$\begin{aligned}\sqrt{0.0144} &= \sqrt{\frac{144}{10000}} \\ &= \frac{\sqrt{144}}{\sqrt{10000}} \\ &= \frac{12}{100} \\ &= 0.12\end{aligned}$$

Ans: 0.12

19. Find the square root of 0.004096. [3]

$$\begin{aligned}\sqrt{0.004096} &= \sqrt{\frac{4096}{1000000}} \\ &= \frac{\sqrt{4096}}{\sqrt{1000000}} \\ 64^2 &= 4096, \text{ so } \sqrt{4096} = 64 \\ &= \frac{64}{1000} \\ &= 0.064\end{aligned}$$

Ans: 0.064

20. Find the square root of 24.01. [5]

$$\sqrt{24.01} = \sqrt{\frac{2401}{100}} = \frac{\sqrt{2401}}{\sqrt{100}}$$

$\sqrt{2401}$ by the long division method:

Pair the digits from the right: $\overline{24} \overline{01}$

$4 \times 4 = 16 \leq 24$: first digit 4, and $24 - 16 = 8$

Bring down 01: we get 801. New divisor: $4 \times 2 = 8$; $89 \times 9 = 801$; $801 - 801 = 0$

$$\sqrt{2401} = 49$$

$$\therefore \sqrt{24.01} = \frac{49}{10} = 4.9$$

Ans: 4.9
