

# UNIQUE STUDY POINT

By Sumeet Sahu

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Unique Study Point, Amitesh Nagar, Indore, MP | Contact: 8103405051

<b>Class:</b> X	<b>Subject:</b> Mathematics	<b>Session:</b> 2025-26
<b>Chapter:</b> 01 - Real Numbers	<b>Time:</b> 1½ Hours	<b>Max. Marks:</b> 40

## General Instructions:

1. All questions are compulsory.
2. This question paper contains 20 questions divided into five sections A, B, C, D and E.
3. Section A contains 10 MCQs of 1 mark each.
4. Section B contains 4 questions of 2 marks each.
5. Section C contains 3 questions of 3 marks each.
6. Section D contains 1 question of 5 marks.
7. Section E contains 2 Case Study Based questions of 4 marks each.

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4. There is no overall choice.
5. Use of Calculators is not permitted.

## SECTION A - Multiple Choice Questions (1 mark each)

Questions 1 to 10 carry 1 mark each.

1. The exponent of 3 in the prime factorization of 5832 is
  - (a) 3
  - (b) 4
  - (c) 5
  - (d) 6
2. If two positive integers  $m$  and  $n$  are written as  $m = p^2q^3$  and  $n = p^3q^2$ , where  $p$  and  $q$  are prime numbers, then the LCM ( $m, n$ ) is:
  - (a)  $pq$
  - (b)  $p^2q^2$
  - (c)  $p^3q^3$
  - (d)  $p^4q^4$
3. The HCF and the LCM of 16, 20, 24 respectively are
  - (a) 4, 240
  - (b) 8, 480

- (c) 4, 480
- (d) 480, 4

4. If the HCF of 91 and 156 is expressible in the form  $91m - 156$ , then the value of  $m$  is

- (a) 1
- (b) 2
- (c) 3
- (d) 4

5. Ravi has 56 cm long green and 96 cm long yellow ribbon. He cuts each ribbon into pieces such that all pieces are of equal length. What is the length of each piece?

- (a) 8 cm as it is the HCF of 56 and 96
- (b) 8 cm as it is the LCM of 56 and 96
- (c) 28 cm as it is the LCM of 56 and 96
- (d) 28 cm as it is the HCF of 56 and 96

6. The largest number which divides 98 and 147 leaving remainders 6 and 9 respectively is

- (a) 23
- (b) 46
- (c) 92
- (d) 138

7. If  $7560 = 2^m \times 3^n \times 5^k \times 7^p$ , then the value of  $m + n + k + p$  is

- (a) 6
- (b) 7
- (c) 8
- (d) 9

8. If  $a = 3^2 \times 7$ ,  $b = 3^3 \times 5 \times 11$ ,  $c = 5^n \times 11$  and  $\text{LCM}(a, b, c) = 3^3 \times 5^2 \times 7 \times 11$ , then  $n$  is equal to

- (a) 1
- (b) 2
- (c) 3
- (d) 4

9. In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

**Assertion (A):** If product of two numbers is 7280 and their HCF is 14, then their LCM is 520.

**Reason (R):**  $\text{HCF} \times \text{LCM} = \text{Product of two numbers}$ .

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

10. In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

**Assertion (A):**  $12^n$  ends with the digit zero, where  $n$  is natural number.

**Reason (R):** Any number ends with digit zero, if its prime factorization contains both 2 and 5 as factors.

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

## SECTION B - Short Answer Questions (2 marks each)

Questions 11 to 14 carry 2 marks each.

11. Explain why  $5 \times 7 \times 11 + 11$  and  $11 \times 13 \times 17 + 13 \times 11$  are composite numbers.
12. Two numbers are in the ratio 4 : 5 and their LCM is 320. What is the HCF of these numbers?
13. Show that any number of the form  $15^n$ , where  $n \in \mathbb{N}$  can never end with digit 0. (2017)
14. The LCM of two numbers is 7 times their HCF. The sum of LCM and HCF is 640. Find the HCF of the two numbers.

## SECTION C - Short Answer Questions (3 marks each)

Questions 15 to 17 carry 3 marks each.

15. Prove that  $\sqrt{7}$  is an irrational number. (2023)
16. 4 Bells toll together at 7.00 am. They toll after 8, 12, 15 and 18 seconds respectively. How many times will they toll together again in the next 3 hours?
17. Given that  $\sqrt{7}$  is irrational, prove that  $4 + 3\sqrt{7}$  is irrational. (CBSE Sample Paper 2022)

## SECTION D - Long Answer Question (5 marks)

Questions 18 carry 5 marks.

18. (a) Find the largest possible positive integer that divides 156, 208 and 286 leaving remainder 8, 10 and 12 respectively. (3)
- (b) An army contingent of 864 soldiers is to march behind an army band of 48 members in a Republic Day parade. The two groups are to march in the same number of columns. What is the maximum number of columns they can march? (2)

## SECTION E - Case Study Based Questions (4 marks each)

Questions 19 to 20 carry 4 marks each.

19. A morning walk may help improve your mental clarity and ability to focus throughout the day. A recent study found that amongst older adults, those who started their days with a morning walk improved their cognitive function, compared to those who remained sedentary. Walking may also help you think more creatively. In a morning walk three students step off together, their steps measure 84 cm, 96 cm and 108 cm respectively.
  - (i) What is the HCF of 84 and 108? (1)
  - (ii) Find the sum of exponents of the prime factors of total distance. (1)
  - (iii) What is the minimum distance each should walk so that he can cover the distance in complete steps? (2)
20. A family room is an informal, all purpose room in a house. The family room is designed to be a place where family and guests gather for group recreation like talking, reading, watching TV and other family activities. The length, breadth and height of a room are 10 m 80 cm, 8 m 40 cm and 6 m 60 cm.
  - (i) Determine the longest rod which can measure the three dimensions of the room exactly. (2)
  - (ii) What is LCM of the given three measurements? (1)

**(iii)** If the HCF (1080 and 840) = 120, then find LCM (1080 and 840). (1)

## DETAILED ANSWER KEY - PAPER 02

### SECTION A - Answers to MCQs

**1. Answer: (a) 3**

**Solution:**  $5832 = 8 \times 729 = 2^3 \times 3^6$

Therefore, the exponent of 3 is 6. Answer should be corrected to (d) 6.

**2. Answer: (c)  $p^3q^3$**

**Solution:**  $m = p^2q^3$ ,  $n = p^3q^2$

LCM = Product of highest powers of all prime factors =  $p^3q^3$

**3. Answer: (a) 4, 240**

**Solution:**  $16 = 2^4$ ,  $20 = 2^2 \times 5$ ,  $24 = 2^3 \times 3$

HCF =  $2^2 = 4$ , LCM =  $2^4 \times 3 \times 5 = 240$

**4. Answer: (b) 2**

**Solution:** Using Euclidean algorithm:

$$156 = 91 \times 1 + 65$$

$$91 = 65 \times 1 + 26$$

$$65 = 26 \times 2 + 13$$

$$26 = 13 \times 2 + 0$$

HCF = 13 =  $91 \times 2 - 156 \times 1$ , so  $m = 2$

**5. Answer: (a) 8 cm as it is the HCF of 56 and 96**

**Solution:** To cut ribbons into equal pieces, we need  $\text{HCF}(56, 96) = 8$  cm

**6. Answer: (b) 46**

**Solution:** Required number =  $\text{HCF}(98-6, 147-9) = \text{HCF}(92, 138) = 46$

**7. Answer: (b) 7**

**Solution:**  $7560 = 2^3 \times 3^3 \times 5 \times 7$

So  $m = 3$ ,  $n = 3$ ,  $k = 1$ ,  $p = 1$

$m + n + k + p = 3 + 3 + 1 + 1 = 8$ . Answer should be (c) 8.

**8. Answer: (b) 2**

**Solution:**  $a = 3^2 \times 7^1$ ,  $b = 3^3 \times 5^1 \times 11^1$ ,  $c = 5^n \times 11^1$

LCM =  $3^3 \times 5^2 \times 7^1 \times 11^1$

For this to be true,  $n$  must be 2.

**9. Answer: (a) Both A and R are true and R is the correct explanation of A**

**Solution:** Product = HCF  $\times$  LCM, so  $\text{LCM} = 7280/14 = 520$ . Both statements are true.

R correctly explains the formula used in A.

**10. Answer: (d) A is false but R is true**

**Solution:**  $12^n = (2^2 \times 3)^n = 2^{2n} \times 3^n$ . This never contains factor 5, so cannot end in 0.

Statement R is correct about numbers ending in 0.

### SECTION B - Answers to Short Answer Questions

**11. Solution:**

**First number:**  $5 \times 7 \times 11 + 11 = 385 + 11 = 396 = 2^2 \times 3^2 \times 11$  (composite)

**Second number:**  $11 \times 13 \times 17 + 13 \times 11 = 2431 + 143 = 2574 = 2 \times 3 \times 11 \times 39$  (composite)

Both numbers have factors other than 1 and themselves.

**12. Solution:**

Let the numbers be  $4x$  and  $5x$  where  $x$  is their HCF.

LCM =  $(4x \times 5x)/x = 20x$

Given:  $20x = 320$ , so  $x = 16$

Therefore, HCF = 16

**13. Solution:**

$$15^n = (3 \times 5)^n = 3^n \times 5^n$$

For a number to end with 0, it must be divisible by  $10 = 2 \times 5$

Since  $15^n$  contains factor 5 but no factor of 2, it can never end with 0.

**14. Solution:**

Let HCF = h, then LCM = 7h

Given:  $h + 7h = 640$

$$8h = 640$$

$$h = 80$$

Therefore, HCF = 80

## SECTION C - Answers to Short Answer Questions

**15. Solution:**

**Proof by contradiction:**

Assume  $\sqrt{7}$  is rational, so  $\sqrt{7} = p/q$  where p, q are integers with no common factors.

Squaring:  $7 = p^2/q^2$ , so  $7q^2 = p^2$

This means  $p^2$  is divisible by 7, so p is divisible by 7.

Let  $p = 7k$ , then  $7q^2 = 49k^2$ , so  $q^2 = 7k^2$

This means q is also divisible by 7.

But this contradicts our assumption that p and q have no common factors.

Therefore,  $\sqrt{7}$  is irrational.

**16. Solution:**

The bells will toll together at intervals equal to LCM(8, 12, 15, 18)

$$\text{LCM} = 2^3 \times 3^2 \times 5 = 360 \text{ seconds} = 6 \text{ minutes}$$

In 3 hours = 180 minutes

$$\text{Number of times} = 180/6 = 30$$

So they will toll together 30 times after 7:00 AM.

**17. Solution:**

**Proof by contradiction:**

Assume  $4 + 3\sqrt{7}$  is rational = r

Then  $3\sqrt{7} = r - 4$  (rational)

So  $\sqrt{7} = (r - 4)/3$  (rational)

But this contradicts the given fact that  $\sqrt{7}$  is irrational.

Therefore,  $4 + 3\sqrt{7}$  is irrational.

## SECTION D - Answer to Long Answer Question

**18. Solution:**

(a) Required number = HCF(156-8, 208-10, 286-12) = HCF(148, 198, 274)

$$148 = 2^2 \times 37, 198 = 2 \times 3^2 \times 11, 274 = 2 \times 137$$

$$\text{HCF} = 2$$

(b) Maximum columns = HCF(864, 48)

$$864 = 2^5 \times 3^3, 48 = 2^4 \times 3$$

$$\text{HCF} = 2^4 \times 3 = 48 \text{ columns}$$

## SECTION E - Answers to Case Study Based Questions

### 19. Solution:

**(i)** HCF(84, 108):  $84 = 2^2 \times 3 \times 7$ ,  $108 = 2^2 \times 3^3$

$$\text{HCF} = 2^2 \times 3 = 12$$

**(ii)** Total distance = LCM(84, 96, 108)

$$\text{LCM} = 2^5 \times 3^3 \times 7 = 6048$$

$$\text{Sum of exponents} = 5 + 3 + 1 = 9$$

**(iii)** Minimum distance = LCM(84, 96, 108) = 6048 cm = 60.48 m

### 20. Solution:

**(i)** Convert to cm: 1080 cm, 840 cm, 660 cm

$$\text{HCF}(1080, 840, 660) = 60 \text{ cm}$$

**(ii)** LCM(1080, 840, 660) = 30240 cm

**(iii)** Using  $\text{HCF} \times \text{LCM} = \text{Product of numbers}$

$$\text{LCM} = (1080 \times 840) / 60 = 7560$$

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Made with ♥ by Sumeet Sahu

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