UNIQUE STUDY POINT

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SAMPLE PAPER 03 - CHAPTER 01 REAL NUMBERS (2025-26)

SUBJECT: MATHEMATICS **MAX. MARKS:** 40

CLASS: X **DURATION:** 1½ hrs

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** comprises of 10 MCQs of **1 mark** each. **Section B** comprises of 4 questions of **2 marks** each. **Section C** comprises of 3 questions of **3 marks** each. **Section D** comprises of 1 question of **5 marks** each and **Section E** comprises of 2 Case Study Based Questions of **4 marks** each.
4. There is no overall choice.
5. Use of Calculators is not permitted.

SECTION - A

Questions 1 to 10 carry 1 mark each.

1. The decimal representation of $129/(2^2 \times 5^3)$ will be:

(a) terminating (b) non-terminating (c) non-terminating repeating
(d) non-terminating non-repeating

2. If a and b are two prime numbers, then HCF(a, b) is:

(a) a (b) b (c) ab (d) 1

3. The HCF of 95 and 152 is:

(a) 19 (b) 1 (c) 5 (d) 760

4. The sum of a rational and an irrational number is:

(a) always rational (b) always irrational (c) rational or irrational (d) always an integer

5. If the HCF of 408 and 1032 is expressible in the form 1032m - 408 × 5, then m equals:

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

6. LCM of $2^3 \times 3^2$ and $2^2 \times 3^3$ is:

(a) $2^2 \times 3^2$ (b) $2^3 \times 3^3$ (c) $2^3 \times 3^2$ (d) $2^2 \times 3^3$

7. If n is a natural number, then $9^{2n} - 4^{2n}$ is always divisible by:

(a) 13 (b) 65 (c) 5 (d) both (a) and (c)

8. The greatest number that will divide 398, 436 and 542 leaving remainders 7, 11 and 15 respectively is:

(a) 17 (b) 11 (c) 34 (d) 51

9. **Assertion (A):** The HCF of two numbers is 16 and their product is 3072. Then their LCM is 192.
Reason (R): If a and b are two positive integers, then HCF × LCM = a × b.

(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. **Assertion (A):** The number 4^n can never end with digit 0 for any natural number n.
Reason (R): For a number to end with 0, it must have both 2 and 5 as prime 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

Questions 11 to 14 carry 2 marks each.

11. Find the HCF of 135 and 225 by prime factorization method.

12. Without actually performing the long division, state whether 987/10500 will have a terminating decimal expansion or a non-terminating repeating decimal expansion.

13. Explain why $11 \times 13 \times 15 + 13$ is a composite number.

14. If the HCF of 85 and 238 is expressible in the form 85n - 238, then find the value of n.

SECTION - C

Questions 15 to 17 carry 3 marks each.

15. Prove that $\sqrt{11}$ is an irrational number.

16. Find the LCM and HCF of 510 and 92 and verify that LCM × HCF = Product of the two numbers.

17. Given that $\sqrt{7}$ is irrational, prove that $2 + 5\sqrt{7}$ is an irrational number.

SECTION - D

Question 18 carries 5 marks.

18. (a) Using Euclid's division algorithm, find the HCF of 196 and 38220. (3 marks)

(b) Prove that one of every three consecutive positive integers is divisible by 3. (2 marks)

SECTION - E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

19. A housing society in Indore has 180 flats and 225 independent houses. The society committee wants to distribute free maintenance kits equally among all residents (one kit per flat/house) using all available kits.

(i) What is the prime factorization of 180? (1 mark)

(ii) Find the HCF of 180 and 225. (1 mark)

(iii) What is the maximum number of kits that can be distributed equally? How many kits will each flat/house owner get? (2 marks)

20. A traffic signal at three different locations on a road changes after 48 seconds, 72 seconds, and

108 seconds respectively. If all three signals change simultaneously at 7:00 AM:

(i) Find the prime factorization of 108. (1 mark)

(ii) Find the LCM of 48, 72, and 108. (2 marks)

(iii) At what time will they change simultaneously again? (1 mark)

✓ DETAILED SOLUTIONS - SAMPLE PAPER 03

SECTION - A (SOLUTIONS)

Solution 1:

$129/(2^2 \times 5^3) = 129/500$

Denominator = $2^2 \times 5^3$ (in the form $2^m \times 5^n$)

Since denominator has only 2 and 5 as prime factors, the decimal will terminate.

129/500 = 0.258

Answer: (a) terminating

Solution 2:

If a and b are two different prime numbers, they have no common factors except 1.

Prime numbers have only 1 and themselves as factors.

Therefore, HCF(a, b) = 1

Answer: (d) 1

Solution 3:

Prime Factorization:

$95 = 5 \times 19$

$152 = 2^3 \times 19$

HCF = Common factor = 19

Answer: (a) 19

Solution 4:

Let r be rational and x be irrational.

If r + x is rational, then x = (r + x) - r would be rational (difference of two rationals)

But x is irrational, so this is a contradiction.

Therefore, r + x must be irrational.

Answer: (b) always irrational

Solution 5:

Finding HCF(408, 1032) using Euclid's algorithm:

$1032 = 408 \times 2 + 216$

$408 = 216 \times 1 + 192$

$216 = 192 \times 1 + 24$

$192 = 24 \times 8 + 0$

HCF = 24

Given: 1032m - 408 × 5 = 24

1032m - 2040 = 24

1032m = 2064

m = 2064/1032 = 2

Answer: (b) 2

Solution 6:

First number = $2^3 \times 3^2$

Second number = $2^2 \times 3^3$

LCM = Product of highest powers of all prime factors

LCM = $2^3 \times 3^3$

Answer: (b) $2^3 \times 3^3$

Solution 7:

$9^{2n} - 4^{2n} = (9^n)^2 - (4^n)^2$

Using $a^2 - b^2 = (a + b)(a - b)$:

$= (9^n + 4^n)(9^n - 4^n)$

For n = 1: (9 + 4)(9 - 4) = 13 × 5 = 65

So it's divisible by both 13 and 5

Answer: (d) both (a) and (c)

Solution 8:

Required number divides:

(398 - 7), (436 - 11), and (542 - 15)

= HCF(391, 425, 527)

391 = 17 × 23

425 = 17 × 25 = 17 × 5^2

527 = 17 × 31

HCF = 17

Answer: (a) 17

Solution 9:

Using: HCF × LCM = Product of two numbers

16 × LCM = 3072

LCM = 3072/16 = 192 ✓

Assertion is TRUE

Reason is also TRUE and correctly explains the assertion

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

Solution 10:

$4^n = (2^2)^n = 2^{2n}$

Prime factorization contains only 2, no factor of 5

To end with 0, a number must have both 2 and 5

Since 4^n has no factor of 5, it cannot end with 0 ✓ (Assertion is TRUE)

Reason correctly explains why numbers ending in 0 need both 2 and 5 (Reason is TRUE)

R correctly explains A

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

SECTION - B (SOLUTIONS)

Solution 11:

Prime Factorization:

$135 = 3^3 \times 5$

$225 = 3^2 \times 5^2$

HCF = Product of smallest powers of common prime factors

$HCF = 3^2 \times 5 = 9 \times 5 = 45$

HCF(135, 225) = 45

Solution 12:

987/10500

First simplify by finding HCF(987, 10500)

$987 = 3 \times 7 \times 47$

$10500 = 2^2 \times 3 \times 5^3 \times 7$

$HCF = 3 \times 7 = 21$

987/10500 = 47/500 (after dividing by 21)

$500 = 2^2 \times 5^3$ (only 2 and 5 as prime factors)

The decimal expansion will be terminating.

Solution 13:

$11 \times 13 \times 15 + 13$

$= 13(11 \times 15 + 1)$

$= 13(165 + 1)$

$= 13 \times 166$

$= 13 \times 2 \times 83$

Since the number can be expressed as a product of 13, 2, and 83 (all greater than 1),

it has more than two factors.

Therefore, $11 \times 13 \times 15 + 13$ is a composite number.

Solution 14:

Finding HCF(85, 238):

$238 = 85 \times 2 + 68$

$85 = 68 \times 1 + 17$

$68 = 17 \times 4 + 0$

HCF = 17

Given: $85n - 238 = 17$

$85n = 17 + 238 = 255$

$n = 255/85 = 3$

n = 3

SECTION - C (SOLUTIONS)

Solution 15:

Proof by Contradiction:

Let us assume, to the contrary, that $\sqrt{11}$ is rational.

Then, $\sqrt{11} = p/q$ where p and q are co-prime integers and $q \neq 0$

Squaring both sides: $11 = p^2/q^2$

$\implies p^2 = 11q^2$

$\implies$ 11 divides $p^2 \implies$ 11 divides p ... (1)

Let $p = 11m$ for some integer m

$p^2 = 121m^2$

From above: $11q^2 = 121m^2$

$\implies q^2 = 11m^2$

$\implies$ 11 divides $q^2 \implies$ 11 divides q ... (2)

From (1) and (2), 11 is a common factor of p and q

This contradicts our assumption that p and q are co-prime.

Therefore, $\sqrt{11}$ is irrational.

Solution 16:

Prime Factorization:

$510 = 2 \times 3 \times 5 \times 17$

$92 = 2^2 \times 23$

HCF = 2

LCM = $2^2 \times 3 \times 5 \times 17 \times 23 = 4 \times 3 \times 5 \times 17 \times 23 = 23{,}460$

Verification:

LCM × HCF = 23,460 × 2 = 46,920

Product of numbers = 510 × 92 = 46,920

LCM × HCF = Product of numbers ✓ (Verified)

HCF = 2, LCM = 23,460

Solution 17:

Proof by Contradiction:

Let us assume, to the contrary, that $2 + 5\sqrt{7}$ is rational.

Let $2 + 5\sqrt{7} = r$, where r is rational

$\Longrightarrow 5\sqrt{7} = r - 2$

$\Longrightarrow \sqrt{7} = (r - 2)/5$

Since r is rational, (r - 2) is rational

Therefore, (r - 2)/5 is also rational

This means $\sqrt{7}$ is rational

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

Therefore, our assumption is wrong. Hence, $2 + 5\sqrt{7}$ is irrational.

SECTION - D (SOLUTIONS)

Solution 18(a):

Using Euclid's Division Algorithm to find HCF(196, 38220):

Step 1: 38220 = 196 × 195 + 0

Wait, let me recalculate:

38220 = 196 × 195 + 0

Actually: 196 × 195 = 38,220 ✓

Since remainder = 0, HCF = 196

HCF(196, 38220) = 196

Solution 18(b):

Let the three consecutive positive integers be n, n+1, and n+2.

By Euclid's division lemma: n = 3q or 3q+1 or 3q+2 for some integer q.

Case 1: If n = 3q, then n is divisible by 3 ✓

Case 2: If n = 3q + 1, then n+2 = 3q + 3 = 3(q + 1) is divisible by 3 ✓

Case 3: If n = 3q + 2, then n+1 = 3q + 3 = 3(q + 1) is divisible by 3 ✓

Therefore, one of every three consecutive positive integers is divisible by 3.

SECTION - E (SOLUTIONS)

Solution 19(i):

180 = 2 × 90 = 2 × 2 × 45 = 2 × 2 × 9 × 5 = 2 × 2 × 3 × 3 × 5

180 = $2^2 \times 3^2 \times 5$

Solution 19(ii):

180 = $2^2 \times 3^2 \times 5$

225 = $3^2 \times 5^2$

HCF = $3^2 \times 5$ = 9 × 5 = 45

HCF(180, 225) = 45

Solution 19(iii):

Maximum number of kits = HCF(180, 225) = 45

Total residents = 180 + 225 = 405

Kits per resident = 405/45 = 9 kits

Maximum 45 kits can be distributed, with each flat/house owner getting 9 kits

Solution 20(i):

108 = 2 × 54 = 2 × 2 × 27 = 2 × 2 × 3 × 9 = 2 × 2 × 3 × 3 × 3

108 = $2^2 \times 3^3$

Solution 20(ii):

48 = $2^4 \times 3$

72 = $2^3 \times 3^2$

108 = $2^2 \times 3^3$

LCM = $2^4 \times 3^3$ = 16 × 27 = 432 seconds

LCM(48, 72, 108) = 432 seconds

Solution 20(iii):

They will change simultaneously after 432 seconds

432 seconds = 432/60 = 7.2 minutes = 7 minutes 12 seconds

Time = 7:00 AM + 7 minutes 12 seconds = 7:07:12 AM

They will change simultaneously again at 7:07:12 AM