UNIQUE STUDY POINT

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Class: VIII	**Subject:** Mathematics	**Session:** 2025-26
Chapter: 05 - Prime Time	**Time:** 1½ Hours	**Max. Marks:** 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.

SECTION A - Multiple Choice Questions (1 mark each)

1. A perfect number is a number for which the sum of all its factors equals:

(a) The number itself
(b) Twice the number
(c) Half the number
(d) Square of the number

2. Which number is divisible by both 4 and 8?

(a) 124
(b) 132
(c) 144
(d) 150

3. The HCF of two co-prime numbers is always:

(a) 0
(b) 1
(c) 2
(d) The smaller number

4. Which of the following is the prime factorization of 180?

(a) $2 \times 2 \times 3 \times 3 \times 5$
(b) $2 \times 3 \times 3 \times 5 \times 5$
(c) $2 \times 2 \times 3 \times 5 \times 5$
(d) $2 \times 2 \times 2 \times 3 \times 5$

5. How many prime numbers are there between 40 and 60?

(a) 4
(b) 5
(c) 6
(d) 7

6. A number is divisible by 10 if its last digit is:

(a) 0 only
(b) 0 or 5
(c) Any even number
(d) 2 or 5

7. If a number ends in 68, it is definitely divisible by:

(a) 2
(b) 3
(c) 5
(d) 8

8. Which is the smallest composite number?

(a) 2
(b) 3
(c) 4
(d) 6

9. The number of prime factors of 100 is:

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

10. Which pair represents twin primes?

(a) 37 and 41
(b) 41 and 43
(c) 43 and 47
(d) 47 and 53

SECTION B - Short Answer Questions (2 marks each)

11. List all the common factors of 20 and 30.

12. Find the prime factorization of 120.

13. Determine whether 57 and 85 are co-prime numbers.

14. Find the smallest number that is divisible by both 6 and 8.

SECTION C - Short Answer Questions (3 marks each)

15. Using the Sieve of Eratosthenes method, find all prime numbers between 50 and 70.

16. Find three pairs of prime numbers less than 30 whose sum is a multiple of 5.

17. A number less than 100 has 7 as one of its factors. The sum of its digits is 10. Find all such possible numbers.

SECTION D - Long Answer Question (5 marks)

18. Anshu observed an interesting pattern in multiplication:

$6 \times 35 = 210$
$14 \times 15 = 210$
$10 \times 21 = 210$

(a) Find the prime factorization of 210. (2 marks)
(b) Using the prime factorization, find three more pairs of numbers whose product is 210. (2 marks)
(c) How many such pairs are possible? Explain your reasoning. (1 mark)

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

19. Case Study 1: The School Bell System

A school has three bells that ring at different intervals. Bell A rings every 45 minutes, Bell B rings every 60 minutes, and Bell C rings every 75 minutes. All three bells ring together at 8:00 AM.

(a) After how many minutes will all three bells ring together again? (2 marks)
(b) At what time will all three bells ring together for the second time? (2 marks)

20. Case Study 2: The Number Mystery

Detective Guna is solving a mystery. A secret code is a 2-digit number with the following clues:

- It is a prime number
- Both its digits are odd
- The sum of its digits is less than 10
- It is greater than 30

(a) List all possible numbers that satisfy these conditions. (2 marks)
(b) If there's an additional clue that the number is a twin prime, what is the secret code? (2 marks)

DETAILED ANSWER KEY - PAPER 02

SECTION A - Answers to MCQs

1. (b) Twice the number

A perfect number is one where the sum of all its factors equals twice the number. For example, 6: factors are 1, 2, 3, 6; sum = 12 = 2 × 6.

2. (c) 144

144 ÷ 4 = 36 and 144 ÷ 8 = 18. Both divisions are exact, so 144 is divisible by both 4 and 8.

3. (b) 1

Co-prime numbers have no common factor other than 1, so their HCF is always 1.

4. (a) 2 × 2 × 3 × 3 × 5

180 = 4 × 45 = 2 × 2 × 9 × 5 = 2 × 2 × 3 × 3 × 5

5. (b) 5

Prime numbers between 40 and 60: 41, 43, 47, 53, 59 (Total = 5)

6. (a) 0 only

A number is divisible by 10 only if it ends in 0.

7. (a) 2

Numbers ending in even digits (like 68) are always divisible by 2.

8. (c) 4

4 = 2 × 2, so it has factors 1, 2, and 4. It is the smallest composite number.

9. (b) 2

100 = 2 × 2 × 5 × 5. The prime factors are 2 and 5 (only 2 different prime factors).

10. (b) 41 and 43

Twin primes differ by 2. 43 - 41 = 2, so they are twin primes.

SECTION B - Answers to Short Answer Questions

11.

Factors of 20: 1, 2, 4, 5, 10, 20

Factors of 30: 1, 2, 3, 5, 6, 10, 15, 30

Common factors: 1, 2, 5, 10

12.

Prime factorization of 120:

$120 = 2 \times 60$
$= 2 \times 2 \times 30$
$= 2 \times 2 \times 2 \times 15$
$= 2 \times 2 \times 2 \times 3 \times 5$
$= 2^3 \times 3 \times 5$

13.

$57 = 3 \times 19$

$85 = 5 \times 17$

Since there are no common prime factors, 57 and 85 are co-prime numbers.

14.

To find the smallest number divisible by both 6 and 8, we find their LCM.

$6 = 2 \times 3$
$8 = 2 \times 2 \times 2$
LCM $= 2 \times 2 \times 2 \times 3 = 24$

The smallest number is 24.

SECTION C - Answers to Short Answer Questions

15.

Using the Sieve of Eratosthenes:

Step 1: List numbers from 50 to 70
Step 2: Cross out multiples of 2 (except 2): 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70
Step 3: Cross out multiples of 3: 51, 57, 63, 69
Step 4: Cross out multiples of 5: 55, 60, 65, 70
Step 5: Cross out multiples of 7: 56, 63

Prime numbers between 50 and 70: 53, 59, 61, 67

16.

Pairs of prime numbers less than 30 whose sum is a multiple of 5:

2 + 3 = 5 (multiple of 5)
3 + 7 = 10 (multiple of 5)
2 + 13 = 15 (multiple of 5)
7 + 13 = 20 (multiple of 5)
2 + 23 = 25 (multiple of 5)

Three pairs: (2,3), (3,7), (2,13)

17.

Numbers less than 100 with 7 as a factor and digit sum of 10:

Multiples of 7: 7, 14, 21, 28, 35, 42, 49, 56, 63, 70, 77, 84, 91, 98
Check digit sums:

28: 2 + 8 = 10 ✓
37: Not a multiple of 7
46: Not a multiple of 7
55: Not a multiple of 7
64: Not a multiple of 7
70: 7 + 0 = 7 ✗
73: Not a multiple of 7
82: Not a multiple of 7
91: 9 + 1 = 10 ✓

Possible numbers: 28 and 91

SECTION D - Answer to Long Answer Question

18.

(a) Prime factorization of 210:

210 = 2 × 105
= 2 × 3 × 35
= 2 × 3 × 5 × 7

(b) Three more pairs whose product is 210:

2 × 105 = 210
3 × 70 = 210
5 × 42 = 210

(c) The number of such pairs depends on how we combine the prime factors. Since 210 = 2 × 3 × 5 × 7, we can create different factor pairs by grouping these primes differently. The total number of factors of 210 is (1+1)(1+1)(1+1)(1+1) = 16. So there are 16/2 = 8 unique pairs (including 1 × 210 and 210 × 1 as one pair).

SECTION E - Answers to Case Study Based Questions

19. Case Study 1: The School Bell System

(a) To find when all three bells ring together, we need the LCM of 45, 60, and 75.

45 = 3 × 3 × 5
60 = 2 × 2 × 3 × 5
75 = 3 × 5 × 5
LCM = 2 × 2 × 3 × 3 × 5 × 5 = 900 minutes

All three bells will ring together after 900 minutes = 15 hours.

(b) Second time they ring together:

8:00 AM + 15 hours = 11:00 PM

All three bells will ring together for the second time at 11:00 PM.

20. Case Study 2: The Number Mystery

(a) Finding all possible numbers:

Prime numbers greater than 30 with both odd digits:

31: 3 + 1 = 4 (less than 10) ✓

33: Not prime

35: Not prime

37: 3 + 7 = 10 (not less than 10) ✗

39: Not prime

51: Not prime

53: 5 + 3 = 8 (less than 10) ✓

55: Not prime

57: Not prime

59: 5 + 9 = 14 (not less than 10) ✗

71: 7 + 1 = 8 (less than 10) ✓

73: 7 + 3 = 10 (not less than 10) ✗

75: Not prime

77: Not prime

79: 7 + 9 = 16 (not less than 10) ✗

91: Not prime

93: Not prime

95: Not prime

97: 9 + 7 = 16 (not less than 10) ✗

99: Not prime

Possible numbers: 31, 53, 71

(b) Twin prime pairs in our list:

29 and 31 are twin primes, so 31 is a twin prime

71 and 73 are twin primes, so 71 is a twin prime

53 is not part of a twin prime pair

The secret code could be 31 or 71. If we need a unique answer, additional information would be needed.
