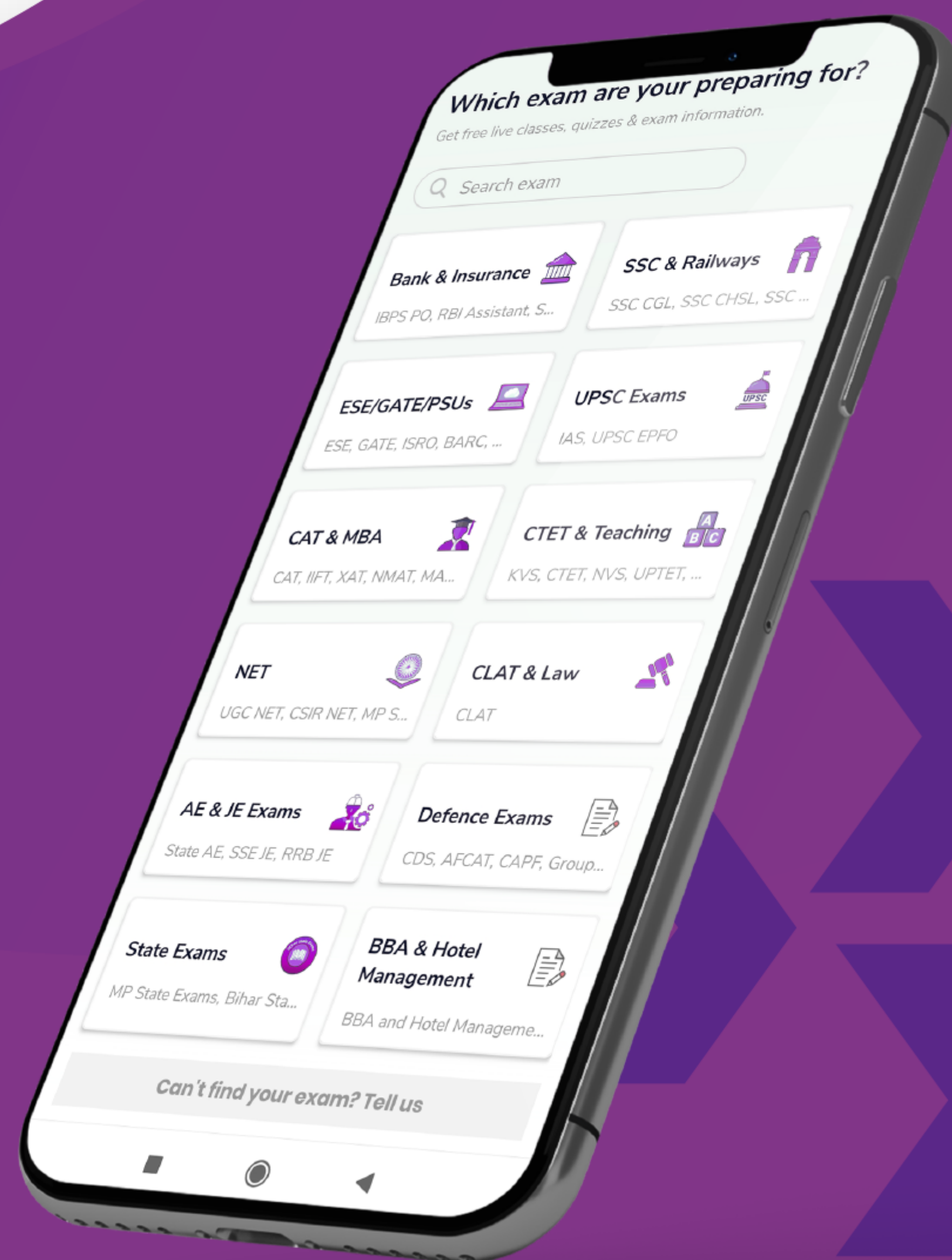


Formula Sheet On HCF & LCM



Highest Common Factor (HCF)

Highest Common Factor (HCF): The highest common factor of two or more numbers is the greatest common divisor, which divides each of those numbers an exact number of times. The process to find the HCF is:

- Express the numbers given as a product of prime numbers separately i.e. find factors of numbers.
- Take the product of prime numbers common to all the given numbers.

Example

Example 1: Find HCF of 540 and 1024.

Solution:

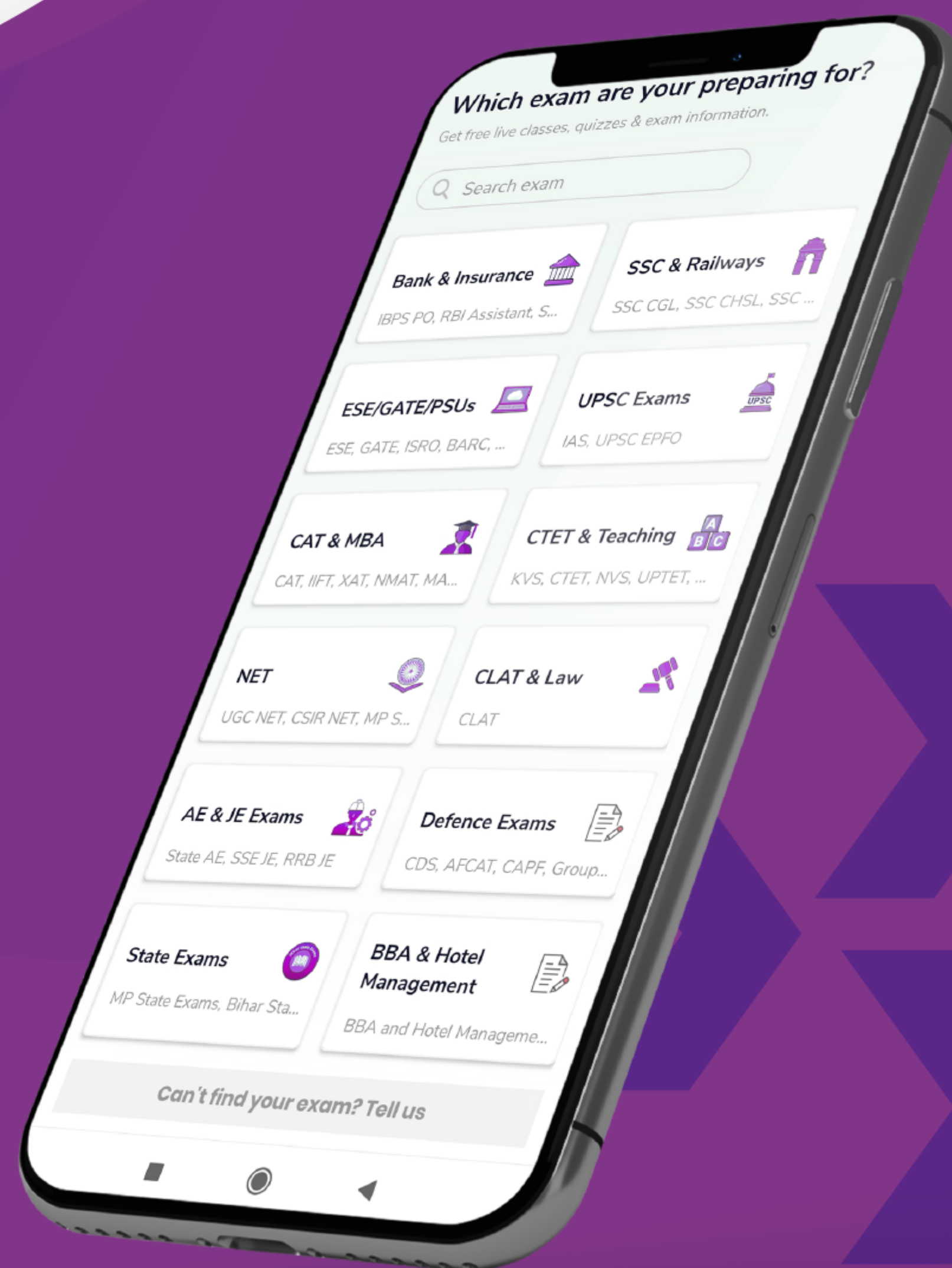
Step 1: Express the numbers given as a product of prime numbers.

$$540 = 2 \times 2 \times 3 \times 3 \times 3 \times 5 = 2^2 \times 3^3 \times 5^1$$

$$1024 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{10}$$

Step 2: Take the product of prime numbers common to all the given numbers.

We can see that only 2^2 is common to both the given numbers. Thus, H.C.F. = $2 \times 2 = 4$



Least Common Multiple (LCM):

Least Common Multiple (LCM): The least common multiple (LCM) of two or more numbers is the smallest of the numbers, which is exactly divisible by each of them, e.g. consider two numbers 18 and 24.

The multiples of 18 are: 18, 36, 54, 72, 90, 108, 126, 144, 162, 180, 198, 216,

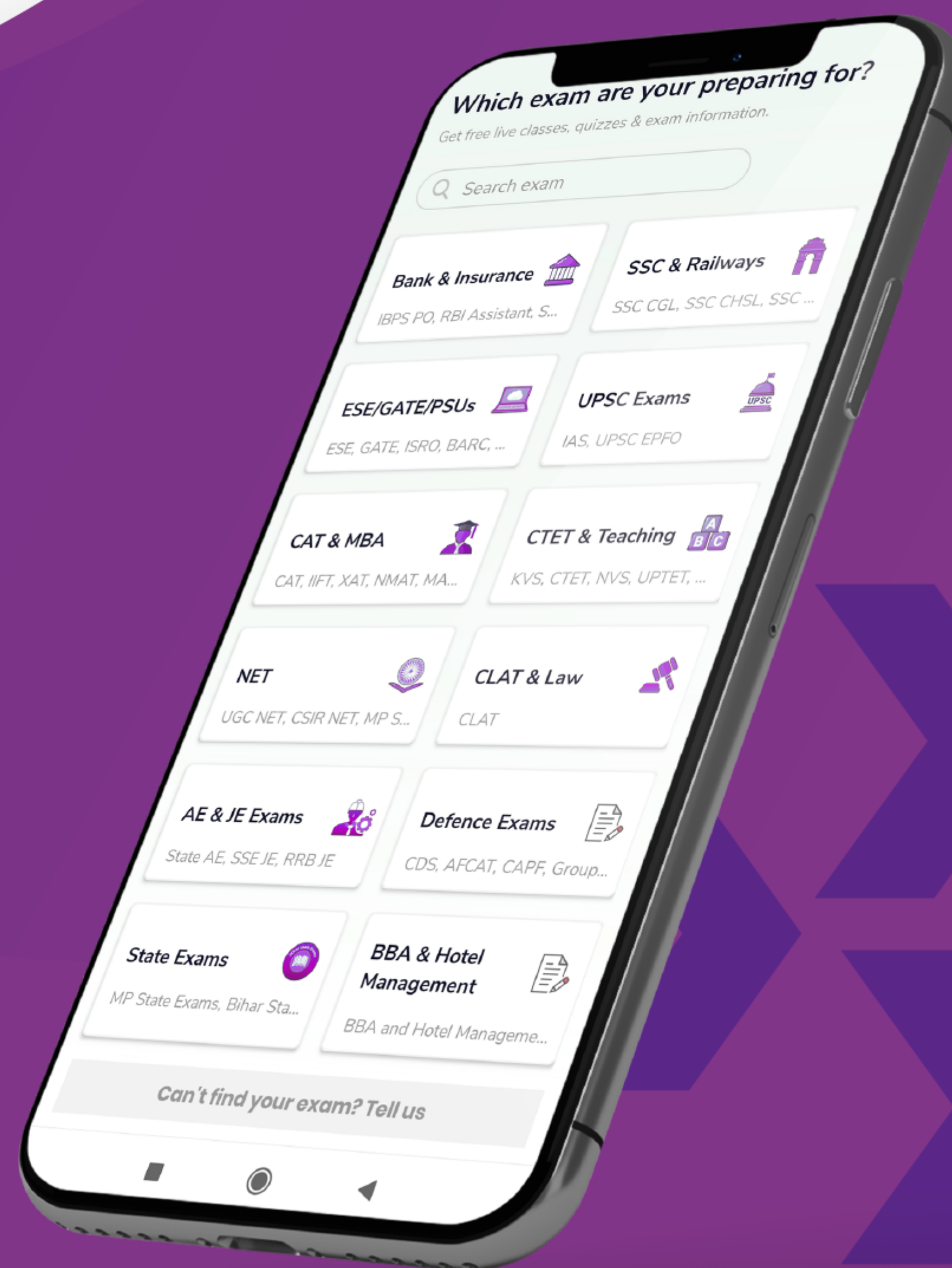
The multiples of 24 are: 24, 48, 72, 96, 120, 144, 168, 192, 216,

The common multiples of both 18 and 24 are 72, 144, 216,

The least common multiple is 72.

Here again, try to break the words in reverse order and understand the concept. Firstly, find the multiples of the numbers. Secondly, the common multiples of the numbers and finally the least out of those will be the LCM. The process to find the LCM is:

- Express the numbers given as a product of prime numbers separately i.e. find factors of numbers
- Take the product of prime factors of the given numbers after eliminating repetition of the common factors.



Examples:

Example: Find the LCM of 210, 360, and 540.

Solution:

Step 1: Express the numbers given as a product of prime numbers.

$$210 = 2 \times 3 \times 5 \times 7$$

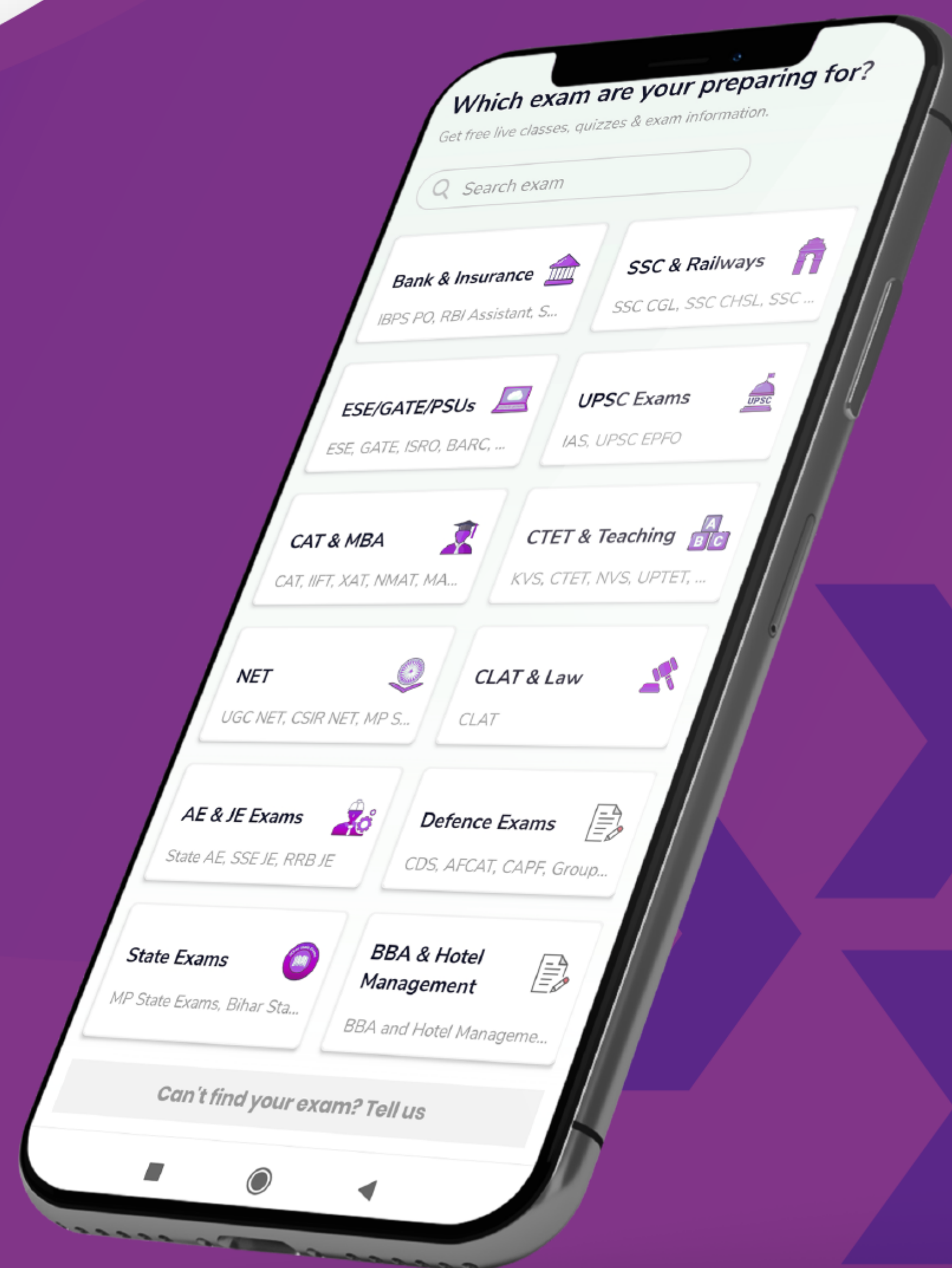
$$360 = 2^3 \times 3^2 \times 5$$

$$540 = 2^2 \times 3^3 \times 5$$

Step 2: Take the product of prime factors of the given numbers after eliminating repetition of the common factors.

Here, eliminating the common factors 2^1 , 3^1 , and 5^1 and multiplying the remaining factors i.e. 2^3 and 3^3 , 5 and 7.

$$\text{So, LCM} = 2^3 \times 3^3 \times 5 \times 7 = 7560$$



Relationship between HCF and LCM

The relationship between any two numbers x and y and their HCF and LCM: $x \times y = \text{LCM} \times \text{HCF}$

Proof: Let us take any two numbers such as 14 and 78.

Factorization of 14 = 2×7 and 78 = $2 \times 3 \times 13$

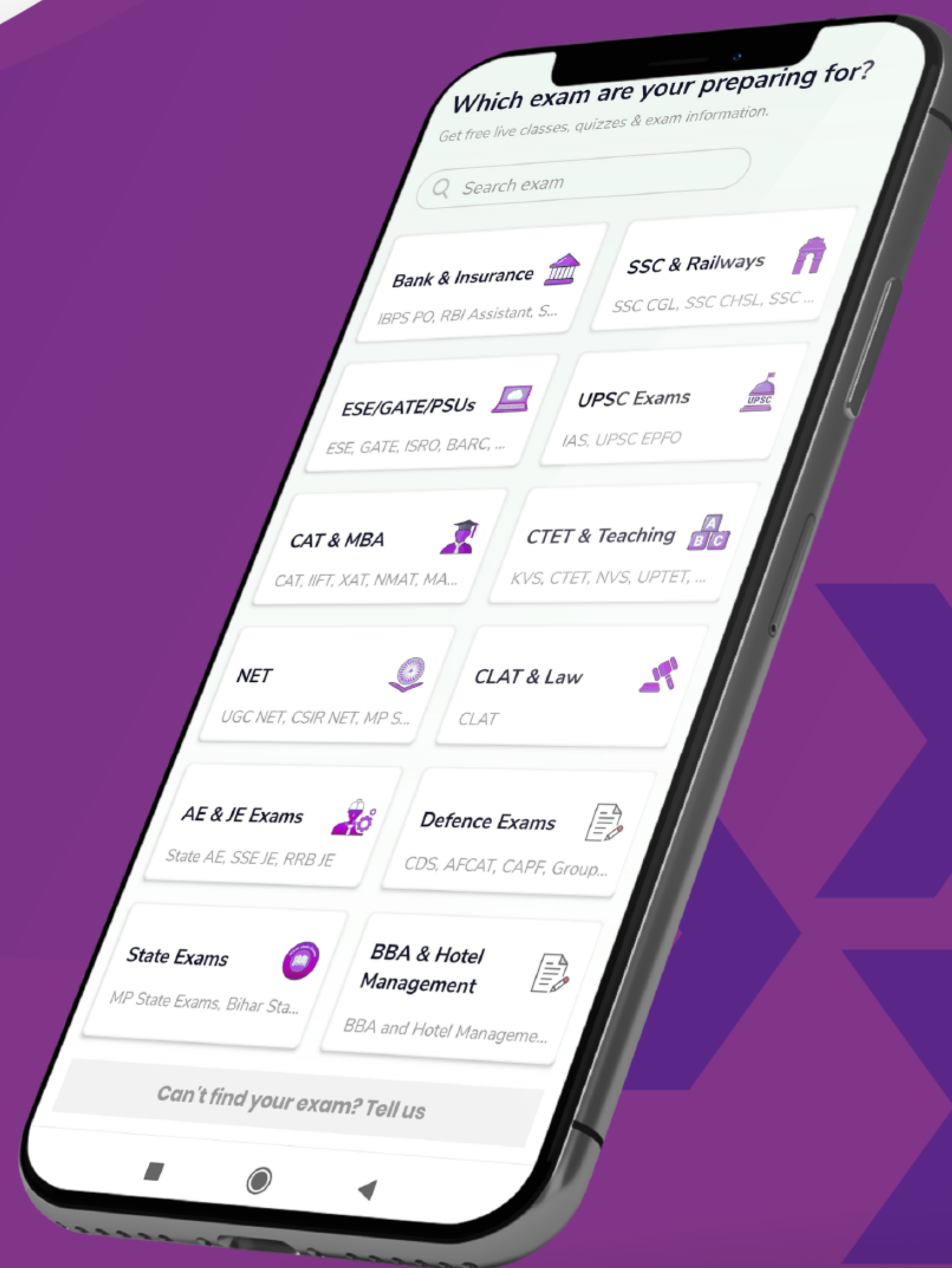
Product of 14 and 78 = $14 \times 78 = 1092$

HCF of 14 and 78 = 2

LCM of 14 and 78 = $2 \times 3 \times 7 \times 13 = 546$

Product of HCF and LCM = $2 \times 546 = 1092$

Thus, Product of 14 and 78 = HCF \times LCM of 14 and 78.



Special case of finding HCF:

The special case of finding HCF: There are some cases when HCF is asked in question but two numbers (N_1 and N_2) are not given instead their sum and LCM are given. So, in that case:

$$\text{HCF of } (N_1 \text{ and } N_2) = \text{HCF of } (\text{Sum of } N_1 \text{ and } N_2, \text{ LCM of } N_1 \text{ and } N_2)$$

Proof: Find the HCF of 36 and 54.

$$36 = 2^2 \times 3^2$$

$$54 = 2^1 \times 3^3$$

$$\text{HCF} = 2^1 \times 3^2 = 18$$

Here, the Sum of 36 and 54 = 90

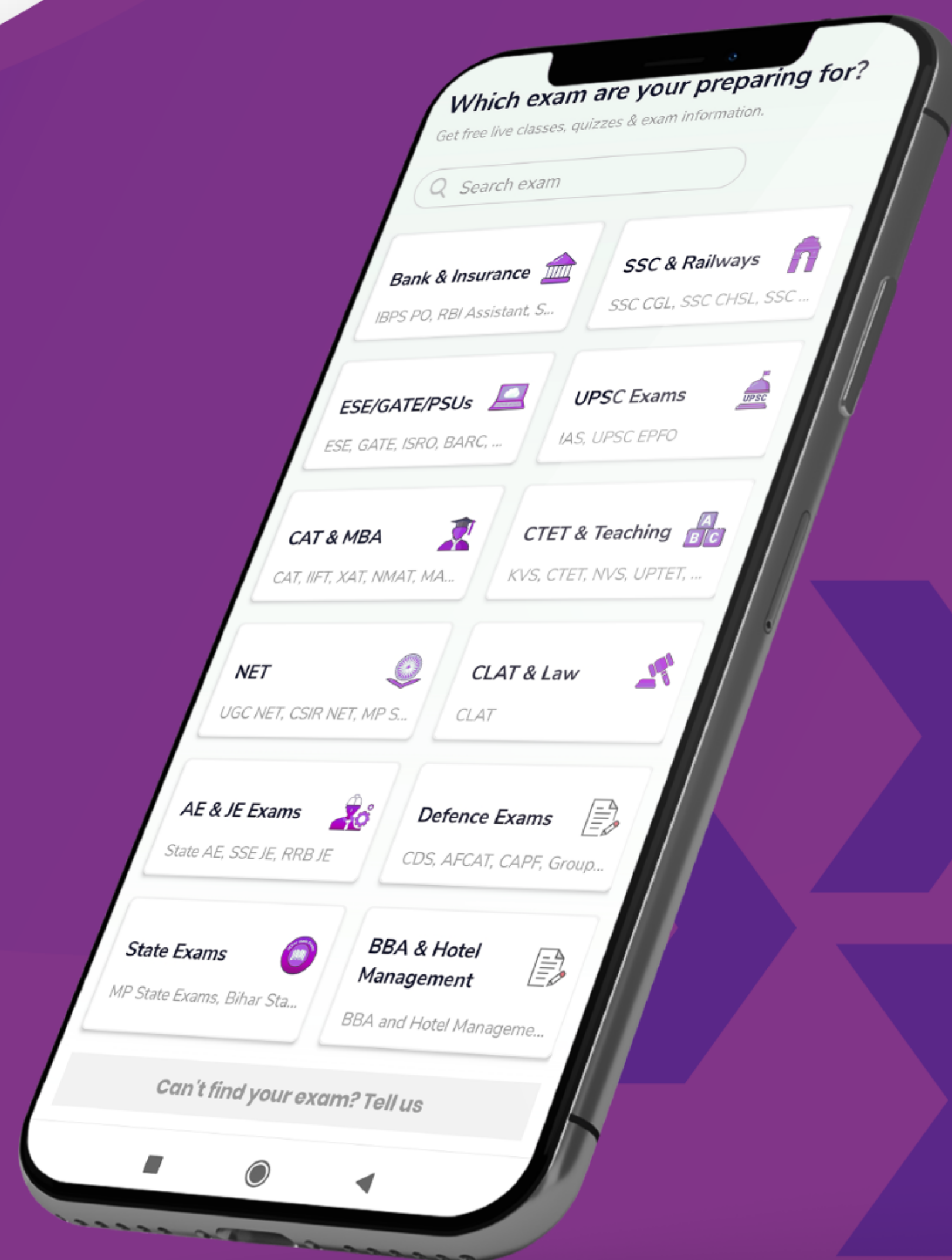
$$\text{And Sum of 36 and 54} = 2^2 \times 3^3 = 108$$

$$\text{HCF of } (\text{Sum of 36 and 54, LCM of 36 and 54}) = \text{HCF of } (90 \text{ and } 108) = 18$$

So, in both cases, HCF is the same.

HCF of fraction values: To calculate the HCF of fraction values, we calculate the ratio of

HCF of all the numerators to LCM of all the denominators.



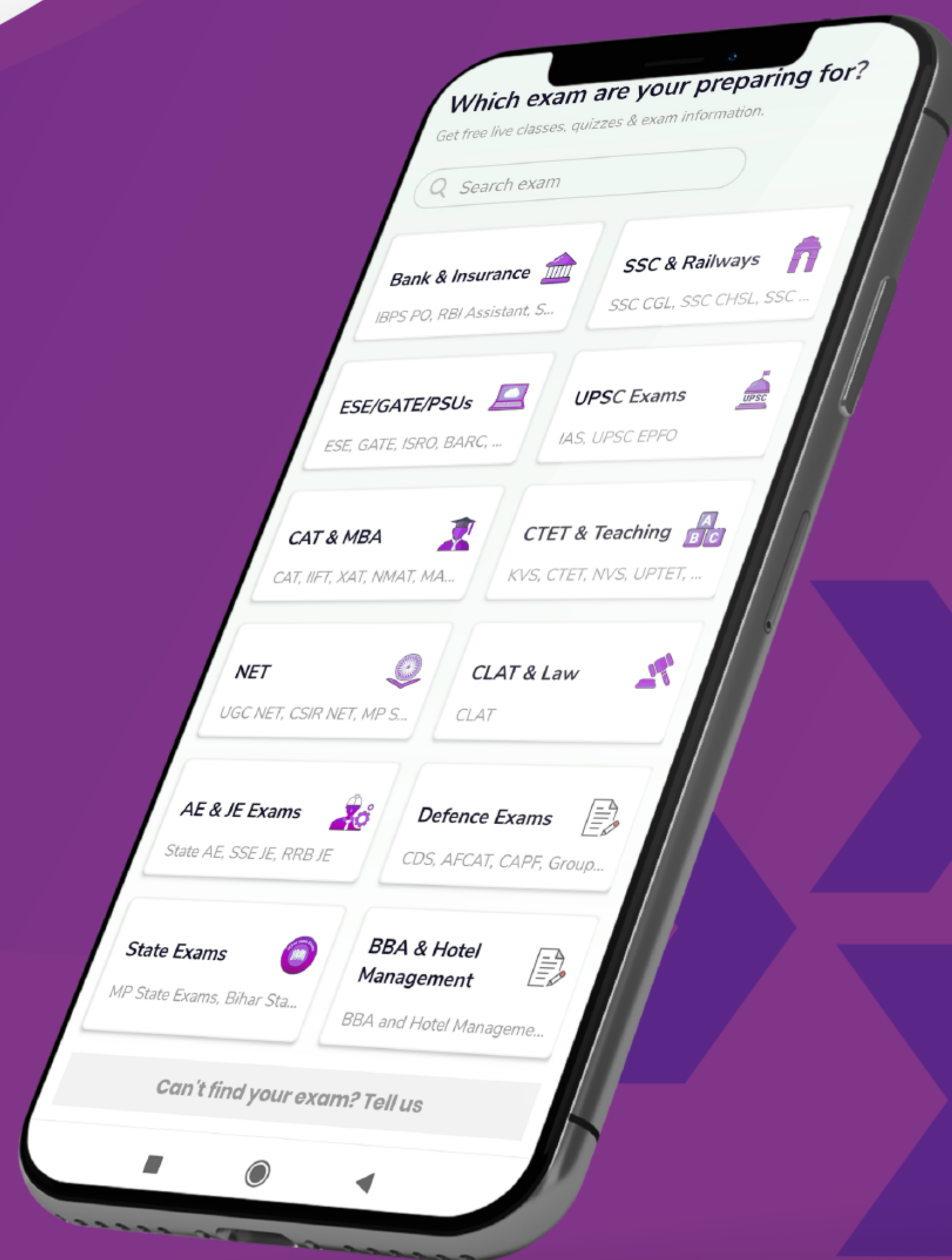
Example : Find the HCF of $\frac{1}{4}, \frac{3}{8}, \frac{5}{6}, \frac{13}{12}$.

Solution:

HCF of numerators = HCF (1, 3, 5, 13) = 1

LCM of denominators = LCM (4, 8, 6, 12) = 24

Thus, HCF of given fractions = $\frac{1}{24}$



LCM of fraction values:

LCM of fraction values: To calculate the LCM of fraction values, we calculate the ratio of LCM of all the numerators to HCF of all the denominators.

Example 9: Find the LCM of $\frac{1}{4}, \frac{3}{8}, \frac{5}{6}, \frac{13}{12}$.

Solution:

LCM of numerators = LCM (1, 3, 5, 13) = 195

HCF of denominators = HCF (4, 8, 6, 12) = 2

Thus, LCM of given fractions = $\frac{195}{2}$

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