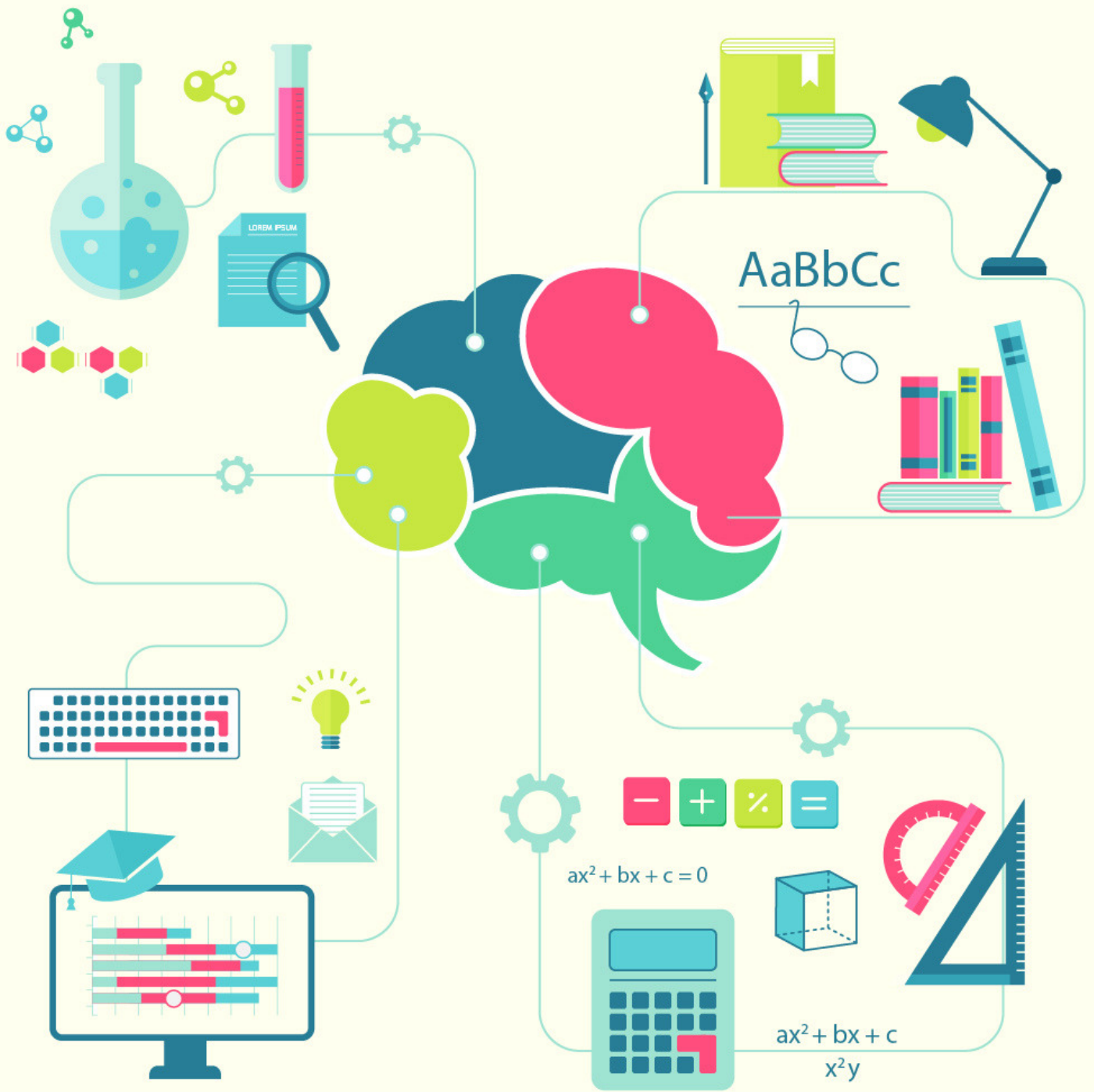


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CAT Questions on Factors of a Number

08 March 2018





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Question 1: A “tragic number” is a number which can be expressed as the sum of three of its factors. For example, 6 can be expressed as the sum of 1, 2 and 3. How many tragic numbers are there that are less than 50?

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

Question 2: If $N = 1980$, Find the number and sum of its even factors.

- a) 28, 6552
- b) 24, 5616
- c) 24, 4630
- d) 28, 5672

Question 3: How many integers are both multiples of 125^{3124} and factors of 125^{3127} ?

- a) 3
- b) 10
- c) 4
- d) 11

Question 4: What is the number of even factors of 36000 which are divisible by 9 but not by 36?

- a) 20
- b) 4
- c) 10
- d) 12

Question 5: How many factors of 36288 are perfect cubes?

- a) 9
- b) 4
- c) 6
- d) 8

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Solutions:

1) Answer (C)

The factors of a number 'x' can be of the form $\frac{x}{2}, \frac{x}{3}, \frac{x}{5}, \dots$

If 2 is not a factor of the number then the highest three factors of the number can be $\frac{x}{3}, \frac{x}{5}, \frac{x}{7}$.
The sum of these three is less than x. So 2 has to be a factor of the number.

If 3 is not a factor of the number then the highest three factors of the number can be $\frac{x}{2}, \frac{x}{4}, \frac{x}{5}$.
The sum of these three is less than x. So 3 has to be a factor of the number.

If 2 and 3 are factors, 6 is also a factor.

Also the sum of $\frac{x}{2}, \frac{x}{3}, \frac{x}{6}$ is exactly equal to x.

So all numbers which are multiples of 6 are tragic numbers.

There are 8 such numbers which are below 50.

2) Answer (B)

$$1980 = 2^2 * 3^2 * 11 * 5$$

Number of even factors = Total number of factors - Number of odd factors.

$$= (2+1)(2+1)(1+1)(1+1) - (2+1)(1+1)(1+1) = 24$$

Sum of even factors = Sum of all the factors - sum of odd factors

$$= \left(\frac{2^{(2+1)} - 1}{(2 - 1)}\right) \times \left(\frac{3^{(2+1)} - 1}{(3 - 1)}\right) \times \left(\frac{11^{(1+1)} - 1}{(11 - 1)}\right) \times \left(\frac{5^{(1+1)} - 1}{(5 - 1)}\right) - \left(\frac{3^{(2+1)} - 1}{(3 - 1)}\right) \times \left(\frac{11^{(1+1)} - 1}{(11 - 1)}\right) \times \left(\frac{5^{(1+1)} - 1}{(5 - 1)}\right)$$

$$= 7 * 13 * 12 * 6 - 13 * 12 * 6 = 5616$$

3) Answer (B)

$$125^{3124} = 5^{9372}$$

$$125^{3127} = 5^{9381}$$

Thus, the factors of 5^{9381} are multiples of 5^{9372} are $5^{9372}, 5^{9373}, \dots, 5^{9381}$. Thus, there are 10 such integers

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4) Answer (B)

$$36000 = 2^5 * 3^2 * 5^3$$

Since we are talking of even factors, there must be at least one 2 in the required factors.

Since the number is divisible by 9, we must have both the threes.

We cannot have more than 1 two as it will make the number divisible by 36.

So we have 1 way of choosing 2, 1 way of choosing 3, 4 ways of choosing 5.

Thus the required number of factors are

$$1*1*4 = 4$$

5) Answer (C)

$$36288 = 2^6 * 3^4 * 7$$

For any perfect cube, all the powers of its prime numbers have to be multiples of 3.

So, if the factor is of form $2^a * 3^b * 7^c$, a can take values 0, 3, 6

And b can take values 0, 3

And c can take value 0.

==> There are $3*2*1 = 6$ possibilities.

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