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SCIENCE —

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Peter Handke

Nobel Prize Winner 2019 (Literature)

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EDITORIAL

Dear learners,

Learning is a continuous process, which involves thinking, articulating, storing, remembering, using, parting and so on. Everyone learns, relearns and unlearns. It becomes an asset for the life. This can never be stolen and it cannot be bought too. It can only be gained. There are lots of ways by which one attains knowledge. What one attains, becomes ornament that shines and is part of one's own life. This is what makes one's life fruitful. To be fruitful one needs to be laborious. If one has gained something through easy means that will not sustain for a long period of time. Therefore, be a learner to be productive member of the society to think, to articulate, to store, to remember, to use, to impart by equipping oneself with the required skills. Proper learning creates lot of opportunities and these would lead to dispel the ignorance and would light up knowledge.

To be a help by being by your side to make your labour easy, we are presenting our humble effort in the form of a magazine named 'EDUMATE'. This is a collective endeavour to reach to the aspirants to make the study easier and also to let you know the day to day affairs. We have tried our level best to incorporate everything required to make a student's study process easy and effective. If our efforts stand helpful for your studies then the herculean task that we started will be fruitful.

No doubt this creative endeavour will bring about an array of knowledge bearing sweetest fruit ever. Let the knowledge sown today bring forth its best fruit with the help of 'EDUMATE'.

To you from us with love...

Geo John
Chief Editor

Life ... Love... Learn... to be a Change



FR. SIJU JOHN, M.A., M.Ed.

‘You must be the change you wish to see in the world’, one of the perfect words of Gandhiji in this new modern fast moving world when everyone wants to perceive changes and fetch changes in the life of others but not in oneself. We call for changes in life and no one would like to be idle in his/her life. We do apply certain words often in our conversation and they are life, love and learn.

LIFE.....

“Twenty years from now you will be more disappointed by the things you didn’t do than by the ones you did do. So throw off the bowlines. Sail away from the safe harbor. Catch the trade winds in your sails. Explore, Dream, Discover.” – Mark Twain.

The American writer’s words about life have a lot of relevance for today’s young buds. Life is to be explored in all meaning. It’s not a free gift but heavily compensated by our dear parents, our visible gods on earth. Every player has a coach but the coach is not always a better player. We have to explore ourselves and to explore we need to dream and discover. Every unearthing initiate with a dream and a better dreamer discovers better. Discovery begins from within and why don’t we take a step forward; a step which is rare, bold and distinctive.

LOVE

“Love is an untamed force. When we try to control it, it destroys us. When we try to imprison it, it enslaves us. When we try to understand it, it leaves us feeling lost and confused.” Paulo Coelho

The Brazilian novelist says that the love is a force. The force, which comes from the heart, penetrates the hearts of others and is the germ of life. It cultivates the worth of life and our young buds have to get the imprint of this precious germ. Today the world is more educated but has less common sense, more degrees but has less capacity of judgment, bigger houses but has small families, big personalities but has less character, spends a lot but has less happiness and conquered the whole world but has lost the germ of life i.e. love. We, the human beings, try to dominate but love cultivates peace which frees us from the burden and pains of life. Let our educators, parents, peer groups, friends and so on nurture the germ of life to our young buds. We can cultivate it by giving a feather touch of love.



LEARN

‘By three methods we may learn wisdom: First, by reflection, which is noblest; Second, by imitation, which is easiest; and third by experience, which is the bitterest.’ – Confucius

The Chinese philosopher says that the toughest way of learning is by experience. A blind person makes a decision after experiencing. He sees the things through his heart because only his eyes are closed not his heart/mind. We have to keep our hearts open to learn by experience and learning through heart is love. The more I read, the more I acquire but the more I love, the more I learn to live. The most precious learning is learning of the meaning of love since all learning has an emotional base. We must learn to live together than leaning various languages and sciences. The standard of living is what we have but the standard of life is what we give from our heart.

BE A CHANGE

“The secret of change is to focus all of your energy not on fighting the old, but on building the new.”-Socrates

To be a change, we need to have clarity of mind and heart and this clarity is acquired through life, love and learning. In order to be a change or revolutionary one must have the vision and heart of a giraffe. Giraffe has a small, powerful, supercharged heart that is different to that possessed by other similar animals and has a holistic vision from above. We obtain speed in life by technology but the direction has to be from a heart which has knowledge by experience. Let us direct our young buds from our experienced hearts to bring changes in their life and lives to come. Therefore we shall lead a simple life but a rich burial by the triumph of our life.

GET UP FROM THE FALL TO WIN



GEO JOHN, M.A., B.Ed.

INTRODUCTION

The moment one thinks about one's own capabilities and is confident about the caliber, he/she will emerge as victorious. Success is the result of positivity. When a person is positive and is with wonderful courage to take up risks can taste triumph and when one is passive and do nothing productive will have a great fall and that would be irreversible. Being positive will make great things possible to those who don't stop believing in oneself, trying something new or better and learning to be different. Be inquisitive to be different, and if you want to be different you need to be different. Being inquisitive will open up to new ideas and these ideas will sprout, grow and yield fruits.

Be curious to win

It is necessary to be curious and curiosity according to Ian Leslie is a combination of intelligence, persistence and hunger for novelty, all wrapped up in one. In order to improve curiosity and wonder one needs to read widely and should follow one's interests. It is said that when you are running into something interesting, drop everything and study it. The feeling of being interested can act as a kind of neurological signal, directing us to fruitful areas of inquiry.

Be thirsty to accomplish your target

The thirst to have fruitful enquiry will lead to fill up and accomplish the target. It will also help one to polish mind with the minds or thoughts of others. One can always be benefitted with the progressive ideas of others. It simply means to consult with the experts to be experts. These ideas will either support or would leave the spark to think what is next. If your ideas can get wings using others' thoughts there is no wrong in it but one should make sure that it is productive and never be destructive.

Do not take up shortcuts

We have crippled ourselves in finding out shortcuts in every way possible. Though we have the potential source, we do not want to rely on anything that would demand time. Even any kind of information we require is to be available at our finger tips, if not, it is very difficult to pass moments. Today's generation is born to Google. In the era of Google searches, we have no problem finding the exact answer to our questions, but by chance likely to encounter information that is not specific or relevant to our question or queries. It is said that a serendipity deficit makes innovation harder, because innovation relies on unexpected collision of

knowledge and ideas. So, it is the fact that we don't exactly get the answers perfect for our questions.

Give wings to your passions

All what you do might be meaningless or absurd for the people watch you from far, but you should never allow your passion and interests to die. Once they are no more with you, then the life will be pathetic and difficult to pursue. On the go there are chances, where you might fall down many times but your passion and interests would be your help in standing on your own foot. You must keep your passion alive and no outer forces can have access on you. This must be your strength to get up from the fall. Falling down would give us experiences and these experiences are the driving forces to stand up. An ant while carrying the grain might fall down many times but it will not stop carrying grains because of the fear of falling down. Life is similar to this. If one wants to sustain life, then it is necessary to have lots of experiences of falling down and getting up. Learn lessons from every instance of your life and this would be a force to live on.

Conclusion

I am the master of my life and everything that is required to stand on my own foot it's within me. If I am able to stand to be different by being curious to win starts my auspicious time and this so called auspicious time is within and will be out of your reach if you are to search elsewhere. Do not be satisfied with the knowledge you have but equip and update yourself at every moment by not taking the shortcuts to win rather shed your perspiration for your cause. If you are determined you will never at the place where you fell but you would fly to the heights by the wings that are created by you to win always.



MY CAREER: THE PATH FINDER



SHAJU JOSEPH, M.A., M. Phil., B. Ed., MBA

Choosing a career after schooling is considered to be the most important activity in a student's life. But the question that baffles everybody is, '**What to choose?**' and '**How to choose?**' Unfortunately these questions remain unanswered in most of the children's lives. The reason...?

In a world where the children get everything 'readymade', this problem is bound to happen. In a world where the children are just taught about the price of things and not the value, this is bound to happen and in a world where the children are not taught to take up the responsibilities or face the challenges and stand on their own legs, this is bound to happen. The parents- especially our (Indian) parents are so concerned about their children's future that they want to have everything ready for them as they grow up and finally a high profile blue collar job with a fat six/ seven digit pay cheque. Once they achieve this – the parents are happy and content that their son/ daughter is well settled.

It looks good and everybody is fine with it. Moreover this is what 90% of the present generation wants. Gradually what happens is – they get fed up with the unending stress related to work, meeting the targets, satisfying the boss etc. In the struggle to keep up with the expectations of the employers and the society, they forget their family life, their children's social and emotional growth, the spouse, the parents and relations. Not only that the extreme stress makes the person mentally and physically tired. The rest of the life is spent going to the hospitals, eating loads of medicines as food etc. or to make things worse, he/ she may get into depression or even commit suicide.

How do these things happen? Was this what was envisioned? Was it the destiny / the life parents wanted the children to have?

No- Obviously No is the answer. Then Why ...? why should this happen? Let us look back to the two questions that we left behind – **What to choose? and How to choose?**

These two questions are quintessentially important because a choice that one makes at a critical point of time makes all the difference. Every apprentice searching for a happy life, should earnestly work on What to Choose- not choose what they have been told to by the parents ,

relatives or the so called well- wishers or not a career to satisfy your parents or your own social status. The choice should ultimately based on your own interests , your own passion and your own heart's desire - failing in which whatever you do will become just a job , a burden and it will never make you happy.

As we discussed, what to Choose entirely depends on your passion, love, affinity and attachment. Your parents / teachers can surely guide you or support you but make sure you be the decision maker. When you go after what you are passionate about, you are bound to enjoy what you do. It will never be a burden for you or even a 'work' for you but it will be the most interesting activity, or 'time pass' for you as you get completely involved in it. As the maxim goes 'Do what you love and Love what you do'.

In the words of Dr. A P J Abdul Kalam, 'If you do what you love, you don't need to work even a single day in your life. So it becomes imperative to make a correct choice before selecting a particular profession.'

Now let's discuss how to identify your passion, your interest or what to do with your life. I hope the following questions will help you to make the choice. Ask yourself the same/ similar questions.

- What do I enjoy doing?
- What kind of activities are fun and fulfilling for me?
- What am I good at?
- What Skills do I have to excel in what I do?
- What are my capabilities?
- What are my drawbacks and what do I do to improve upon them?
- How much time do / can I spend to sharpen my skills?
- How confident am I?
- How strong is my Intrapersonal as well as my Interpersonal skills?
- Am I willing to / able to face the challenges that emerge in this field?

If you are able to find satisfying answers to these questions, be sure that you are on the right track. Develop a strong proactive mindset and 'Never say Die' attitude and an unrelenting thirst to achieve what you value the most and it will surely make your life and you will be happy and your life will be meaningful. As Swami Vivekananda reminds us " Arise, awake and stop not until the goal is reached".



REAL NUMBERS

EUCLID'S DIVISION LEMMA

An algorithm is a series of well defined steps which give a procedure for solving a type of problem.

A lemma is a proven statement used for proving another statement.

Euclid's division algorithm is an alternative method to calculate HCF

To obtain HCF of two positive integers say c and d with $c > d$

Step 1 : Apply Euclid's division lemma, to c and d . So we find whole numbers q and r such that $c=dq+r$ $0 \leq r < d$.

Step 2 : If $r = 0$, d is the HCF of c and d . If $r \neq 0$, apply the division lemma on d and r .

Step 3 : Continue the process till the remainder is zero. The divisor at this stage will be the required HCF.

The fundamental Theorem of Arithmetic

- Every composite number can be expressed (factorised) as a product of primes and this factorisation is unique, apart from the order in which the prime factors occur.

Rational and Irrational Numbers

- A number 's' is called rational if it can be written in $\frac{p}{q}$ from where $q \neq 0$
- A number 's' is called irrational if it can't be written in $\frac{p}{q}$ from where $q \neq 0$

Irrationality of square roots of 2, 3 and 5

- Let p be a prime number. If ' p ' divides a^2 , then ' p ' divides ' a ', where ' a ' is a positive integer.
- $\sqrt{2}, \sqrt{3}, \sqrt{5}$ are irrational.

Decimal expressions of rational numbers

- Let ' x ' be a rational number, whose decimal expansion terminates. Then we can express ' x ' in the form of $\frac{p}{q}$, where p, q are co prime and prime factorisation of ' q ' is of the form $2^n 5^m$ where ' n ' and ' m ' are non negative integers.
- Let $x = \frac{p}{q}$ be a rational number, such that the prime factorization of ' q ' is the form of $2^n 5^m$ where n and m are non integers. Then ' x ' has a decimal expansion which terminates.
- Let $x = \frac{p}{q}$ be a rational number, such that the prime factorization of ' q ' is not of the form $2^n 5^m$ where n and ' m ' are non negative integers. Then ' x ' has a decimal expansion which is non terminating repeating (recurring).

Exercise 1.1

1. Use Euclid's division algorithm to find the HCF of

i) 135 and 225

Answer: We apply division algorithm

$$225 = (135 \times 1) + 90 \quad (225 > 135)$$

$$135 = (90 \times 1) + 45$$

$$90 = (45 \times 2) + 0$$

Reminder is 0, the divisor in the last step is 45

\therefore Therefore HCF (135, 225) is 45.

ii) 196 and 38220

Answer: We apply division algorithm

$$38220 = (196 \times 195) + 0$$

\therefore Therefore HCF is 196

iii) 867 and 255

Answer: We apply division algorithm

$$867 = (255 \times 3) + 102 \quad (867 > 255)$$

$$255 = (102 \times 2) + 51$$

$$102 = (51 \times 2) + 0$$

\therefore Therefore HCF is 51

2. Show that any positive odd integer is of the form $6q+1$, or $6q+3$, or $6q+5$, where q is some integer.

Answer: Let ' a ' be any positive integer and $b = 6$

Then by Euclid's algorithm

$$a = 6q+r \text{ for some integer } q \geq 0 \text{ and}$$

$$r = 0, 1, 2, 3, 4, 5$$

Therefore

$$a = 6q, 6q+1, 6q+2, 6q+3, 6q+4, 6q+5, \text{ also}$$

$$6q+1 = 2x(3q)+1 = 2k_1+1, \text{ where } k_1 \text{ is an integer}$$

$$6q+3 = 2x(3q+1) + 1 = 2k_2+1, \text{ where } k_2 \text{ is an integer}$$

$$6q+5 = 2(3q+2)+1 = 2k_3+1, \text{ where } k_3 \text{ is an integer.}$$

Therefore clearly $6q+1, 6q+2$ and $6q+5$ are of the form $2k+1$, where k is an integer.

Hence these expressions of numbers are odd numbers and therefore any odd integer can be expressed in the form of $6q+1, 6q+3$ or $6q+5$.

3. An army contingent of 616 members is to march behind an army band of 32 members in a parade. The two groups are to march in the same number of columns. What is the maximum number of columns in which they can march?

Answer:

Total number of members = 616

Number of members in the army band = 32

Maximum number of columns in which they can march = HCF (616, 32)

By using Euclid's division algorithm

since $616 > 32$,

$$616 = (32 \times 19) + 8$$

$$32 = (8 \times 4) + 0$$

The HCF (616, 32) = 8.

Hence, the maximum number of columns in which they can march = 8

4. Use Euclid's division lemma to show that the square of any positive integer is either of the form $3m$ or $3m+1$ for some integer m .

Answer: Let 'a' be positive integer and $b = 3$, using division algorithm lemma

$a = 3q+r$ for some integer $q > 0$ where $r = 0, 1, 2$

Therefore

$$a = 3q \text{ or } 3q+1 \text{ or } 3q+2$$

$$a^2 = (3q)^2 = 9q^2 = 3(3q^2)$$

$$= 3m_1, \text{ where } m_1 \text{ is an integer}$$

$$(3q+1)^2 = 9q^2 + 6q + 1$$

$$= 3(3q^2 + 2q) + 1$$

$$= 3m_2 + 1 \text{ where } m_2 \text{ is an integer}$$

$$(3q+2)^2 = 9q^2 + 12q + 4$$

$$= 9q^2 + 12q + 3 + 1$$

$$= 3(3q^2 + 4q + 1) + 1$$

$$= 3m_3 + 1 \text{ where } m_3 \text{ is an integer}$$

\therefore clearly it can be said that square of any positive integer is either of form $3m$ or $3m+1$

5. Use Euclid's division lemma to show that the cube of any positive integer is of the form $9m$, $9m+1$ or $9m+8$.

Answer : Let 'a' be any positive integer and $b = 3$ Using division lemma

$$a = 3q+r \text{ where } r = 0, 1, 2$$

$$\therefore a = 3q, 3q+1, 3q+2$$

Case 1 where $a = 3q$

$$a^3 = (3q)^3 = 27q^3 = 9(3q^3) = 9m, \text{ where } m = 3q^3$$

Case 2 where $a = 3q+1$

$$a^3 = (3q+1)^3 = 27q^3 + 1 + 27q^2 + 9q$$

$$= 9(3q^3 + 3q^2 + q) + 1$$

$$= 9m+1, \text{ where } m = 3q^3 + 3q^2 + q$$

Case 3 where $a = 3q+2$

$$a^3 = (3q+2)^3$$

$$= 27q^3 + 54q^2 + 36q + 8$$

$$= 9(3q^3 + 6q^2 + 4q) + 8$$

$$= 9m + 8 \text{ where } m = 3q^3 + 6q^2 + 4q$$

\therefore cube of any positive integer is of the form $9m$, $9m+1$, $9m+8$

Exercise 1.2

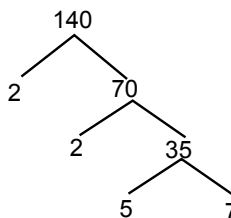
1. Express each number as a product of its prime factors

i) 140, ii) 156, iii) 3825, iv) 5005, v) 7429

Answer:

i) 140

Using factor tree method



ii) $140 = 2 \times 2 \times 5 \times 7 = 2^2 \times 5 \times 7$
156

iii) $156 = 2 \times 2 \times 3 \times 13 = 2^2 \times 3 \times 13$
3825

$$3825 = 3 \times 3 \times 5 \times 5 \times 17 = 3^2 \times 5^2 \times 17$$

iv) $5005 = 5 \times 7 \times 11 \times 13$

v) $7429 = 17 \times 19 \times 23$

2. Find the LCM and HCF of the following pairs of integers verify that $LCM \times HCF = \text{product of the two numbers}$.

i) 26 and 91 ii) 510 and 92 iii) 336 and 54

Answer:

HCF is the product of common prime factors raised to least power, while LCM is product of prime factors raised to highest power. HCF is always a factor of the LCM.

i) 26 and 91

HCF

$$26 = 2 \times 13$$

$$91 = 7 \times 13$$

\therefore HCF = 13

LCM

$$26 = 2 \times 13$$

$$91 = 7 \times 13$$

\therefore LCM = $2 \times 7 \times 13 = 182$

Now

Product of two numbers = $26 \times 91 = 2366$

HCF x LCM = $13 \times 182 = 2366$

\therefore LCM x HCF = Product of numbers

ii) 510 and 92

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

$$92 = 2 \times 2 \times 23$$

\therefore HCF = 2

LCM = $2 \times 3 \times 5 \times 2 \times 17 \times 23 = 23460$

Product of two numbers = $510 \times 92 = 46920$

$$\text{LCM} \times \text{HCF} = 2 \times 23460 = 46920$$

∴ Hence verified

iii) 336 and 54

$$\begin{aligned} 336 &= 2^4 \times 3 \times 7 \\ 54 &= 2 \times 3^3 \end{aligned}$$

$$\text{HCF} = 2 \times 3 = 6$$

$$\text{LCM} = 24 \times 3^3 \times 7 = 3024$$

$$\text{Product of two numbers} = 336 \times 54 = 18144$$

$$\text{LCM} \times \text{HCF} = 6 \times 3024 = 18144$$

∴ Hence verified

3. Find the LCM and HCF of the following integers by applying the prime factorisation method.

i) 12, 15 and 21 ii) 17, 23 and 29 iii) 8, 9 and 25

Answer:

HCF is the product of common prime factors of all three numbers raised to least power, while LCM is product of prime factors of all here raised to highest power. Use the fact that HCF is always a factor of the LCM to verify the answer.

i) 12, 15 and 21

$$\begin{array}{l} 12 = 2 \times 2 \times 3 \\ 15 = 3 \times 5 \\ 21 = 3 \times 7 \end{array} \quad \begin{array}{l} \frac{2}{2} \frac{12}{6} \\ \frac{3}{3} \frac{15}{5} \\ \frac{3}{3} \frac{21}{7} \\ \hline 1 \quad 1 \quad 1 \end{array}$$

$$\text{HCF} = 3$$

$$\text{LCM} = 2 \times 2 \times 3 \times 5 \times 7 = 420$$

ii) 17, 23 and 29

$$17 = 1 \times 17$$

$$23 = 1 \times 23$$

$$29 = 1 \times 29$$

$$\text{HCF} = 1$$

$$\text{LCM} = 17 \times 23 \times 29 = 11339$$

iii) 8, 9 and 25

$$8 = 2 \times 2 \times 2$$

$$9 = 3 \times 3$$

$$25 = 5 \times 5$$

$$\text{HCF} = 1$$

$$\text{LCM} = 8 \times 9 \times 25 = 1800$$

4. Given that HCF (306, 657) = 9, find LCM (306, 657)

Answer:

This problem must be solved using product of two numbers = HCF x LCM rather than prime factorisation.

$$\text{HCF} (306, 657) = 9$$

We know,

$$\text{LCM} \times \text{HCF} = \text{Product of two numbers}$$

$$\text{LCM} = \frac{\text{Product of two numbers}}{\text{HCF}} = \frac{306 \times 657}{9} = 22338$$

5. Check whether 6n can end with the digit 0 for any natural number 'n'.

Answer:

If any number ends with digit 0, it should be divisible by 2, 5 or 10

Prime factorisation of $6^n = (2 \times 3)^n$.

As 5 is not in the prime factorisation of 6^n

Hence for any value of 'n', 6^n will not be divisible by 5 or 2 and hence by 10

Therefore, 6^n can't end with digit 0 for any natural number 'n'.

6. Explain why $7 \times 11 \times 13 + 13$ and $7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 + 5$ are composite numbers.

Answer:

Numbers are of two types - prime and composite.

Prime numbers can be divided by 1 and the number itself.

Hence,

$$\begin{aligned} 7 \times 11 \times 13 + 13 &= 13(7 \times 11 + 1) \\ &= 13(77 + 1) = 13 \times 78 \\ &= 13 \times 13 \times 6 \end{aligned}$$

The given expression has 6 and 13 as its factors.

Therefore it is a composite number.

$$\begin{aligned} 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 + 5 &= 5(7 \times 6 \times 4 \times 3 \times 2 \times 1 + 1) \\ &= 5(1008 + 1) \\ &= 5 \times 1009 \end{aligned}$$

The given expression has 5 and 1009 as its factors.

Therefore it is a composite number.

7. There is a circular path around a sports field. Sonia takes 18 minutes to drive one round of the field. While Ravi takes 12 minutes for the same. Suppose they both start at the same point and at the same time, and go in the same direction. After how many minutes will they meet again at the starting point?

Answer:

It can be observed that Ravi takes lesser time than Sonia for completing 1 round of the circular path. As they are going in same direction, they will meet again at the same time when Ravi will have completed 1 round of that circular path with respect to Sonia. LCM of time taken by Sonia and Ravi for completing 1 round i.e.,

$$\text{LCM of 18 minutes and 12 minutes}$$

$$18 = 2 \times 3 \times 3$$

$$\text{And } 12 = 2 \times 2 \times 3$$

$$\text{LCM of 12 and 18} = 2 \times 2 \times 3 \times 3 = 36$$

Therefore, Ravi and Sonia will meet together at the starting point after 36 minutes.

Exercise 1.3

1. Prove that $\sqrt{5}$ is irrational.

Answer:

Let $\sqrt{5}$ is a rational number

Therefore we can find two integers a, b ($b \neq 0$) such that

$$\sqrt{5} = \frac{a}{b} \text{ where } a, b \text{ are co prime}$$

$$\text{Now } a = \sqrt{5}b$$

$$a^2 = 5b^2$$

Therefore a^2 is divisible by 5 and hence 'a' is divisible by 5 ----- 1

Now let $a = 5c$ where c is an integer

Squaring both sides

$$\begin{aligned} a^2 &= 25c^2 \\ &= 5b^2 = 25c^2 \quad (a^2 = 5b^2) \\ &= b^2 = 5c^2 \end{aligned}$$

This means that 5 divides b^2 and so 5 divides b ----- 2

From 1 and 2 it contradicts the fact that 'a' and 'b' are co-prime

Therefore $\sqrt{5}$ is irrational.

2. Prove that $3+2\sqrt{5}$ is irrational.

Answer:

Let $3+2\sqrt{5}$ is rational

∴ we can find two co prime integer a, b ($b \neq 0$) such that

$$\begin{aligned} 3+2\sqrt{5} &= \frac{a}{b} \\ = 2\sqrt{5} &= \frac{a}{b} - 3 \\ = \sqrt{5} &= \frac{1}{2} \frac{(a-3)}{b} \end{aligned}$$

As a and b are integers $\frac{1}{2} \frac{(a-3)}{b}$ will be a rational numbers and hence $\sqrt{5}$ is rational. It contradicts the fact that $\sqrt{5}$ is irrational. Hence our assumption that $3+2\sqrt{5}$ is rational is wrong. Therefore $3+2\sqrt{5}$ is irrational.

3. Prove that the following are irrational:

- i) $\frac{1}{\sqrt{2}}$ ii) $7\sqrt{5}$ iii) $6+\sqrt{2}$

Answer: $\frac{1}{\sqrt{2}}$

Let $\frac{1}{\sqrt{2}}$ is rational. So we can find 'a' and 'b' and co-prime numbers ($b \neq 0$)

Such that $\frac{1}{\sqrt{2}} = \frac{a}{b}$
 $= \sqrt{2} = \frac{b}{a}$

As b is rational ... $\sqrt{2}$ is also rational

It contradicts the fact that $\sqrt{2}$ is irrational, Thus $\frac{1}{\sqrt{2}}$ is irrational.

ii) $7\sqrt{5}$

Let $7\sqrt{5}$ is rational. that is, we can find 'a' and 'b' as co-prime numbers ($b \neq 0$) such that

$$\begin{aligned} 7\sqrt{5} &= \frac{b}{a} \\ = \sqrt{5} &= \frac{b}{a} \end{aligned}$$

As $\frac{a}{7b}$ is rational, ... $\sqrt{5}$ is rational too. It contradicts the fact that $\sqrt{5}$ is irrational.

iii) $6+\sqrt{2}$

Let $6+\sqrt{2}$ is rational

Therefore, we can find two co-prime integers a, b ($b \neq 0$)

such that

$$\begin{aligned} 6+\sqrt{2} &= \frac{b}{a} \\ = \sqrt{2} &= \frac{b}{a} - 6 \end{aligned}$$

Since a and b are integers, $\frac{b}{a} - 6$ is also rational

And hence $\sqrt{2}$ is also rational. This contradicts the fact that $\sqrt{2}$ is irrational. Therefore our assumption is wrong. Thus $6+\sqrt{2}$ is irrational.

EXERCISE 1.4

1. Without actually performing the long division, state whether the following rational numbers will have a terminating decimal expansion or a non terminating repeating decimal expansion:

- i) $\frac{13}{3125}$ ii) $\frac{17}{8}$ iii) $\frac{64}{455}$ iv) $\frac{15}{1600}$ v) $\frac{29}{343}$
 vi) $\frac{23}{2^3 5^2}$ vii) $\frac{129}{2^2 5^7 7^5}$ viii) $\frac{6}{15}$ ix) $\frac{35}{50}$ x) $\frac{77}{210}$

Answer:

i) $\frac{13}{3125} = \frac{13}{5^3}$

As denominator is of the form 5^m
 Therefore $\frac{13}{3125}$ is terminating

ii) $\frac{17}{8} = \frac{17}{2^3}$

As denominator is of the form 2^m ... $\frac{17}{8}$ is terminating.

iii) $\frac{64}{455} = \frac{64}{4 \times 7 \times 13}$

Since denominator is not in the form of 2^m or 5^m or $2^n 5^m$
 Therefore $\frac{64}{455}$ is non terminating repeating.

iv) $\frac{15}{1600} = \frac{15}{2^6 \times 5^2}$

As denominator is of form $2^m 5^n$
 Therefore $\frac{15}{1600}$ is terminating

v) $\frac{29}{343} = \frac{29}{7^3}$

As denominator is not in the form $2^m 5^n$
 Therefore $\frac{29}{343}$ is non terminating

vi) $\frac{23}{2^3 5^2}$

As denominator is of the form $2^n 5^m$
 Therefore $\frac{23}{2^3 5^2}$ is terminating

vii) $\frac{129}{2^2 5^7 7^5}$

Since denominator is not of the form $2^n 5^m$ and has 7 as its factor.

Therefore $\frac{129}{2^2 5^7 7^5}$ is non terminating repeating.

viii) $\frac{6}{15} = \frac{2 \times 3}{5 \times 3} = \frac{2}{5}$

The denominator is of form 5^n
Hence the decimal expansion $\frac{6}{15}$ is terminating

ix) $\frac{35}{50} = \frac{5 \times 7}{5 \times 5 \times 2} = \frac{7}{5 \times 2}$

The denominator is of the form $5^m 2^n$
Hence the decimal expansion of $\frac{35}{50}$ is terminating.

x) $\frac{77}{210} = \frac{7 \times 11}{7 \times 2 \times 3 \times 5} = \frac{11}{2 \times 3 \times 5}$

The denominator is not of the form $2^n 5^m$
Hence $\frac{77}{210}$ is terminating

2. Write down the decimal expansions of those rational numbers in Question 1 above which have terminating decimal expansions.

Answer:

i) $\frac{13}{3125} = \frac{13 \times 2^5}{5^5 \times 2^5} = \frac{13 \times 32}{10^5} = 0.00416$

ii) $\frac{17}{8} = \frac{17 \times 5^3}{2^3 \times 5^3} = \frac{17 \times 125}{10^3} = 2.125$

iii) $\frac{64}{455}$ = Decimal expansion is non terminating repeating.

iv) $\frac{15}{1600} = \frac{15}{2^6 \times 5^2} = \frac{15 \times 5^4}{2^6 \times 5^6} = \frac{15 \times 625}{10^6}$
 $= \frac{9375}{10^6} = 0.009375$

v) $\frac{29}{343}$ = Decimal expansion is non terminating repeating

vi) $\frac{23}{2^3 5^2} = \frac{23 \times 5}{2^3 \times 5^2} = \frac{115}{10^3} = 0.115$

vii) $\frac{129}{2^2 5^7 7^5}$ = Decimal expansion is non terminating repeating.

viii) $\frac{6}{15} = \frac{2 \times 3}{3 \times 5} \times \frac{2}{2} = \frac{4}{10} = 0.4$

ix) $\frac{35}{50} = \frac{5 \times 7}{5 \times 5 \times 2} = \frac{7}{10} = 0.7$

x) $\frac{77}{210}$ = Decimal expansion is non terminating repeating

3. The following real numbers have decimal expansions as given below. In each case decide whether they are rational or not. If they are rational, and of the form $\frac{p}{q}$ what can you say about the prime factors of q?

- i) 43.123456789 ii) 0.120120012000120000
iii) 43.123456789

Answer:

i) 43.123456789

Since this number has a terminating decimal expansion. It is a rational number of the form $\frac{p}{q}$ and q of the form $2^m \times 5^n$
Prime factors of q will be either 2 or 5 both.

ii) 0.120120012000120000

The decimal expansion is neither terminating non recurring. Therefore the given number is an irrational number.

iii) 43.123456789

Since the decimal expansion is non terminating recurring, the given number is a rational number of $\frac{p}{q}$

Form where q is not of the form $2^m \times 5^n$. i.e., prime factors of q has factors other than 2 or 5.

Extra Questions

1. HCF of 2 numbers is 97 their LCM is 1455. If one of the numbers is 485 find the other.

Answer:

We know,

HCF x LCM	=	Product of two numbers
97 x 1455	=	485 x X
= X	=	$\frac{97 \times 1455}{485}$
= X	=	291

Therefore the other number is 291.

2. Prove that product of 2 consecutive numbers (positive integers) is divisible by 2.

Answer:

Let two consecutive numbers be X and X+1

Let $X = 2q + r$, $0 < r < 2$

Therefore $X = 2q$, $2q + 1$

Product of X (X+1) = $(2q)(2q+1)$

if $X = 2q$ then it is divisible by 2

if $X = 2q + 1$

= $(2q + 1)(2q+2)$

= $2(2q+1)(q+1)$ which is divisible by 2

Product of any 2 consecutive integers is divisible by 2

Note : Product of 'n' consecutive positive integers is divisible by n! [$n! = n \times (n-1) \times (n-2) \times \dots \times 1$]
For example : $3! = 3 \times 2 \times 1 = 6$

3. Prove that if a and b are even positive integers their $a^2 + b^2$ is even and is divisible by 2

Answer:

Let $a = 2p$ $b = 2q$

$$\begin{aligned} a^2 + b^2 &= (2p)^2 + (2q)^2 = 4p^2 + 4q^2 \\ &= 4(p^2 + q^2) \\ &= 2 \times 2(p^2 + q^2) \\ &= 2m \text{ where } m \\ &= 2(p^2 + q^2) \end{aligned}$$

Therefore $a^2 + b^2$ is even and is divisible by 2.

4. Show that $\sqrt{6}$ is not a rational number.

Answer:

Let $\sqrt{6}$ be a rational number.

i.e., $\sqrt{6} = \frac{p}{q}$ where p and q are co-prime and $b \neq 0$

As $1^3 = 1$ and $2^3 = 8$

Therefore $1 < \frac{p}{q} < 2$

$\frac{p}{q}$ is an integer

Therefore no integer lies between 1 and 2

Now $6 = \frac{(p)^3}{q}$

$= 6 = \frac{p^3}{q}$

$= 6q^2 = \frac{p^3}{q}$

As q is an integer $6q^2$ is also an integer and since $q > 1$.

Thus it does not have common factor with p and consequently with p^3

So $\frac{p^3}{q}$ is a fraction different from an integer

Thus $6q^2 \neq \frac{p^3}{q}$

This contradicts the fact and hence $3\sqrt{6}$ is irrational.

5. What is the HCF and LCM of

A = $X^3 Y^5$

B = $X^2 Y^3$

Answer:

$A = X \times X \times X \times Y \times Y \times Y \times Y \times Y$

$B = X \times X \times Y \times Y \times Y$

HCF = $X^2 Y^3$

LCM = $X^3 Y^5$

6. Find the least number that is divisible by all number between 2 to 8 (both exclusive)

Answer:

We have to find the LCM

Therefore LCM (3,4,5,6,7)

Therefore The least number that is divisible by these numbers is 420.

MULTIPLE CHOICE QUESTIONS

1. Decimal expansion of $\frac{7}{80}$ will terminate after

- a. one decimal place
- b. two decimal place
- c. three decimal place
- d. four decimal place

Answer : c. three decimal place

2. Every even integer is of the form

- a. p
- b. 2p
- c. 2p + 1
- d. p+ 3

Answer : b. 2p

3. If p and q are two integers such that $p = a5b7$ and $q = a3b5$ where a and b are prime then LCM (p, q) = ?

- a. $a^3 b^5$
- b. $a^8 b^{12}$
- c. $a^5 b^7$
- d. ab

Answer : $a^5 b^7$

4. When rational number is multiplied with irrational number, the result is

- a. always irrational
- b. always rational
- c. either a or b
- d. none of these

Answer : a. always irrational

5. If the HCF of 57 and 133 is expressible in the form $133 - 57p$ then value of p is

- a. 4
- b. 3
- c. 2
- d. 1

Answer : c. 2

6. $\frac{173}{625}$

- a. terminating decimal expansion
- b. non-terminating decimal expansion
- c. non-terminating repeating decimal expansion
- d. none of these

Answer: a. terminating decimal expansion

7. $a^{2m} - b^{2n}$ is divisible by

- a. $a^m + b^n$
- b. $a^m - b^n$
- c. both a and c
- d. none of these

Answer : c. both a and c

8. What is the condition of 'q' and 'r' in Euclid's Division Algorithm?

- a. q is not unique and $r > b$, r also unique
- b. q is unique and $0 < r < b$, r not unique
- c. q is unique and $0 \leq r < b$, r not unique
- d. q is unique and $0 \leq r \leq b$, r unique

Answer : d. q is unique and $0 \leq r \leq b$, r unique

9. Any rational number can be of the form

- a. $\frac{p}{q}$, $q \neq 0$
- b. $\frac{p}{q}$, $q = 0$
- c. either a or b
- d. none of these

Answer : a. $\frac{p}{q}$, $q \neq 0$

10. HCF of 29 x 16 and 29 x 17 is

- a. 16
- b. 17
- c. 29
- d. 29 x 17

Answer : c. 29

11. What is the greatest possible time taken by Ram when he walk 22 km and 77 km at equal speeds?

- a. 22 km/hr
- b. 77 km/hr
- c. 14 km/hr
- d. 11 km/hr

Answer : d. 11 km/hr

12. The number between 4000 and 5000 divisible by each of 12, 18, 21 and 32 is

- a. 4302 b. 4032
- c. 4023 d. 4203

Answer : b. 4032

TRUE OR FALSE

1. Does every point on the number line represent a rational number.

Answer : False

2. Is $\frac{22}{7}$ a rational number?

Answer : True (rational as it recurring)

3. Is π rational number?

Answer : False (It is non terminating, non repeating)

4. $6 + 3\sqrt{5}$ is irrational

Answer : True (as $\sqrt{5}$ is irrational)

5. The prime factorisation of a natural number is unique, except for the order of its factors.

Answer : True

6. HCF (a, b) where a and b are prime is ab.

Answer : False

7. Irrational number can't be written as $\frac{p}{q}$ form $q \neq 0$

Answer : True

8. The product and quotient of a non zero rational and irrational number is irrational.

Answer : True

9. $\frac{23}{400}$ will terminate after 2 decimal places

Answer : False

FILL IN THE BLANKS

1. is a technique used to calculate HCF of two given positive integers.

Answer : Euclid's Division Algorithm

2. Every composite number can be expressed as

Answer : Product of prime

3. HCF (16, 20) = of each common prime factor in the number.

Answer : Product of smallest number

4. LCM (46, 120) = of each prime factor involved in the number.

Answer : Product of greatest number

5. HCF x = Product of numbers.

Answer : LCM

6. The product of rational and irrational number is always

Answer : Irrational

7. Any rational number of the form $\frac{p}{q}$ where q is of the form $2^n 5^m$ has?

Answer : Decimal expansion

8. Every irrational number is of the form.....

Answer : Non terminating and non repeating decimal

EXTRA QUESTION

1. Assertion : If HCF = 9 and the numbers are 18 and 27, then LCM = 54

Reason : HCF x LCF = Product of the numbers

- a. Both assertion and reason are true and reason is the correct explanation of assertion.
- b. Both assertion and reason are true and reason is not the correct explanation of assertion.
- c. Assertion is true and reason is false.
- d. Assertion is false and reason is true.

Answer : Option (a) is correct

$$\begin{aligned} \text{HCF} \times \text{LCM} &= \text{Product of the numbers.} \\ 9 \times 54 &= 18 \times 27 \end{aligned}$$

Q 2.

Statement 1 - Euclid's Division Lemma states that given any positive integers 'a' and 'b' there exist unique 'q' and 'r'.

Statement 2 - $a = bq + r, 0 \leq r < b$

- a. Statement 1 is true and statement 2 is false
- b. Statement 1 is false and statement 2 is true
- c. Statement 1 and 2 are true
- d. Both statement 1 and 2 are false.

Answer : c. Statement 1 and 2 are true

Q 3.

Statement 1 - Every composite number can be expressed as product of primes. This factorisation is unique apart from the order in which prime factors occur.

Statement 2 - This is known as fundamental theorem of arithmetic.

- a. Statement 1 is true, statement 2 is false.
- b. Statement 1 is false, statement 2 is true.
- c. Both statement 1 and statement 2 are true.
- d. Both statement 1 and statment 2 are false.

Answer : c. Both statement 1 and statement 2 are true.

Q4.

Statement 1 - Let $x = \frac{p}{q}$ be rational number where q is of the form $2^n 5^m$ where n and m are integers (non-negative).

Statement 2 - x has decimal expansion which is non terminating (non-recurring)

- a. Statement 1 is true, statement 2 is false.
- b. Statement 1 is false, statement 2 is true.
- c. Both statement 1 and statement 2 are true.
- d. Both statement 1 and statement 2 are false.

Answer : a. Statement 1 is true, statement 2 is false.

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February 01, 2020

MOHAMMED ALLAWI

One of the former communication ministers of Iraq, Mr. Mohammed Allawi was appointed as the Prime Minister of the country. Allawi has been appointed the Prime Minister of the Country amidst long protests that has so far killed 600 in the country.



March 30, 2020

NASA ANNOUNCES SUNRISE MISSION

NASA announced Sun Radio Interferometer Space Experiment (SunRISE) mission. The mission is to study about how sun creates Giant Solar Particle Storms. The SunRISE mission will provide information on how the Sun's radiation affects the space environment and to understand the working of the solar system. The study will also aid future astronauts mission.



February 25, 2020

MOHAMMED HOSNI MUBARAK

The Egypt ruler Mohammed Hosni Mubarak died at the age of 91. He served as the President of Egypt between 1981 to 2011.



March 30, 2020

RAJASTHAN STATEHOOD DAY

Rajasthan celebrates its Statehood Day on March 30 every year.

Popularly known as "Land of the Kings", the day is also called "Rajasthan Day". This year, the state was silent due to the lock down in the country. Usually there were radiant and invigorating events held all across



March 21, 2020

SATYARUP SIDDHANTA

The Indian Mountaineer Satyarup Siddhanta has entered 'Limca Book of Records'. He has set the record of becoming the first Indian to climb the highest volcano in the world. He already holds Guinness Book of World Records, India Book of Records, Asia Book of Records, British Book of records and Champion Book of Records.



March 28, 2020

EARTH HOUR

Since 2007, every year millions of people participate in the campaign called "Earth Hour" in March. This year, it was celebrated on 28 March 2020. It is a symbolic movement of "Lights OFF" to save the environment. The event is organized by the World wide Fund. The event was first started in Sydney, Australia. The aim of marking Earth Hour is to give attention towards global warming, climate change and loss of biodiversity. During the one-hour campaign, all over the world switch off lights and electronic items between 8:30 PM to 9:30 PM. The Earth Hour is held every year on the last Saturday of March.



April 7, 2020

WORLD HEALTH DAY

April 7 is marked as the World Health Day every year. The day is marked to celebrate the work of midwives and nurses for their role in keeping the world safety and healthy. This year, 2020, has celebrated as International Year of Nurses and Midwives. The World Health Day is marked by World Health Organization along with several other organizations. The theme of the World Health Day is selected by WHO. Theme of 2020: Support Nurses and Midwives.



March 29, 2020

AIR VICE MARSHALL CHANDAN SINGH RATHORE

The Mahavir Chakra recipient Air Vice Marshall Chandan Singh Rathore died at his Jodhpur residence. His services during 1962 war and 1971 war were impeccable. He was honored with Mahavir Chakra for the same.



APRIL 9, 2020

INDIAN RAILWAY AGAINST COVID 19

Apart from converting its coaches into hospital beds, the Indian Railways has also launched isolation wards. Around 3,250 coaches have been converted into isolation wards. It has recruited 2,500 temporary doctors and 35,000 paramedic staffs. Around 5,000 beds have been identified for treatment in railway hospitals.

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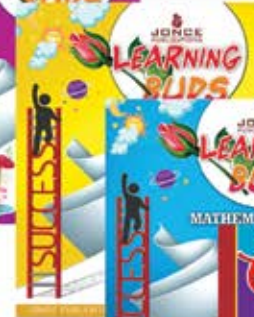
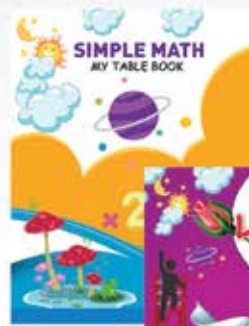
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