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General InstructionsScience and Ability

- Section - I
- Question #05
1. Give numbering to headings.
  2. Do not write lengthy paragraphs. Write medium sized paragraphs with headings.
  3. Do not use table for comparison and contrast questions.
  4. Draw figures/diagram/flowchart where needed.

Human Ear - Structure & Functions

- (a)
- Functions:
5. Start new question from fresh page.
  6. Write unit of the answer in ability section.
  7. Explain mathematical steps and the reasoning for better score.
  8. Change colour scheme for references to give them more visibility.
  9. Manage time well.
  10. Wide page borders are discouraged.

Human ear is one of the sensory organs of human body. It is responsible for hearing. Human ear performs two primary functions:

- (i) Human ear is responsible for sensing auditory information and transmit it to brain.
- (ii) Human ear is also responsible for maintaining the balance of human body as it contains a fluid in inner part which specifically performs it.

Structure:

Human ear can be divided into three parts;

- i) Outer ear
- ii) Middle ear
- iii) Inner ear

i) Outer Ear:

It is the outermost part of human ear. It



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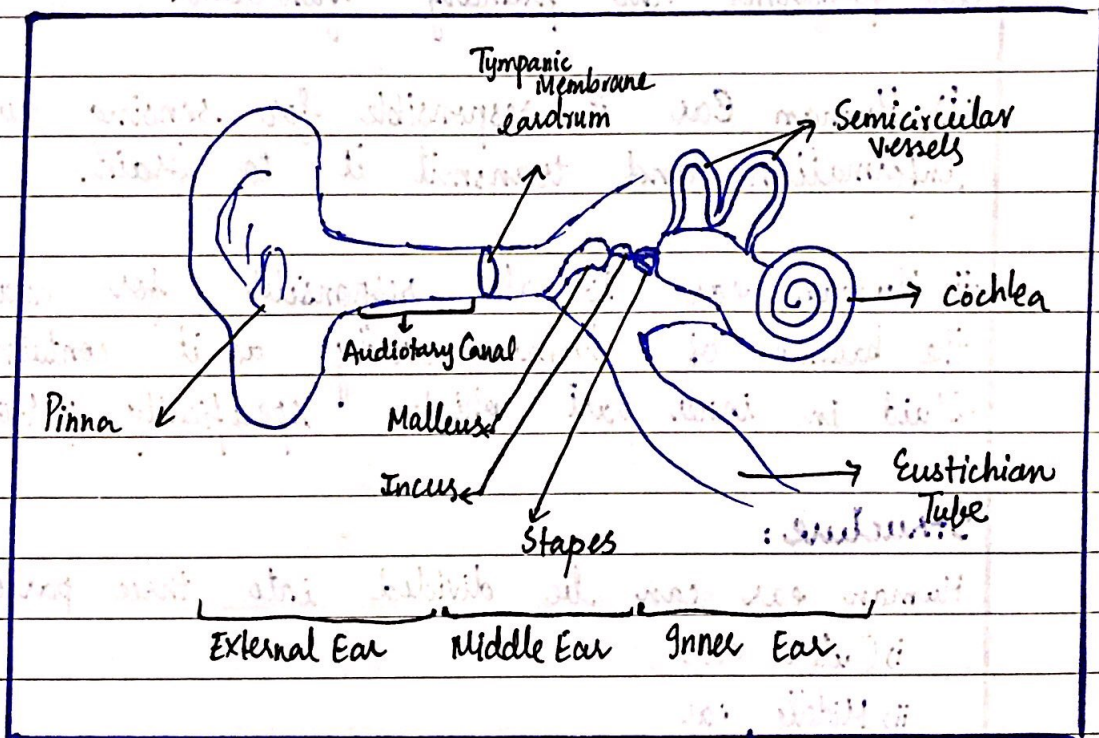
is constituted of auditory canal and tympanic membrane. When sound waves enter the auditory canal, they strike the tympanic membrane which passes them to middle ear in the form of vibration.

### ii) Middle Ear:

Middle ear contains three ossicles which are small bones. These three are hammer, stirrup and anvil. The smallest bone in human body is stirrup (stapes). Middle ear is tympanic cavity.

### iii) Inner Ear:

Inner ear contains semicircular vessels and cochlea. The cochlea is a spiral shaped structure containing fluid that balances human body.



## Structure of Ear

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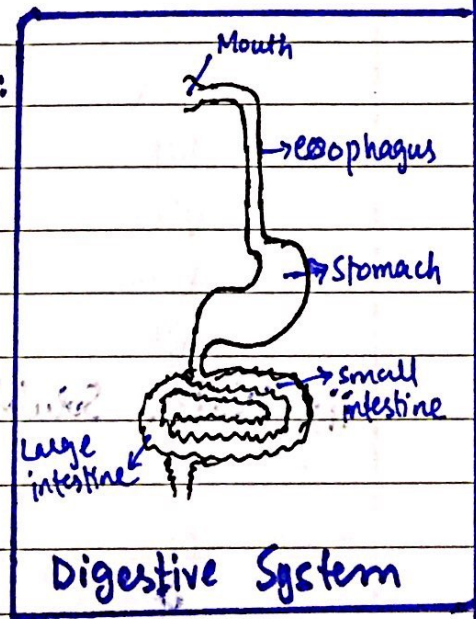
# (b) Digestive System

Human body properly functions due to various organ systems. One of them is digestive system. It is very significant for the survival of human body as it digests the food. Digestive system is a system which is responsible for the breakdown and digestion of food and absorptions of nutrients from food. Stomach is the main organ of digestive system along with small and large intestine. The process of digestion takes place in mouth (mechanical digestion via mastication) and stomach (chemical digestion via acids). The process of absorption of nutrients takes place in intestine.

## • Role of Small Intestine:

Food being digested in small stomach is transported to small intestine. In small intestine, the absorption of minerals and salts is done.

Some amount of required water is absorbed here too. Then the food is passed to large intestine.





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# Vitamins

Vitamins are one of the primary nutrients required for human body. Vitamins are essential nutrients (that are not produced in human body) and they are provided to human body through balanced diet. There are 13 vitamins found in human body.

## Classification of Vitamins:

Vitamins can be categorized, on the basis of their solubility, into two groups:

- (i) Fat Soluble Vitamins
- (ii) Water Soluble Vitamins

### i) Fat Soluble Vitamins:

They are the vitamins that require fat to be absorbed in human body. There are 4 fat soluble vitamins in human body. They are:

Vitamin A (Retinol)

Vitamin D (Calciferol)

Vitamin E (Tocopherol)

Vitamin K (Mandain)

### ii) Water Soluble Vitamins:

Water soluble vitamins are easily excreted from body if excessive amount is in body. There are 9 in number with 8 various forms of vitamin B and Vitamin C. They are as following:

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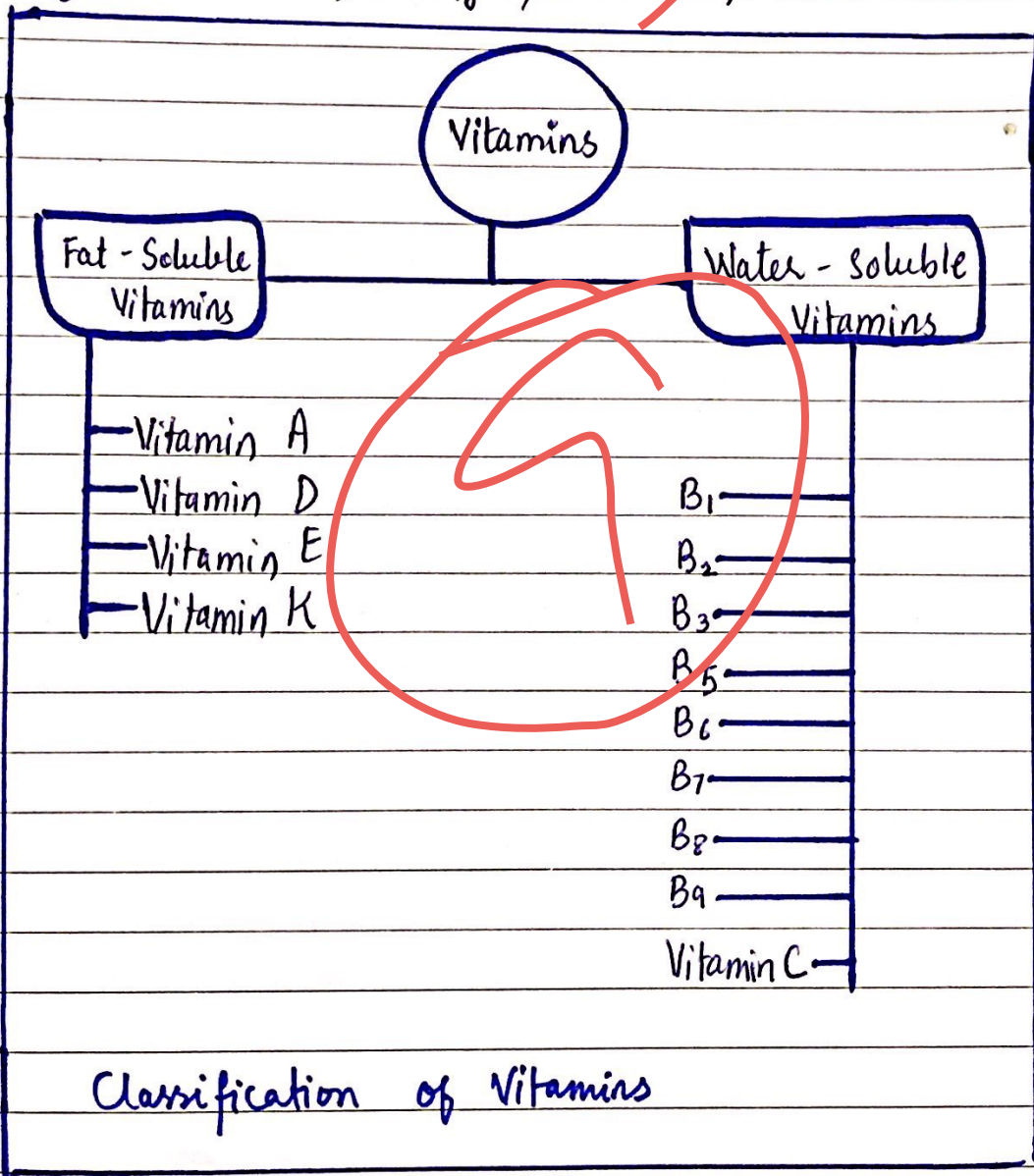
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B<sub>1</sub> (Thiamine), B<sub>2</sub> (Riboflavin), B<sub>3</sub> (Nicotinic Acid), B<sub>5</sub> (Pantothelic Acid), B<sub>6</sub> (Periyodine), B<sub>7</sub> (Biotin), B<sub>8</sub> (Folic Acid, Vitamin M) and Vitamin C (ascorbic acid).

### Diseases:

The imbalance in ~~vitamins~~ intakes lead to various diseases cause by ~~deficiency~~ or excess of various vitamins. These ~~diseases~~ include night blindness, scurvy, beriberi, rickets etc





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## Question # 02

single and interventions (a) (b) (c) (d) (e) (f) (g) (h) (i) (j) (k) (l) (m) (n) (o) (p) (q) (r) (s) (t) (u) (v) (w) (x) (y) (z)

### Role of Nutrition in Human Treatment

The doctor of future will no longer treat humans with drugs but rather will cure and prevent diseases with nutrition. It is obvious that intake of balanced diet and exercise enables a person to live a healthy life. The doctors in future will avoid drugs to treat humans due to the side effects of drugs. Various medicines cure one disease but adversely affect the other body organs.

Another reason for turning towards prevention and precautions is that treating a patient by means of nutritious diet has no side effects and is helpful in long term better functioning of human body.



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# (b) Composting Incineration Pyrolysis

Solid waste management is done with various methods. Open dumping, composting, incineration, pyrolysis and landfilling are some of them.

## Composting:

It is the process of decomposing organic wastes by use of various decomposing organisms and elements. In composting, organic waste is decomposed by using microbes. The end result is often compost which is used as a fertilizer. Composting is done in a controlled environment.

## Incineration:

Incineration is the combustion of waste in the presence of oxygen. The waste is added into reactors and burnt over there.

Output?

Cost?

Energy?

Carbon efficiency?

Input materials?

## Pyrolysis:

It is also the process of burning the waste. This process is carried out in the absence of oxygen.

Overall, these all processes are very useful methods for solid waste management.

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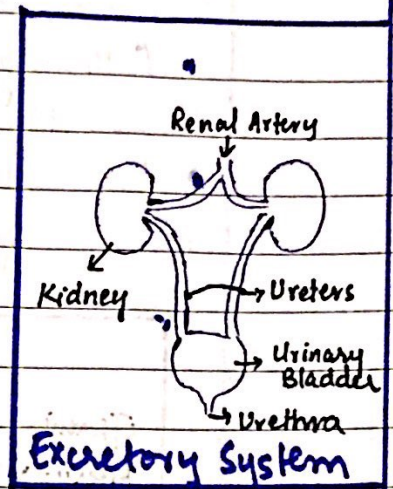
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# (C) Kidney and Urine Formation

Excretory system, in human body, is responsible for the removal of wastes from human body. The process of urine formation primarily takes place in human kidneys.

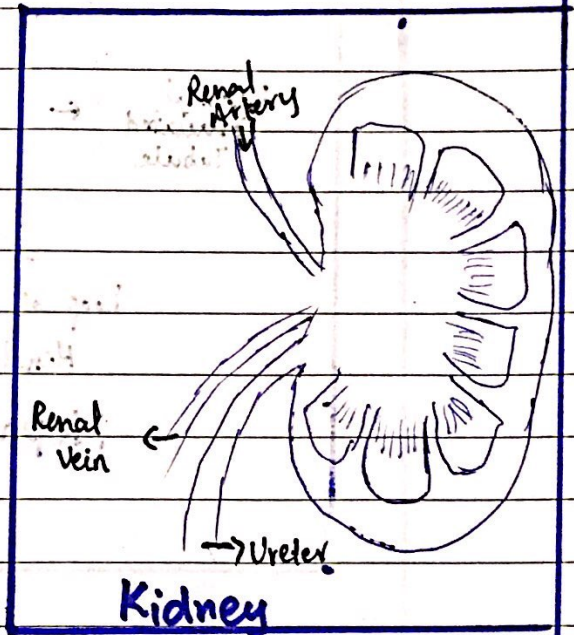
Kidneys contains 7-18 lobes in them. In each lobe, there are millions of nephrons where the process of filtering blood and forming urine takes place.



## Nephron:

It is the basic structural and functional unit of kidneys. The blood enters the kidney through renal artery and it enters nephrons.

- Unfiltered blood enters nephron from afferent artery.
- This blood is taken to glomerulus that is placed in Bowman's capsule.
- The process of blood filtration occurs here.
- The filtered blood is sent back via efferent artery.



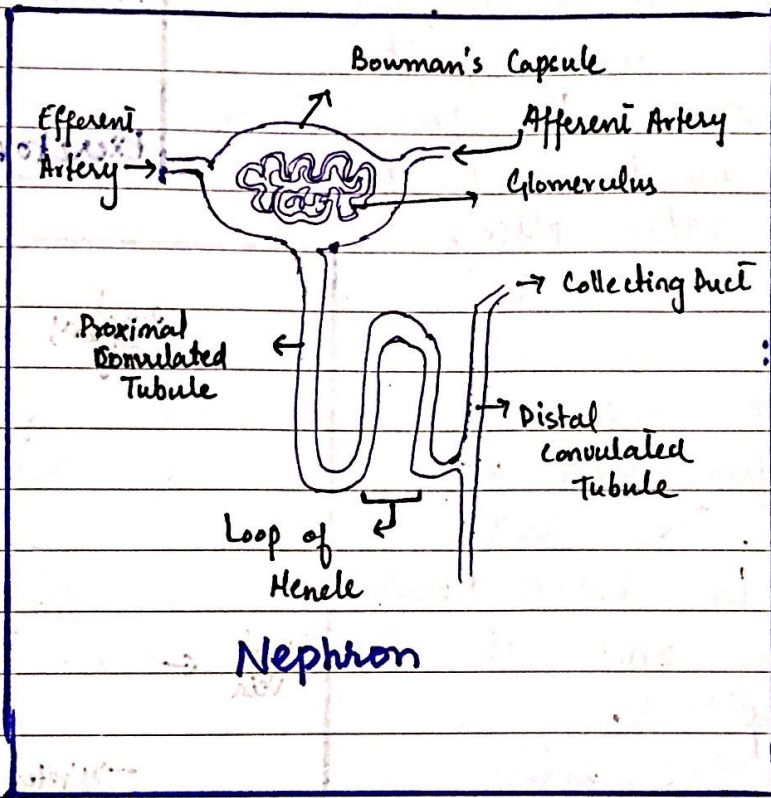


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Avoid bullets. Write paragraphs with headings.

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- The filtrate is sent to proximal convoluted tubule, loop of henle and distal convoluted tubule for further absorption of any useful element present in filtrate.
- The filtrate, that is urine, is transferred to collecting duct.
- Collecting duct transfers urine to ureter which sends it to urinary bladder.
- In this way, the main process of urine formation takes place in kidney.





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## Section II

### Question #07

Part (a)

• **Given Data:**

Price of shirt raised by = 20%

Price on tag = Rs. 80

• **To Find:**

Original Price of shirt = ?

• **Solution:**

Let the price of shirt =  $x$

$$x = \text{Rs. } 80 - (20\% \text{ of Rs. } 80) \rightarrow \text{eq. (1)}$$

$$20\% \text{ of Rs. } 80 = \frac{20}{100} (80)$$

$$= \frac{1}{5} \times 80$$

$$= \text{Rs. } 16$$

$$x = 80 - 16$$

$$x = \text{Rs. } 64 = \text{original price of shirt}$$

$$\text{Price of shirt in sale of } 20\% = 64 - (20\% \text{ of } 64)$$

$$= 64 - \left( \frac{20}{100} \times 64 \right)$$

$$= 64 - 12.4$$

$$= \text{Rs. } 51.8$$



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### Part (b)

#### Given Data:

In a certain code, BROTHER is written = QDGSNQA

#### To Find:

Code for word SISTER = ?

#### Solution:

Reverse reading of BROTHER forms

QDGSNQA by reading each alphabet

1 step backward. So, by that code,

the word SISTER can be

written as QDSRHR

Rough Work

A B C D  
E F G H  
I J K L  
M N O P  
Q R S T  
U V W X  
Y Z

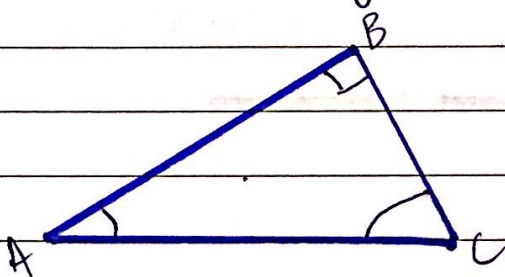
S I S T E R  
↑ ↑ ↑ ↑ ↑  
Q D S R H R

### Part (c)

Define and Draw:

#### i) Scalene Triangle:

A triangle that has no equal angle and no equal side is called scalene triangle.



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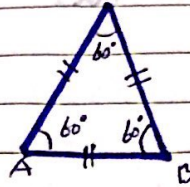


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### ii) Equilateral Triangle:

An equilateral triangle has all three angles and all three sides equal.

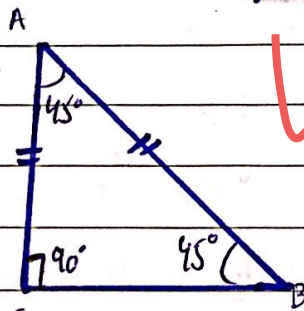


### iii) Isosceles and Right Triangle at the same time:

An isosceles triangle has two equal sides and two equal angles. A right angle triangle has at least one angle of  $90^\circ$ . A triangle which is isosceles as well as right angle triangle at the same time has two angles of  $45^\circ$  and one of  $90^\circ$ .

So that;

$$\begin{aligned} \text{Sum of all angles of } \triangle &= 180^\circ \\ 90^\circ + 45^\circ + 45^\circ &= 180^\circ \\ 180^\circ &= 180^\circ \end{aligned}$$





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# Question # 08

## Part (a)

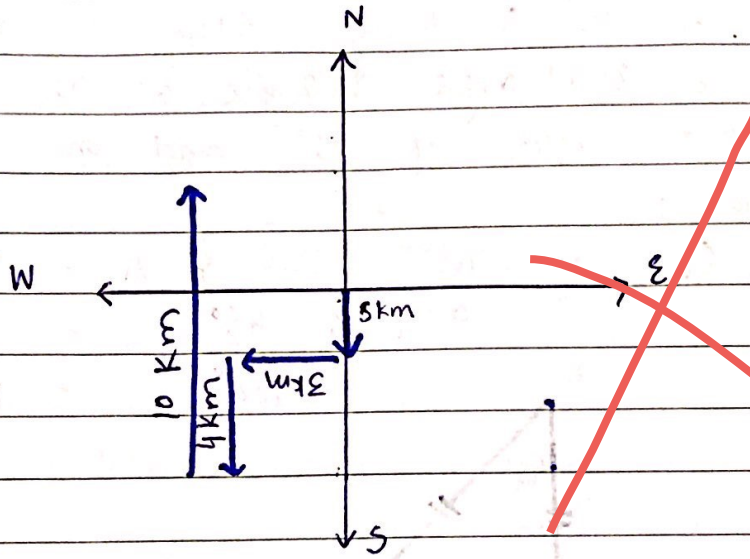
• **Given Data:**

- Man walks towards south = 5 Km
- walks after turning right = 3 Km
- walks after turning left = 4 Km
- goes back straight = 10 Km

• **To Find:**

- Direction from starting point = ?
- Distance from starting point = ?

• **Solution:**



Distance from starting point =  $5 + 3 + 4 + 10$   
 $= 22 \text{ km}$

Direction from starting point = North wards.



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### Part (b)

• Data Given:

1<sup>st</sup> five prime numbers

• To Find:

Arithmetic Mean of cubes of 1<sup>st</sup> five prime numbers = ?

• Solution:

1<sup>st</sup> 5 Prime Numbers = 1, 3, 5, 7, 11

Cubes of 1<sup>st</sup> 5 Prime numbers:

$$(1)^3 = 1$$

$$(3)^3 = 27$$

$$(5)^3 = 125$$

$$(7)^3 = 343$$

$$(11)^3 = 1331$$

$$\text{Arithmetic Mean} = \frac{\text{Sum of observations}}{\text{Number of observations}}$$

$$\text{Arithmetic Mean of first 5 prime numbers} = \frac{1 + 27 + 125 + 343 + 1331}{5}$$

$$= \frac{607}{5}$$

$$\text{Arithmetic mean of cubes of 1<sup>st</sup> five prime numbers} = \boxed{321.4}$$

Rough Work

$$\frac{49}{7 \times 7}$$

$$\frac{49}{7}$$

$$\frac{49}{7} = 7$$

$$\frac{11 \times 11}{11}$$

$$\frac{11}{11}$$

$$\frac{11 \times 11}{11}$$

$$\frac{11 \times 11}{11}$$

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### Part (c)

#### • Given Data:

No. of men = 50

Construction they did = 20 Km road

No. of Days = 40

#### • To Find :

How long will 70 men take to make same road?

#### • Solution:

By Using Arrow method:

No. of Men	Length of Road	No. of Days
50 ↓	20 Km ↑	↑ 40
70 ↓	20 Km ↑	↑ x

Let no. of days = x

$$\frac{x}{40} = \frac{50}{70} \times \frac{50}{20}$$

$$\frac{x}{40} = \frac{50 \times 50}{70 \times 20}$$

$$x = \frac{5 \times 40}{7}$$

$$x = \frac{200}{7}$$

$$x = 28.57 \text{ Days}$$



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### Part (d)

• **Given Data:**

Zahid's Total Property <sup>worth</sup> = 1750,000

Family Debt = 150,000

• **To Find:**

Share of son and daughter if son's share is double than daughter's share

• **Solution:**

$$\text{Amount left after paying debt} = \frac{\text{Total Amount} - \text{Debt}}$$

$$= \text{Rs } 1750,000 - 150,000$$

$$\text{Amount to be distributed after debt payment} = \text{Rs } 1600,000$$

$$\text{Share of son} : \text{Daughter's share} \\ 2 : 1$$

$$\text{No. of parts} = 2 + 1$$

$$= 3 \text{ parts}$$

$$\text{Son's Share} = \frac{\text{ratio}}{\text{Total parts}} \times (\text{Total Amount})$$

$$= \frac{2}{3} (1600,000)$$

$$= \frac{3200,000}{3}$$

$$\text{Son's share} = 1066666.6$$

Rough Work

1750,000

150,000

1600,000

answer

1600000

1066666.6

3200000

36 20  
- 18  
20  
- 18  
20  
18



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$$\text{Daughter's share} = \frac{1}{3} (1600,000)$$

$$= \frac{1600,000}{3}$$

$$\text{Daughter's share} = 533333.3$$

So,

$$\text{Son's share} = \text{Rs } 1066666.6$$

$$\text{Daughter's share} = \text{Rs } 533333.3$$

53  
3/1600000  
1500000  
10  
- 90  
10  
539289  
539999

5333  
5