Mathematics - 8
(Part–II)

1. Fraction In Disguise

Work it Out—1

1. (a) $\frac{3}{4} = \frac{3}{4} \times 100\%$

$= 0.75 \times 100\%$

So, $\frac{3}{4} = 75\%$.

(b) $\frac{9}{20} = \frac{(9 \times 5)}{(20 \times 5)} = \frac{45}{100}$

So, $\frac{9}{20} = 45\%$.

(c) $\frac{11}{25} = \frac{(11 \times 4)}{(25 \times 4)} = \frac{44}{100}$

So, $\frac{11}{25} = 44\%$.

(d) $\frac{1}{8} = \left(\frac{1}{8}\right)\times 100\% = \frac{100}{8} = 12.5\%$

So, $\frac{1}{8} = 12.5\%$.

2. Total chocolates = 50,
Dark chocolates = 18

Fraction of dark chocolates = $\frac{18}{50}$

$= \left(\frac{18}{50}\right)\times 100\% = \frac{1800}{50} = 36\%$

So, 36% of the chocolates are dark chocolates.

3. $45\% = \frac{45}{100}$

Simplify by dividing numerator and denominator by HCF (5) :

$= \frac{9}{20}$

So, $45\% = \frac{9}{20}$.

Work it Out—2

1. $25\% = \frac{25}{100}$

Simplify by dividing by 25:

$= \frac{1}{4}$

So, 25% air volume = $\frac{1}{4}$.

2. $71\% = \frac{71}{100}$

71 and 100 have no common factor other than 1.

So, $71\% = \frac{71}{100}$.

3. $15\% = \frac{15}{100}$

Simplify by dividing by HCF (5):

$= \frac{3}{20}$

So, 15% skin weight = $\frac{3}{20}$.

Work it Out—3

1. Case A – Simple Interest:

Principal P = Rs 10,000, Rate R = 10%, Time n = 2 years

Simple Interest = P × R × n = 10,000 × 0.10 × 2 = Rs 2,000

Amount = 10,000 + 2,000 = Rs 12,000

Case B – Compound Interest:

Amount = $P\times\left(1+\frac{R}{100}\right)^n$

$= 1000\times\left(1+\frac{10}{100}\right)^2$

$= 10{,}000 \times (1.1)^2$

$= 10{,}000 \times 1.21$

= Rs 12,100

Extra money in Case B = 12,100 – 12,000 = Rs 100

So, you get Rs 100 more in Case B.

2. Initial count = 40,000, Rate = 5% per hour, Time = 2 hours

Count after 2 hours = $40{,}000\times\left(1+\frac{5}{100}\right)^2$

$= 40{,}000 \times (1.05)^2$

$= 40{,}000 \times 1.1025$

= 44,100 algae cells

So, the algae count after 2 hours will be 44,100.

Connect and Reflect

A. Multiple Choice Questions

1. (c) **2.** (a) **3.** (b) **4.** (d) **5.** (b)

B. Fill in the Blanks

1. $\frac{3}{4}$ **2.** 90 **3.** No **4.** 30 **5.** 1.5

C. State True or False

1. True **2.** False **3.** True **4.** True **5.** False

D. Subjective Question

1. 35% means 35 out of every 100 parts. It equals the fraction $\frac{35}{100} = \frac{7}{20}$.

2. $\left(\frac{3}{5}\right)\times 100 = 60\%$

So, $\frac{3}{5} = 60\%$.

3. $72\% = \frac{72}{100}$

HCF of 72 and 100 = 4

$= \frac{18}{25}$

So, $72\% = \frac{18}{25}$.

4. $\left(\frac{25}{100}\right)\times 160 = 40$

So, 25% of 160 = 40.

5. $\left(\frac{45}{60}\right)\times 100 = 75\%$

So, the student scored 75%.

6. Percentages greater than 100 indicate a value that exceeds the original or reference quantity. For example, 150% means 1.5 times the original value.

7. Let total distance = x km

40% of x = 80

$\left(\frac{40}{100}\right)\times x = 80$

$x = 80 \times \frac{100}{40} = 200$ km

So, the total distance is 200 km.

8. Profit = 20% of 500

$= \left(\frac{20}{100}\right)\times 500 =$ Rs 100

SP = CP + Profit = 500 + 100 = Rs 600

So, the selling price is Rs 600.

9. Discount = 25% of 800

$= \left(\frac{25}{100}\right)\times 800 =$ Rs 200

SP = MP – Discount

= 800 – 200 = Rs 600

So, the selling price is Rs 600.

10. Increase = 50 – 40 = Rs 10

Percentage increase $= \left(\frac{10}{40}\right)\times 100 = 25\%$

So, the price increased by 25%.

11. Loss = CP – SP = 400 – 360 = Rs 40

Loss% $= \left(\frac{40}{400}\right)\times 100 = 10\%$

So, the loss percentage is 10%.

12. Percentage of a quantity

$= \left(\frac{\text{Givenpercent}}{100}\right)\times \text{Quantity}$

13. $\left(\frac{150}{100}\right)\times 80 = 1.5 \times 80 = 120$

So, 150% of 80 = 120.

14. Fractions, decimals, and percentages are different ways of representing the same value.

Example: $\frac{3}{4}$ = 0.75 = 75%. They can be converted into each other.

15. The multiplier $= 1 - \frac{10}{100} = 1 - 0.10$

= 0.9

So, the multiplier is 0.9.

NCERT EXERCISE

Figure It Out Questions

Page 3-4

1. (i) $\frac{3}{5} = \left(\frac{3}{5}\right)\times 100 = 60\%$

(ii) $\frac{7}{14} = \frac{1}{2} = \left(\frac{1}{2}\right)\times 100 = 50\%$

(iii) $\frac{9}{20} = \left(\frac{9}{20}\right)\times 100 = 45\%$

(iv) $\frac{72}{150} = \left(\frac{72}{150}\right)\times 100 = \frac{7200}{150} = 48\%$

(v) $\frac{1}{3} = \left(\frac{1}{3}\right)\times 100 = 33.33\%$ (approximately)

(vi) $\frac{5}{11} = \left(\frac{5}{11}\right)\times 100 = \frac{500}{11}$

= 45.45% (approximately)

2. Fraction of white = $\frac{15}{25} = \frac{3}{5}$

Percentage = $\left(\frac{3}{5}\right)\times 100 = 60\%$

So, answer is (iv) 60%.

3. $\left(\frac{15}{80}\right)\times 100 = \frac{1500}{80} = 18.75\%$

So, 18.75% of students come by walking.

4. Match the positions to percentages completed (A, B, C, D on a race track):

Based on positions shown in the figure:

A → 38%, B → 55%, C → 72%, D → 93%.

5. Pairs of quantities – identify symbols without calculation.

(i) 50% > 5%

(ii) $\frac{5}{10} = \frac{1}{2} = \frac{50}{100}$

(iii) $\frac{3}{11} \approx 27.3\%$, which is less than 61%

So, $\frac{3}{11} < 61\%$.

(iv) $\frac{1}{3} \approx 33.3\%$, which is greater than 30%

So, $30\% < \frac{1}{3}$.

Page-12, 13 and 14

1. (ii) The bar has 10 total segments and a total value of 90.

The percentage of one segment is found by the formula Percentage = 100% ÷ Total segments, which gives 100% ÷ 10 = 10%.

The value of each segment is 90 ÷ 10 = 9.

The arrow covers 3 segments, so the value is 3 × 9 = 27.

So, the missing percentage is 10% and the missing value is 27.

(iii) The bar has 4 total segments and a total value of 140.

The percentage of one segment is found by the formula Percentage = 100% ÷ Total segments, which gives 100% ÷ 4 = 25%.

The value of each segment is 140 ÷ 4 = 35.

The arrow covers 3 segments, so the value is 3 × 35 = 105.

So, the missing percentage is 25% and the missing value is 105.

2. (i) $\left(\frac{25}{100}\right)\times 160 = 40$

(ii) $\left(\frac{16}{100}\right)\times 250 = 40$

(iii) $\left(\frac{62}{100}\right)\times 360 = 223.2$

(iv) $\left(\frac{140}{100}\right)\times 40 = 1.4 \times 40 = 56$

(v) $\left(\frac{1}{100}\right)\times 60 = 0.6$ minutes = 36 seconds

(vi) $\left(\frac{7}{100}\right)\times 10 = 0.7$ kg = 700 g

3. Red paint = $\frac{3}{4}$ of 60 ml = 45 ml

So, Surya used 45 ml of red paint.

4. (i) Since 510 < 515, 50% of 510 < 50% of 515.

(ii) Since 37% < 73%, 37% of 148 < 73% of 148.

(iii) 29% of 43 = 0.29 × 43 ≈ 12.47

92% of 110 = 0.92 × 110 = 101.2

So, 29% of 43 < 92% of 110.

(iv) 30% of 40 = 12; 40% of 50 = 20

So, 30% of 40 < 40% of 50.

(v) 45% of 200 = 90; 10% of 490 = 49

So, 45% of 200 > 10% of 490.

(vi) 30% of 80 = 24; 24% of 64 = 15.36

So, 30% of 80 > 24% of 64.

5. (i) If 30% of k = 70, then $k = 70 \times \frac{100}{30} =$ 233.33

60% of $k = 2 \times 70 = 140$

90% of $k = 3 \times 70 = 210$

120% of $k = 4 \times 70 = 280$

(ii) 10% of m = $\frac{215}{10} = 21.5$

1% of m = $\frac{215}{100} = 2.15$

6% of m = $6 \times 2.15 = 12.9$

(iii) If 90% of $n = 270$, then $n = 270 \times \frac{100}{90}$

$= 300$

9% of $n = \frac{270}{10} = 27$

18% of $n = 2 \times 27 = 54$

100% of $n = 300$

(iv) Do yourself

6. (i) $\left(\frac{3}{300}\right)\times 100 = 1\%$

(ii) $\left(\frac{40}{100}\right)\times 4 = 1.6$

(iii) Let x be the number. 80% of $x = 40$

$x = 40 \times \frac{100}{80} = 50$

So, 40 is 80% of 50.

7. 10% of a day = 10% of 24 hours = $0.1 \times 24 = 2.4$ hours

1% of a week = 1% of 7×24 = 1% of 168 hours = 1.68 hours

Since 2.4 hours > 1.68 hours, yes, 10% of a day is longer than 1% of a week.

8. Mariam's farm and the bull eating fodder. The bull eats 1 unit less than given each day.

Day 1: Given 2, ate 1 → fraction eaten = $\frac{1}{2}$ = 50%

Day 2: Given 3, ate 2 → fraction eaten = $\frac{2}{3}$ ≈ 66.67%

Day 3: Given 4, ate 3 → fraction eaten = $\frac{3}{4}$ = 75%

Day 99: Given 100, ate 99 → fraction eaten = $\frac{99}{100}$ = 99%

So, each day the fraction eaten increases progressively.

9. If 20% takes 18 days, then 100% takes:

$= \left(\frac{18}{20}\right)\times 100 = 90$ days

So, it will take 90 days to complete the entire picking.

The assumption necessary: The rate of work remains constant throughout.

10. The badminton coach planned the ratio of warm-up : play : cool-down = 10% : 80% : 10% for 90 minutes.

Warm-up = 10% of 90 = 9 minutes

Play = 80% of 90 = 72 minutes

Cool-down = 10% of 90 = 9 minutes

So, warm-up = 9 min, play = 72 min, cool-down = 9 min.

11. 90% of the world's population lives in the Northern Hemisphere. World population in current year ≈ 8.2 billion (2025).

People in Northern Hemisphere = 90% of 8.2 billion = $0.9 \times 8.2 = 7.38$ billion (approximately).

So, approximately 7.38 billion people live in the Northern Hemisphere.

12. A recipe for halwa for 4 people: Rava 40%, Sugar 40%, Ghee 20%. Total weight = 2 kg.

(i) For 8 people (double the recipe), the proportion of each ingredient remains the same: Samalina 40%, Sugar 40%, Ghee 20%.

(ii) Total weight = 2 kg = 2000 g

Samalina = 40% of 2000 = 800 g

Sugar = 40% of 2000 = 800 g

Ghee = 20% of 2000 = 400 g

So, Samalina = 800 g, Sugar = 800 g, Ghee = 400 g.

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1. Profit = 110 – 75 = Rs 35

Profit margin = $\left(\frac{35}{75}\right)\times 100 = 46.67\%$

So, the profit margin is approximately 46.67%.

2. Profit = 50% of 475 = $\left(\frac{50}{100}\right)\times 475$ = Rs 237.50

Selling price = CP + Profit = 475 + 237.50 = Rs 712.50

So, the chair should be sold for Rs 712.50.

3. Profit = 25% of 2.5 crore = 0.25 × 2.5 = 0.625 crore

Expenditure = Revenue – Profit = 2.5 – 0.625 = Rs 1.875 crore

So, the total expenditure was Rs 1.875 crore.

4. Discount = 25% of 300 = Rs 75

Amount to pay = 300 – 75 = Rs 225

So, Anwar will pay Rs 225.

5. Increase = 100 – 60 = Rs 40

Percentage increase = $\left(\frac{40}{60}\right)\times 100 = 66.67\%$

So, answer is (iv) 66.66%.

6. SP = MP × $\frac{(100-15)}{100}$

4,40,000 = MP × $\frac{85}{100}$

MP = 4,40,000 × $\frac{100}{85}$ = Rs 5,17,647 (approximately)

So, the original price was approximately Rs 5,17,647.

7. $\left(\frac{500}{1600}\right)\times 100 = 31.25\%$

So, the winner got 31.25% of the total votes.

The minimum number of candidates would be 2 (one winner and at least one other).

8. Increase = 42 – 38 = Rs 4

Rate of inflation = $\left(\frac{4}{38}\right)\times 100 \approx 10.53\%$

So, the rate of inflation is approximately 10.53%.

9. Let the number = x

x + 20% of x = 90

$x \times (1.2) = 90$

$x = \frac{90}{1.2} = 75$

So, the number is 75.

10. For the first buffalo (5% profit):

SP = 80,000, Profit = 5%

CP = 80,000 × $\frac{100}{105}$ = Rs 76,190.48

For the second buffalo (10% loss):

SP = 80,000, Loss = 10%

CP = 80,000 × $\frac{100}{90}$ = Rs 88,888.89

Total CP = 76,190.48 + 88,888.89 = Rs 1,65,079.37

Total SP = 80,000 + 80,000 = Rs 1,60,000

Loss = CP – SP = 1,65,079.37 – 1,60,000 = Rs 5,079.37

So, the milkman suffered a net loss of Rs 5,079.37.

11. p + 5% of p = p × 1.05

So, answer is (iv) p × 1.05.

12. If demand fell by 85%, then present demand = (100 – 85)% = 15% of original.

Only (iii) means the same.

Page-22-23

1. Bank of Yahapur: 10% p.a., deposit Rs 20,000 for 2 years.

Compare compounding vs. no compounding.

Without compounding (Simple Interest):

Simple Interest = 20,000 × 0.10 × 2 = Rs 4,000

Total = 20,000 + 4,000 = Rs 24,000

With compounding:

Year 1 Interest = 10% of 20,000 = Rs 2,000; Amount = Rs 22,000

Year 2 Interest = 10% of 22,000 = Rs 2,200; Amount = Rs 24,200

Total = Rs 24,200

With compounding you get Rs 24,200 which is Rs 200 more than without compounding.

2. Bank of Wahapur: 5% p.a., deposit Rs 20,000 for 4 years.

Without compounding:

SI = 20,000 × 0.05 × 4 = Rs 4,000

Total = Rs 24,000

With compounding:

Year 1: 5% of 20,000 = 1,000; Amount = 21,000

Year 2: 5% of 21,000 = 1,050; Amount = 22,050

Year 3: 5% of 22,050 = 1,102.50; Amount = 23,152.50

Year 4: 5% of 23,152.50 = 1,157.63; Amount = 24,310.13

Total ≈ Rs 24,310.13

With compounding you get Rs 24,310.13 which is Rs 310.13 more.

3. The observation is that compounding gives more interest than simple interest, and the difference grows larger over longer time periods. Compounding produces exponential growth.

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4. Simple Interest for 4 years = p × 0.06 × 4 = 0.24p

Total amount = p + 0.24p = 1.24p

Checking the options:

(i) p × 6 × 4 = 24p, Not correct

(ii) p × 0.6 × 4 = 2.4p, Not correct

(iii) $p \times \frac{0.6}{100} \times 4 = 0.024p$, Not correct

(iv) $p \times \frac{0.06}{100} \times 4 = 0.0024p$, Not correct

(v) p × 1.6 × 4 = 6.4p, Not correct

(vi) p × 1.06 × 4 = 4.24p, Not correct

(vii) p + (p × 0.06 × 4) = p + 0.24p = 1.24p – This is correct.

So, answer is (vii) p + (p × 0.06 × 4).

5. Without compounding:

Interest = 50,000 × 0.07 × 3 = Rs 10,500

Total = Rs 60,500

With compounding:

Year 1: 7% of 50,000 = 3,500; Amount = 53,500

Year 2: 7% of 53,500 = 3,745; Amount = 57,245

Year 3: 7% of 57,245 = 4,007.15; Amount = 61,252.15

Extra earned = 61,252.15 – 60,500 = Rs 752.15

So, without compounding the interest is Rs 10,500, and with compounding you earn ₹ 11,252.15 means an extra Rs 752.15.

6. Giridhar (without compounding):

Interest = 12,500 × 0.12 × 3 = Rs 4,500

Raghava (with compounding at 10%):

Year 1: 10% of 12,500 = 1,250; Amount = 13,750

Year 2: 10% of 13,750 = 1,375; Amount = 15,125

Year 3: 10% of 15,125 = 1,512.50; Amount = 16,637.50

Interest = 16,637.50 – 12,500 = Rs 4,137.50

Giridhar pays Rs 4,500 and Raghava pays Rs 4,137.50.

Giridhar pays more by Rs 4,500 – Rs 4,137.50 = Rs 362.50.

So, Giridhar pays more interest, by Rs 362.50.

7. Without compounding:

SI per year = 10% of 1000 = Rs 100

To double (reach Rs 2000): 1000 additional needed

$\text{Years} = \frac{1000}{100} = 10 \text{ years}$

With compounding:

Year 1: 1000 × 1.1 = 1100

Year 2: 1100 × 1.1 = 1210

Year 3: 1210 × 1.1 = 1331

Year 4: 1331 × 1.1 = 1464.1

Year 5: 1464.1 × 1.1 = 1610.51

Year 6: 1610.51 × 1.1 = 1771.56

Year 7: 1771.56 × 1.1 = 1948.72

Year 8 (approximately): 1948.72 × 1.1 = 2143.59

So, with compounding it doubles in approximately 7-8 years (approximately 7.27 years).

Yes, compounding is an example of exponential growth, and non-compounding is an example of linear growth.

8. $1.5 \times (1.03)^3$

= 1.5 × 1.0927

= 1.639 crore ≈ Rs 1.64 crore (approximately)

So, the expected population after 3 years is approximately 1.64 crore.

9. Bacteria increase at 2.5% per hour.

Initial count = 5,06,000.

$= 5,06,000 \times \left(1 + \frac{2.5}{100}\right)^2$

$= 5,06,000 \times (1.025)^2$

= 5,06,000 × 1.050625

= 5,31,616 (approximately)

So, the bacteria count after 2 hours will be approximately 5,31,616.

Page-28-30

1. Population of Bengaluru in 2025 is 250% of its population in 2000.

Population in 2000 = 50 lakhs.

Population in 2025 = 250% of 50 = $\left(\frac{250}{100}\right) \times 50$ = 125 lakhs = 1.25 crore.

So, the population in 2025 is approximately 1.25 crore.

2. World population 2025 ≈ 8.2 billion.

Germany: 83 million = $\frac{83}{8200} \times 100 \approx 1\%$

India: 1.46 billion = $\frac{1460}{8200} \times 100 \approx 18\%$

Bangladesh: 175 million = $\frac{175}{8200} \times 100 \approx 2\%$

USA: 347 million = $\frac{347}{8200} \times 100 \approx 4\%$

So, Germany → 1%, India → 18%, Bangladesh → 2%, USA → 4%.

3. Mobile phone price = Rs 8,250 with 18% GST.

GST = 18% of 8,250 = 0.18 × 8,250 = 1,485

Final price = 8,250 + 1,485 = Rs 9,735

Checking options:

(v) 8250 × 1.18 = 9,735 – Correct

(vi) 8250 + 8250 × 0.18 = 8250 + 1485 = 9,735 – Correct

So, answers are (v) and (vi).

4. Monthly change in population of mice:

Month 1 = +5%, Month 2 = –2%, Month 3 = –3%. Initial population = p.

(i) p × 0.05 × 0.02 × 0.03 – This is the product of decimal rates, which is incorrect.

(ii) p × 1.05 × 0.98 × 0.97 – This correctly applies each month's change multiplicatively. True.

(iii) p + 0.05 – 0.02 – 0.03 – This adds and subtracts directly without applying to the previous value. False.

(iv) The population after three months was p – Not necessarily true.

(v) The population after three months was more than p – Let's check: 1.05 × 0.98 × 0.97 ≈ 0.9988 which is less than 1, so the final population is slightly less than p. False.

(vi) The population after three months was less than p – True (since 0.9988p < p).

So, (ii) and (vi) are true.

5. Let CP = 100

SP with 35% profit = 135

After 30% discount: New SP = 135 × 0.70 = 94.5

Since 94.5 < 100 (CP), the shopkeeper makes a loss.

Loss% = (100 – 94.5)/100 × 100 = 5.5%

So, the shopkeeper makes a loss of 5.5%.

6. Area occupied by region E in the figure:

Looking at the figure, the square is divided into regions A, B, C, D, E where D and C are triangles and E is in the corner.

Without exact figure dimensions, based on the typical breakdown: If total area = 1, region E occupies 1/8 = 12.5% of the total area.

7. 5% of 40 and 40% of 5:

5% of 40 = 2

40% of 5 = 2

These are equal!

25% of 12 = 3

12% of 25 = 3

These are equal!

15% of 60 = 9

60% of 15 = 9

These are equal!

Observation: x% of y = y% of x (they are always equal).

Algebraic justification: x% of y = $\left(\frac{x}{100}\right) \times y$

$= \frac{xy}{100}$ and y% of x = $\left(\frac{y}{100}\right) \times x = \frac{xy}{100}$.

So they are equal.

8. 40% of students going on excursion are Grade 8 students. Among Grade 8 students, 60% are girls.

(i) Percentage of Grade 8 girls = 60% of 40% = 0.6 × 40 = 24%

So, 24% of all students are Grade 8 girls.

(ii) Total students = 160

Grade 8 girls = 24% of 160 = $\left(\frac{24}{100}\right) \times 160$ = 38.4 ≈ 38 students

So, approximately 38 Grade 8 girls are going on the excursion.

9. Shopkeeper sells pencils such that SP of 3 pencils = CP of 5 pencils.

Let CP per pencil = Rs 1

CP of 5 pencils = Rs 5 = SP of 3 pencils

SP per pencil = Rs $\frac{5}{3}$

Profit per pencil = $\frac{5}{3} - 1 = \frac{2}{3}$

Profit% = $\frac{\left(\frac{2}{3}\right)}{1} \times 100 = 66.67\%$

So, the shopkeeper makes a profit of 66.67%.

10. Let original fare = 100

After 3% increase: 100 × 1.03 = 103

After 4% increase: 103 × 1.04 = 107.12

Overall increase = 107.12 – 100 = 7.12%

So, the overall percentage increase in the last 2 years is 7.12%.

11. Let original length = L, breadth = B, Area = L × B

New length = 1.1 L

New area = 1.1 L × New breadth = L × B (unchanged)

New breadth = $\frac{(L \times B)}{(1.1L)} = \frac{B}{1.1} = B \times \frac{10}{11}$

Decrease in breadth = $B - B \times \frac{10}{11} = \frac{B}{11}$

Percentage decrease = $\frac{\left(\frac{B}{11}\right)}{B} \times 100 = \frac{100}{11}$

= 9.09% (approximately)

So, the breadth decreases by exactly $9\frac{1}{11}\%$ (approximately 9.09%).

12. 65 g chips packet.

Potato: 70% of 65 = 45.5 g

Vegetable oil: 24% of 65 = 15.6 g

Salt: 3% of 65 = 1.95 g

Spices: 3% of 65 = 1.95 g

So, the weights are: Potato 45.5 g, Vegetable oil 15.6 g, Salt 1.95 g, Spices 1.95 g.

13. Three shops sell same items at same price with different offers.

Let price of one item = Rs 100.

Shop A: "Buy 1 get 1 free" – Pay for 1, get 2

Effective price per item = $\frac{100}{2}$ = Rs 50

Shop B: "Buy 2 get 1 free" – Pay for 2, get 3

Effective price per item = $\frac{200}{3}$ = Rs 66.67

Shop C: "Buy 3 get 1 free" – Pay for 3, get 4

Effective price per item = $\frac{300}{4}$ = Rs 75

(i) Effective prices: A = Rs 50, B = Rs 66.67, C = Rs 75. Cheapest to costliest: A < B < C.

(ii) Percentage discount:

Shop A: Free item = 1 out of 2 total = 50% discount

Shop B: Free item = 1 out of 3 total ≈ 33.33% discount

Shop C: Free item = 1 out of 4 total = 25% discount

(iii) If you need 4 items:

Shop A: Pay for 4, get 8 (need only 4, so pay for 2) = Rs 200

Shop B: Pay for 4, get 6 (but need only 4, so use offer once) Pay 2, get 3, then pay 2 more = Rs 200 total for 4 items effectively = Pay Rs 267 for 4 items if buying exactly

Actually if you need exactly 4: Shop A gives 4 for Rs 200, Shop B gives 4 for Rs 267, Shop C gives 4 for Rs 300.

So, choose Shop A for 4 items.

14. Currently: 99 left-handed, 1 right-handed (100 total)

Let x left-handed people leave.

Remaining: $(99 - x)$ left-handed, 1 right-handed, total = $(100 - x)$

$\frac{(99 - x)}{(100 - x)} = \frac{98}{100}$

$100(99 - x) = 98(100 - x)$

$9900 - 100x = 9800 - 98x$

$100 = 2x$

$x = 50$

So, 50 left-handed people must leave the room.

15. Based on the graph about computer literacy by age and gender:

(i) People in their twenties are the most computer-literate – Valid (highest bar for age 20s).

(ii) Women lag behind across all age groups – Valid (as shown in graph).

(iii) There are more people in their twenties than teenagers – Invalid (the graph shows percentages, not population counts).

(iv) More than a quarter of people in their thirties can use computers – Valid (above 25%).

(v) Less than 1 in 10 aged 60 and above can use computers – Valid (below 10%).

(vi) Half of the people in their twenties can use computers – Invalid (it's more than half, shown to be above 50%).

So, valid statements are (i), (ii), (iv), and (v).

2. The Baudhayana-Pythagoras Theorem

Work it Out—1

1. Formula: Hypotenuse $c = a\sqrt{2}$ where a is the side length.

$\sqrt{2} \approx 1.4142$

(a) Side length = 5 cm

$c = 5 \times 1.4142 = 7.071 \approx 7.1$ cm

So, hypotenuse = 7.1 cm.

(b) Side length = 7 cm

$c = 7 \times 1.4142 = 9.899 \approx 9.9$ cm

So, hypotenuse = 9.9 cm.

(c) Side length = 10 cm

$c = 10 \times 1.4142 = 14.142 \approx 14.1$ cm

So, hypotenuse = 14.1 cm.

(d) Side length = 12 cm

$c = 12 \times 1.4142 = 16.970 \approx 17.0$ cm

So, hypotenuse = 17.0 cm.

(e) Side length = 15 cm

$c = 15 \times 1.4142 = 21.213 \approx 21.2$ cm

So, hypotenuse = 21.2 cm.

2. The hypotenuse of an isosceles right triangle is 14 units.

(a) Find the lengths of the other two sides.

Using $c = a\sqrt{2}$: $14 = a\sqrt{2}$

$$a = \frac{14}{\sqrt{2}} = \frac{14}{1.442} = 9.899 \approx 9.9 \text{ units}$$

So, each of the two equal sides ≈ 9.9 units (or exactly $7\sqrt{2}$ units).

(b) Find the area of the square formed using these two sides.

$$\text{Area of square} = a^2 = \left(\frac{14}{\sqrt{2}}\right)^2 = \frac{196}{2} = 98$$

square units.

So, the area of the square is 98 square units.

Work it Out—2

1. We place the two squares in an L-shape so their outer edges form the two perpendicular legs of a right-angled triangle. This arrangement allows us to draw the diagonal (hypotenuse) that represents the side of the larger combined square.

2. Using Baudhayana-Pythagoras Theorem:

$c^2 = 5^2 + 12^2$

$c^2 = 25 + 144 = 169$

$c = \sqrt{169} = 13$ cm

So, the side length of the combined square is 13 cm.

Work it Out—3

1. Using the odd number magic technique, calculate and list five new Pythagorean triplets. Start with odd numbers greater than 9.

Using method: For odd number m, set $2n - 1 = m^2$, solve for n, triplet is $(m, n - 1, n)$.

(a) $m = 11$ (odd number > 9, choose odd square: 11 itself)

Actually using perfect odd squares:

$m^2 = 121 = 11^2$: $2n - 1 = 121$, $n = 61$, triple = (11, 60, 61)

Check: $11^2 + 60^2 = 121 + 3600 = 3721 = 61^2$

(b) $m^2 = 169 = 13^2$: $2n - 1 = 169$, $n = 85$, triple = (13, 84, 85)

Check: $13^2 + 84^2 = 169 + 7056 = 7225 = 85^2$

(c) $m^2 = 225 = 15^2$: $2n - 1 = 225$, $n = 113$, triple = (15, 112, 113)

Check: $15^2 + 112^2 = 225 + 12544 = 12769 = 113^2$

(d) $m^2 = 289 = 17^2$: $2n - 1 = 289$, $n = 145$, triple = (17, 144, 145)

Check: $17^2 + 144^2 = 289 + 20736 = 21025 = 145^2$

(e) $m^2 = 361 = 19^2$: $2n - 1 = 361$, $n = 181$, triple = (19, 180, 181)

Check: $19^2 + 180^2 = 361 + 32400 = 32761 = 181^2$

So, the five new triplets are: (11, 60, 61), (13, 84, 85), (15, 112, 113), (17, 144, 145), (19, 180, 181).

2. In each triplet generated, the hypotenuse and second-longest side are consecutive integers (e.g., 60 and 61). Consecutive integers are always co-prime (GCD = 1). Therefore, none of the three numbers share a common factor, making each triplet a primitive triplet.

So, yes, all these sets are primitive triplets.

3. No, not every primitive triplet can be found this way. For example, the triplet (8, 15, 17) cannot be obtained using this method because neither 8 nor 17 is one more than 15. There are primitive triplets where the two shorter sides differ by more than 1.

Connect and Reflect

A. Multiple Choice Questions

1. (c) **2.** (d) **3.** (b) **4.** (c) **5.** (c)

B. Fill in the Blanks

1. double **2.** c^2

3. 1.414 and 1.415

4. Baudhayana (or pythagorean)

5. longest.

C. State True or False

1. False **2.** False **3.** True **4.** True **5.** True

D. Subjective Question

1. If side = s, area = s^2. New side = $2s$, new area = $(2s)^2 = 4s^2$.

So, the area becomes 4 times the original area.

2. Draw a diagonal of the given square and use that diagonal as the side of the new square. The square built on the diagonal has double the area of the original.

3. The diagonal divides the original square into 2 equal triangles. The new square on the diagonal contains 4 such triangles. Since $4 = 2 \times 2$, the new square has double the area.

4. Mark the midpoints of all four sides of the given square and connect them. The inner tilted square formed has half the area of the original square.

5. The hypotenuse is the longest side of a right-angled triangle, which is the side opposite the right angle.

6. Using Baudhayana (or Pythagorean) triplet: $a^2 + b^2 = c^2$

$c^2 = 1^2 + 1^2 = 1 + 1 = 2$

$c = \sqrt{2}$ units

So, the hypotenuse is $\sqrt{2}$ units.

7. Because no terminating decimal, when squared, gives exactly 2. The decimal expansion of $\sqrt{2}$ goes on forever without repeating, making it an irrational number.

8. $1.414^2 = 1.999396$ (just below 2)

$1.415^2 = 2.002225$ (just above 2)

So, $\sqrt{2}$ lies between 1.414 and 1.415.

9. In a right-angled triangle, the square of the hypotenuse equals the sum of the squares of the other two sides: $a^2 + b^2 = c^2$.

10. Using Baudhayana (or Pythagorean) triplet: $a^2 + b^2 = c^2$

$c^2 = 6^2 + 8^2 = 36 + 64 = 100$

$c = 10$ cm

So, the hypotenuse is 10 cm.

11. A set of three positive integers (a, b, c) that satisfy $a^2 + b^2 = c^2$ is called a Baudhayana (or Pythagorean) triplet.

12. (3, 4, 5) is a primitive Baudhayana triplet:

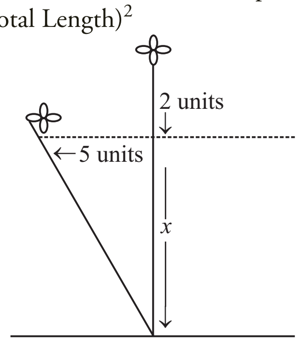
$3^2 + 4^2 = 9 + 16 = 25 = 5^2$.

13. A primitive Baudhayana triplet is one where the three numbers have no common factor greater than 1 (they are co-prime as a group).

14. (ka, kb, kc) is called a scaled Baudhayana triple or a non-primitive (branch) triplet.

15. A right-angled triangle is formed using the horizontal distance from the plant base to where it touches water, the depth of the pond (one leg), and the total plant length (hypotenuse). Applying $a^2 + b^2 = c^2$ gives us the depth.

(Horizontal Distance)^2 + (Depth)^2 = (Total Length)^2

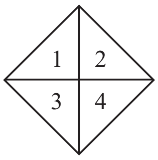


NCERT EXERCISE

Figure It Out Questions

Page 39-40

1. Method to create a square with double the area using two identical squares cut diagonally:



Cut both square papers diagonally in half. You get four identical right triangles. Arrange these four triangles with their hypotenuses forming the sides of a new square. This new square has double the area of the original.

2. (i) Side = 3: $c = 3\sqrt{2}$. Now $1.4 < \sqrt{2} < 1.5$, so $4.2 < c < 4.5$.

More precisely: $4.23 < c < 4.26$.

So, 4.23 < hypotenuse < 4.26.

(ii) Side = 4: $c = 4\sqrt{2}$. $5.64 < c < 5.68$.

So, 5.64 < hypotenuse < 5.68.

(iii) Side = 6: $c = 6\sqrt{2}$. $8.46 < c < 8.52$.

So, 8.46 < hypotenuse < 8.52.

(iv) Side = 8: $c = 8\sqrt{2}$. $11.25 < c < 11.36$.

So, 11.25 < hypotenuse < 11.36.

(v) Side = 9: $c = 9\sqrt{2}$. $12.69 < c < 12.78$.

So, 12.69 < hypotenuse < 12.78.

3. $c = 10$, $c^2 = 2a^2$ (since isosceles)

$100 = 2a^2$

$a^2 = 50$

$a = \sqrt{50} = 5\sqrt{2}$ units each

So, each of the two equal sides is $5\sqrt{2}$ units.

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1. Using Baudhayana (or Pythagorean) triplet: $a^2 + b^2 = c^2$

$c^2 = 5^2 + 12^2 = 25 + 144 = 169$

$c = \sqrt{169} = 13$ cm

So, the hypotenuse is 13 cm.

2. Using Baudhayana (or Pythagorean) triplet: $a^2 + b^2 = c^2$

$a^2 + 8^2 = 17^2$

$a^2 = 289 - 64 = 225$

$a = 15$ cm

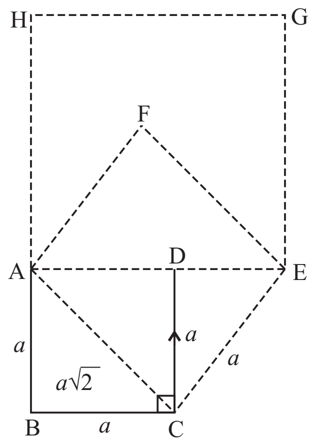
So, the third side is 15 cm.

3. (a) ABCD is a square with side a.

AC = a/2

ACEF is a rectangle with sides a/2 and a.

Now AE = a/3



AEGH is s square with a side of a√3

Then Ar AEGH = $3a^2$

Ar ABCD = a^2

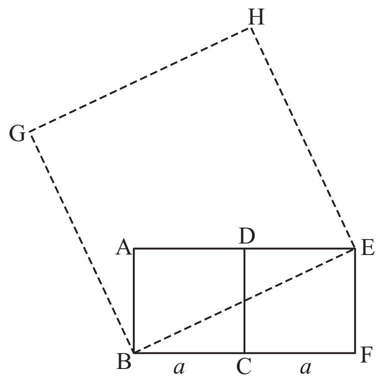
$\therefore$ Area of AEGH = 3 × Area of ABCD

(b) ABCD and CEFD are squares with side 'a'.

BE is a diagonal of the rectangle ABFE.

In rectangle ABFE

EF = a and BF = BC + CF = a + a = 2a



Using Baudhayana's Theorem

$BE^2 = EF^2 + BF^2$

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

$= a^2 + 4a^2$

$= 5a^2$

$BE = \sqrt{5}\, a$

BEFG is a square with side BE.

Area BEFG = BE^2

= $(\sqrt{5}a)^2$

= $5a^2$

Then the area of BEFG = 5 × the area of ABCD

4. Using Baudhayana (or Pythagorean) triplet: $a^2 + b^2 = c^2$

(i) $a = 5$, $b = 7$: $c = \sqrt{(25+49)} = \sqrt{74}$

So, $c = \sqrt{74}$.

(ii) $a = 8$, $b = 12$: $c = \sqrt{(64+144)} = \sqrt{208}$ $= 4\sqrt{13}$

So, $c = \sqrt{208}$ (approximately 14.42).

(iii) $a = 9$, $c = 15$: $b = \sqrt{(225-81)} = \sqrt{144}$

So, $b = 12$.

(iv) $a = 7$, $b = 12$: $c = \sqrt{(49+144)} = \sqrt{193}$

So, $c = \sqrt{193}$ (approximately 13.89).

(v) $a = 1.5$, $b = 3.5$: $c = \sqrt{(2.25+12.25)} = \sqrt{14.5}$

So, $c = \sqrt{14.5}$ (approximately 3.81).

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1. Using Baudhayana (or Pythagorean) triplet: $a^2 + b^2 = c^2$

Starting from odd perfect squares :

(7, 24, 25): $2n - 1 = 49$, $n = 25$, $n - 1 = 24$

(9, 40, 41): $2n - 1 = 81$, $n = 41$, $n - 1 = 40$

(11, 60, 61): $2n - 1 = 121$, $n = 61$, $n - 1 = 60$

(13, 84, 85): $2n - 1 = 169$, $n = 85$, $n - 1 = 84$

(15, 112, 113): $2n - 1 = 225$, $n = 113$, $n - 1 = 112$

So, five Baudhayana triplets are: (7, 24, 25), (9, 40, 41), (11, 60, 61), (13, 84, 85), (15, 112, 113).

2. No. In each triplet generated by this method, the hypotenuse and second-longest side are consecutive integers. Two consecutive integers are always co-prime. Therefore all triplets generated are primitive (non-primitive cannot be generated this way).

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1. $d = 5\sqrt{2} = 5 \times 1.4142 \approx 7.07$ cm

So, the diagonal is $5\sqrt{2}$ cm (approximately 7.07 cm).

2. (Based on standard calculations using Baudhayana theorem for given side values in the figure)

Results : $\sqrt{130}$, $\sqrt{84}$ (approximately 11.4 and 9.2), and other values as given in the figure.

3. Diagonals bisect each other at right angles.

Half diagonals = 12 and 35.

$Side^2 = 12^2 + 35^2 = 144 + 1225 = 1369$

Side = $\sqrt{1369}$ = 37 units

So, the side length of the rhombus is 37 units.

4. Yes. The hypotenuse is opposite the largest angle (90°), and in any triangle, the side opposite the largest angle is the longest.

5. True or False: Every Baudhayana triplet is either a primitive triplet or a scaled version of a primitive triple.

True. Every Pythagorean triplet can be expressed as (ka, kb, kc) where (a, b, c) is a primitive triplet and k is a positive integer.

6. Give 5 examples of rectangles whose side lengths and diagonals are all integers.

Using Pythagorean triplets as side lengths :

(3, 4) → diagonal = 5

(5, 12) → diagonal = 13

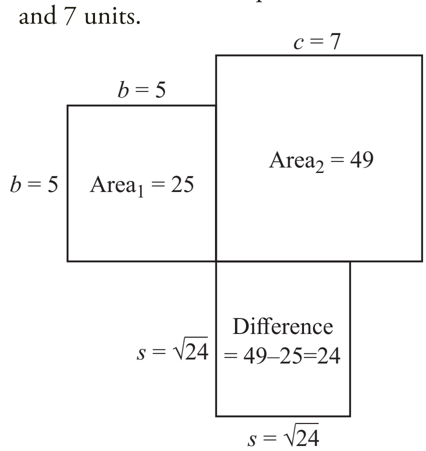
(8, 15) → diagonal = 17

(7, 24) → diagonal = 25

(9, 40) → diagonal = 41

So, five rectangles: 3 × 4 (diagonal 5), 5 × 12 (diagonal 13), 8 × 15 (diagonal 17), 7 × 24 (diagonal 25), 9 × 40 (diagonal 41).

7. Construct a square whose area equals the difference of areas of squares with sides 5 and 7 units.



Required Square

Area of square with side 7 = 49 square units

Area of square with side 5 = 25 square units

Difference = 49 – 25 = 24 square units

Side of new square = $\sqrt{24} = 2\sqrt{6}$ units

To construct: Form a right triangle where the legs are 5 and $\sqrt{24}$ and the hypotenuse is 7. Then build a square on the side $\sqrt{24}$.

8. Grid dots and squares :

(i) (a) Yes, 2 sq. units: Draw a square tilted 45° on a 1 × 1 grid with diagonal = $\sqrt{2}$, area = $\frac{(\sqrt{2})^2}{2}$ actually draw a 1 × 1 square rotated 45° – it has area 2.

(b) For 3 sq. units: Not directly possible with integer vertices if you require exact 3. Tilt at different angles.

(c) Yes, 4 sq. units: 2 × 2 regular square.

(d) Yes, 5 sq. units: 1 × 2 right triangle hypotenuse = $\sqrt{5}$, build square on it.

(ii) Possible integer areas = any positive integer (all positive integers are achievable as areas of grid squares).

9. Height h = $\sqrt{(6^2 - 3^2)}$ = $\sqrt{(36 \quad 9)}$ = $\sqrt{27}$ = $3\sqrt{3}$

Area = $\left(\frac{1}{2}\right)$ × base × height = $\left(\frac{1}{2}\right)$ × 6 × $3\sqrt{3}$ = $9\sqrt{3}$ ≈ 15.59 square units.

So, the area of the equilateral triangle is $9\sqrt{3}$ square units (approximately 15.59).

3. Proportional Reasoning-2

Work it Out—1

1. Total ratio parts = 3 + 2 + 1 = 6

Value of 1 part = $\frac{120}{6}$ = 20 minutes

Cardio = 3 × 20 = 60 minutes

Strength = 2 × 20 = 40 minutes

Stretching = 1 × 20 = 20 minutes

So, cardio = 60 min, strength = 40 min, stretching = 20 min.

2. 36 French books = 4 parts

1 part = $\frac{36}{4}$ = 9

Spanish = 3 × 9 = 27 books

German = 2 × 9 = 18 books

So, Spanish books = 27 and German books = 18.

3. Total ratio parts = 1 + 2 + 5 = 8

value of 1 part = $\frac{80}{8}$ = 10 coins

Rs 10 coins = 1 × 10 = 10 coins

Rs 5 coins = 2 × 10 = 20 coins

Rs 2 coins = 5 × 10 = 50 coins

So, Rs 10 coins = 10, Rs 5 coins = 20, Rs 2 coins = 50.

4. Sum of two smaller sides = 1 + 2 = 3, which is not greater than the third side (3). By the triangle inequality, the sum of any two sides must be strictly greater than the third side.

So, no, a triangle cannot be formed with sides in ratio 1:2:3.

5. New length = 4 × 3 = 12 cm

New breadth = 6 × 1 = 6 cm

So, the new dimensions are 12 cm × 6 cm.

Note: The enlargement ratio 3 : 1 may mean all sides scaled by 3. Then: 4 × 3 = 12 cm and 6 × 3 = 18 cm.

Work it Out—2

1. Total = 140 + 100 + 90 + 70 = 400

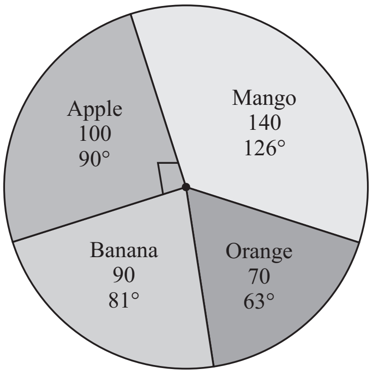
Angle for each = $\left(\frac{\text{number}}{400}\right) \times 360°$

Mango = $\left(\frac{140}{400}\right) \times 360$ = 126°

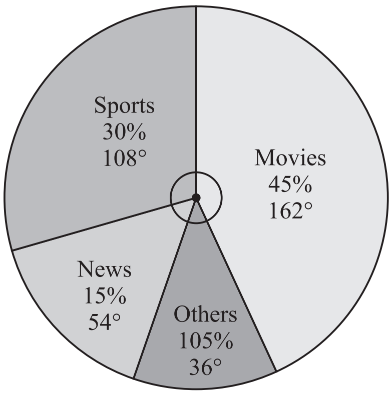
Apple = $\left(\frac{100}{400}\right) \times 360$ = 90°

Banana = $\left(\frac{90}{400}\right) \times 360$ = 81°

Orange = $\left(\frac{70}{400}\right) \times 360$ = 63°



2. Angle = percentage × 3.6
Movies = 45 × 3.6 = 162°
Sports = 30 × 3.6 = 108°
News = 15 × 3.6 = 54°
Others = 10 × 3.6 = 36°
Total = 360°



3. Prepare pie chart with favourite subjects data from class – do it yourself using the data collected.

Work it Out—3

1. (i) x : 10, 20, 50 and y: 100, 50, 20
Product $x \times y$: 10 × 100 = 1000, 20 × 50 = 1000, 50 × 20 = 1000 (constant)
So, this is inverse proportion.
(ii) x : 5, 10, 15 and y : 15, 30, 45
As x increases, y also increases. Ratio $\frac{y}{x} = 3$ (constant).
So, this is direct proportion, not inverse.

2. Complete the table assuming inverse proportion ($x \times y$ = constant).
Given: $x = 12, y = 4$: constant $k = 12 \times 4 = 48$
When $x = 6$: $y = \frac{48}{6} = 8$
When $y = 16$: $x = \frac{48}{16} = 3$
Completed table: x : 12, 6, 3 and y : 4, 8, 16.

Connect and Reflect

A. Multiple Choice Questions

1. (c) **2.** (b) **3.** (a) **4.** (c) **5.** (b)

B. Fill in the Blanks

1. cross products **2.** constant
3. 360 **4.** constant **5.** multi-term.

C. State True or False

1. True **2.** False **3.** True **4.** False **5.** True

D. Subjective Questions

1. A proportional relationship is one where two quantities change such that their ratio remains constant.

2. Two ratios $a : b$ and $c : d$ are proportional when $a \times d = b \times c$ (cross products are equal).

3. RF is the ratio of distance on a map to the actual distance on the ground. For example, RF = 1 : 50,000 means 1 unit on map = 50,000 units on the ground.

4. First part = $\frac{x \times a}{(a + b)}$
Second part = $\frac{x \times b}{(a + b)}$

5. A ratio with more than two terms compares three or more quantities. Example: 2 : 3 : 5 compares three quantities.

6. Two variables are in direct proportion if one increases (or decreases) as the other increases (or decreases) at the same rate.
Their ratio remains constant : $\frac{x}{y} = k$.

7. Give one example of direct proportion.
The number of items purchased and the total cost (at fixed price per item) are directly proportional.

8. Two variables are in inverse proportion when one increases as the other decreases, such that their product remains constant: $x \times y = k$.

9. Speed and time for covering a fixed distance are inversely proportional.

10. The product of the two quantities ($x \times y$) remains constant.

11. The total angle of pie chart is 360 degrees.

12. Angle = $\left(\frac{\text{Part}}{\text{Total}}\right)\times 360°$

13. Workers × days = constant : $3 \times 6 = 6 \times x$

$x = \frac{18}{6} = 3$ days

So, 6 workers will take 3 days.

14. Because distance = speed × time is constant for a fixed journey. As speed increases, time decreases, and their product (distance) stays constant.

15. It is used to divide 180° in proportion when angles of a triangle are given in a ratio.

NCERT EXERCISE

Figure It Out Questions

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1. Cricket coach schedules: warm-up/cool-down : batting : bowling : fielding = 3: 4 : 3 : 5. Session = 150 minutes.

Total ratio = 3 + 4 + 3 + 5 = 15

1 part = $\frac{150}{15}$ = 10 minutes

Warm-up/cool-down = 3 × 10 = 30 minutes each

Batting = 4 × 10 = 40 minutes

Bowling = 3 × 10 = 30 minutes

Fielding = 5 × 10 = 50 minutes

So, warm-up/cool-down = 30 min, batting = 40 min, bowling = 30 min, fielding = 50 min.

2. Library books ratio Odiya : Hindi : English = 3 : 2 : 1. Odiya books = 288.

3 parts = 288, so 1 part = 96

Hindi = 2 × 96 = 192 books

English = 1 × 96 = 96 books

So, Hindi = 192 books, English = 96 books.

3. 100 coins in ratio ₹ 10 : ₹ 5 : ₹ 2 : ₹ 1 = 4 : 3 : 2 : 1.

Total ratio = 4 + 3 + 2 + 1 = 10

1 part = $\frac{100}{10}$ = 10 coins

₹ 10 coins = 4 × 10 = 40 → value = ₹ 400

₹ 5 coins = 3 × 10 = 30 → value = ₹ 150

₹ 2 coins = 2 × 10 = 20 → value = ₹ 40

₹ 1 coins = 1 × 10 = 10 → value = ₹ 10

Total = 400 + 150 + 40 + 10 = ₹ 600

So, I have ₹ 600 in coins.

4. Construct triangle with sides 3 : 4 : 5. Not congruent because only the ratio is given, not the actual size, so many similar triangles with different sizes can be drawn.

5. Cannot construct triangle with sides 1 : 3 : 5 because 1 + 3 = 4 which is not greater than 5 (violates triangle inequality).

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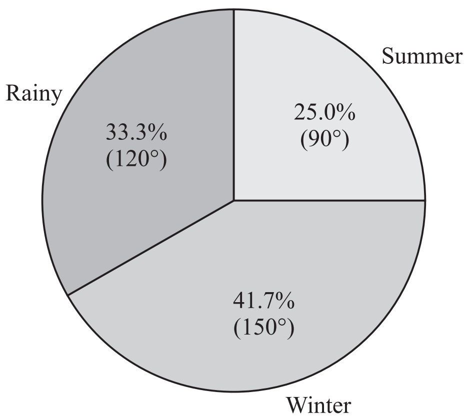
1. 360 people voted for favourite season. 90 liked summer, 120 liked rainy, rest (150) liked winter.

Summer = $\frac{90}{360} \times 360° = 90°$

Rainy = $\frac{120}{360} \times 360° = 120°$

Winter = $\frac{150}{360} \times 360° = 150°$

Favourite Seasons (with Degrees)



2. Pie chart for TV channels: Entertainment 50%, Sports 25%, News 15%, Information 10%.

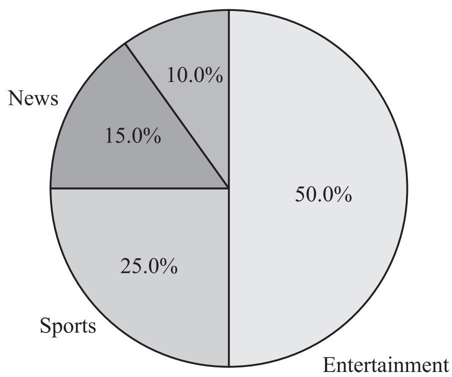
Entertainment = 50 × 3.6 = 180°

Sports = 25 × 3.6 = 90°

News = 15 × 3.6 = 54°

Information = 10 × 3.6 = 36°

Viewers' Favourite TV Channel Information



3. Favourite subjects pie chart – collect data from class and draw accordingly (do it yourself).

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1. (i) x : 40, 80, 25, 16 and y : 20, 10, 32, 50

Products : $40 \times 20 = 800$, $80 \times 10 = 800$, $25 \times 32 = 800$, $16 \times 50 = 800$ (constant)

So, this is inverse proportion.

(ii) x : 40, 80, 25, 16 and y : 20, 10, 12.5, 8

Products : $40 \times 20 = 800$, $80 \times 10 = 800$, $25 \times 12.5 = 312.5$ (not constant)

So, this is not inverse proportion.

(iii) x : 30, 90, 150, 10 and y : 15, 5, 3, 45

Products : $30 \times 15 = 450$, $90 \times 5 = 450$, $150 \times 3 = 450$, $10 \times 45 = 450$ (constant)

So, this is inverse proportion.

2. Given: $x = 16$, $y = 9$: $k = 16 \times 9 = 144$

$x = 12 : y = \frac{144}{12} = 12$

$y = 48 : x = \frac{144}{48} = 3$

$x = 36 : y = \frac{144}{36} = 4$

Completed table :

x : 16, 12, 3, 36 and

y : 9, 12, 48, 4.

Page-67-68

1. (i) Taps and time to fill tank : More taps → less time. Inverse proportion. Yes.

(ii) Painters and days : More painters → fewer days. Inverse proportion. Yes.

(iii) Distance and petrol : More distance → more petrol needed. Direct proportion. No.

(iv) Speed and time for fixed route : More speed → less time. Inverse proportion. Yes.

(v) Length of cloth and price at fixed rate : More length → more price. Direct proportion. No.

(vi) Pages in book and reading time at fixed speed : More pages → more time. Direct proportion. No.

So, (i), (ii), and (iv) are in inverse proportion.

2. Direct proportion: cost is proportional to number

Cost of 1 pencil = $\frac{120}{24}$ = Rs 5

Cost of 20 pencils = 20×5 = Rs 100

So, 20 pencils cost Rs 100.

3. $20 \times 6 = 30 \times x$

$x = \frac{120}{30} = 4$ days

Assumption : Each family uses the same amount of water per day.

So, the water will last 4 days.

4. From the given list: 15, 2.5, 20, 8, 3.5, 13, 10.5, 18

By observing the pictures (left to right):

1. Baby → 15 hours
2. Elephant → 3 hours
3. Child → 10.5 hours
4. Lion → 20 hours
5. Cat → 13 hours
6. Rabbit → 8 hours
7. Snake → 18 hours
8. Bat → 2.5 hours

5. Pie chart study on transport modes :

(i) Most common mode: Bus (largest sector).

(ii) Fraction by car: From pie chart, approximately $\frac{1}{12}$ (if car = 30°).

(iii) If 18 children by car = 30°, total children = $18 \times \frac{360^\circ}{30} = 216$; Taxi users = using proportion from pie chart.

(iv) Car and taxi (if they have equal sectors/angles).

6. 3 workers paint fence in 4 days. If 1 more joins:

$3 \times 4 = 4 \times x$

$x = \frac{12}{4} = 3$ days

Assumption: All workers work at the same pace.

So, it will take 3 days.

7. 6 hours to fill 2 tanks.

(Direct proportion: time proportional to number of tanks)

6 hours for 2 tanks → 3 hours per tank → 5 tanks = 5×3 = 15 hours

So, it will take 15 hours.

8. 25 rows of 12 chairs each, rearranged with 20 per row.

Total chairs = $25 \times 12 = 300$

New rows = $\frac{300}{20}$ = 15 rows

So, there will be 15 rows.

9. School has 8 periods of 45 minutes.

Total school time = 8×45 = 360 minutes

Each of 9 periods = $\frac{360}{9}$ = 40 minutes

So, each period will be 40 minutes.

10. Small pump fills tank in 3 hours, large pump in 2 hours.

Small pump does $\frac{1}{3}$ of tank per hour, large does $\frac{1}{2}$ per hour.

Together = $\frac{1}{3} + \frac{1}{2} = \frac{2}{6} + \frac{3}{6} = \frac{5}{6}$ of tank per hour

Time = $1 \div \left(\frac{5}{6}\right) = \frac{6}{5}$ = 1.2 hours (1 hour 12 minutes)

So, together they fill the tank in 1.2 hours.

11. Factory needs 42 machines to produce toys in 63 days.

(Inverse proportion: more machines → fewer days)

$42 \times 63 = x \times 54$

$x = \frac{(42 \times 63)}{54} = \frac{2646}{54}$ = 49 machines

So, 49 machines are required.

12. Car takes 2 hours at 60 km/h.

Distance = 60 × 2 = 120 km

Time at 80 km/h = $\frac{120}{80}$ = 1.5 hours

So, the car will take 1.5 hours (1 hour 30 minutes).

4. Exploring Some Geometric Themes

Work it Out—1

1.

Step 0 : Start with an equilateral triangle with all sides equal.

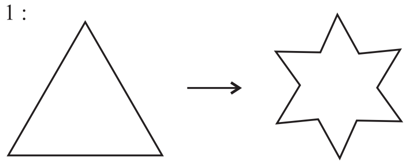
Step 1 : Each side of the triangle is divided into three equal parts. On the middle section of each side, a smaller equilateral triangle is built pointing outward, and the base of this smaller triangle is removed. The shape now has 12 sides.

Step 2: The same process is repeated on each of the 12 sides, creating even more points. The shape now has 48 sides.

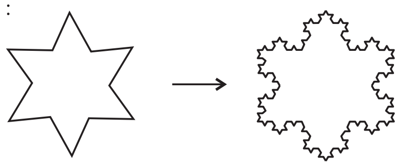
Draw these three stages in your notebook to visualize the Koch snowflake forming.

You can see the figures below.

Step 1 :



Step 2 :



2. At Step 0 : 3 sides

At Step 1 : Each side becomes 4 sides, so total = 3 × 4 = 12 sides

At Step 2 : 12 × 4 = 48 sides

At Step n : sides = 3×4^n

So, number of sides at n^{th} step = 3×4^n.

3. Each side of starting triangle = 1 unit.

At Step 0 : perimeter = 3 × 1 = 3 unit

At Step 1 : each side is replaced by 4 sides of length $\frac{1}{3}$ each. Total sides = 12, each of length $\frac{1}{3}$. Perimeter = $12 \times \frac{1}{3}$ = 4 unit.

At Step n : each side has length $\left(\frac{1}{3}\right)^n$, total sides = 3×4^n

Perimeter = $3 \times 4^n \times \left(\frac{1}{3}\right)^n = 3 \times \left(\frac{4}{3}\right)^n$

So, perimeter at nth step = $3 \times \left(\frac{4}{3}\right)^n$ units.

Work it Out—2

1. The long strip (6 squares in a straight line) : No, this will not fold into a cube because the arrangement does not allow closing all faces.

The cross (4 vertical, 1 left, 1 right of second from top) : Yes, this is a valid cube net.

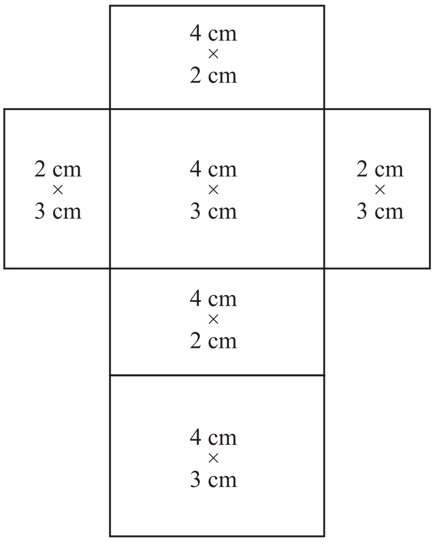
The 3 × 2 block: No, this cannot fold into a cube because opposite faces cannot be separated.

So, the cross arrangement folds into a cube.

2. Draw a net for a cuboid with Length = 4 cm, Width = 3 cm, Height = 2 cm.

A cuboid net consists of 6 rectangles arranged in a cross-like pattern. From left to right in the center row, place three rectangles : 4 × 2, 4 × 3, 4 × 2. Above and below the middle rectangle (4 × 3), attach the remaining 4 × 3 faces. On the left of the center row, attach a 3 × 2 face.

Net of a Cuboid (4 cm × 3 cm × 2 cm)



Connect and Reflect

A. Multiple Choice Questions

1. (c) **2.** (b) **3.** (c) **4.** (c) **5.** (d)

B. Fill in the Blanks

1. self-similar **2.** 8^n **3.** congruent
4. net **5.** top

C. State True or False

1. True **2.** False **3.** True **4.** True **5.** False

D. Subjective Questions

1. A fractal is a shape that shows the same or similar pattern at different levels of magnification. Smaller parts of the shape look like the whole shape.

2. Start with a square. Divide it into 9 equal parts and remove the center. Repeat the same process on each of the remaining 8 squares, and continue this pattern indefinitely.

3. It is a fractal formed by dividing an equilateral triangle into 4 equal triangles and removing the middle one. This process is then repeated on the remaining triangles indefinitely.

4. Start with an equilateral triangle. Divide each side into three equal parts. On the middle third of each side, build a smaller equilateral triangle pointing outward and remove the base. Repeat this process on every new side indefinitely.

5. Faces are the flat surfaces of a solid. Edges are the line segments where two faces meet. Vertices are the corner points where edges meet.

NCERT EXERCISE

Figure It Out Questions

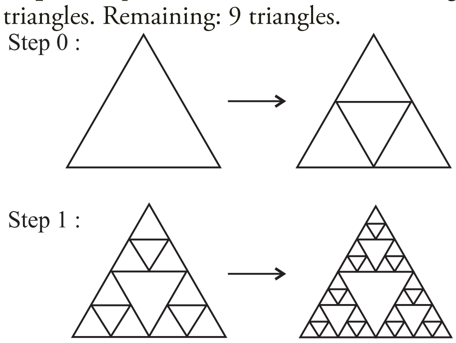
Page 72

1. Draw initial steps of Sierpinski Triangle.

Step 0 : One equilateral triangle.

Step 1 : Divide into 4 equal triangles. Remove the middle inverted triangle. Remaining : 3 triangles.

Step 2 : Repeat for each of the 3 remaining triangles. Remaining: 9 triangles.



2. Number of holes and triangles remaining.

Step 0 : Triangles = 1, Holes = 0

Step 1 : Triangles = 3, Holes = 1

Step 2 : Triangles = 9, Holes = 4

Step 3 : Triangles = 27, Holes = 13

Pattern : Remaining triangles at step $n = 3^n$

Holes at step $n = \dfrac{(3^n - 1)}{2}$

3. Area remaining at nth step in Sierpinski fractals.

For Sierpinski Triangle :

At each step, $\frac{3}{4}$ of the area remains ($\frac{1}{4}$ is removed).

Area at step $n = \left(\frac{3}{4}\right)^n$ square units.

For Sierpinski Carpet:

At each step, $\frac{8}{9}$ of the area remains.

Area at step $n = \left(\frac{8}{9}\right)^n$ square units.

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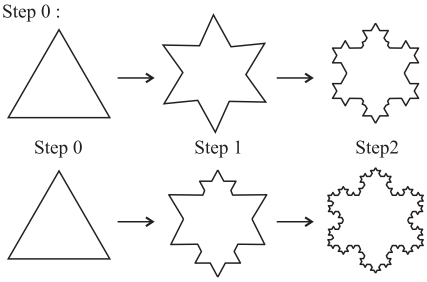
1. Draw initial steps of Koch Snowflake.

Step 0 : Equilateral triangle.

Step 1 : Each side becomes 4 sides (adding triangle bumps). Total sides = 12.

Step 2 : Each side again becomes 4 sides. Total sides = 48.

Step 0 :



2. Number of sides at nth step of Koch Snowflake :

Starting with 3 sides. At each step, each side becomes 4 sides.

Sides at step $n = 3 \times 4^n$.

3. Perimeter at nth step (starting equilateral triangle with side = 1 unit).

At each step, each side's length multiplies by $\frac{4}{3}$.

Perimeter at step $n = 3 \times \left(\frac{4}{3}\right)^n$ units.

Page-80-81

1. Nets of a cube (valid or not):

(i) Yes – valid net.

(ii) No – not a valid net.

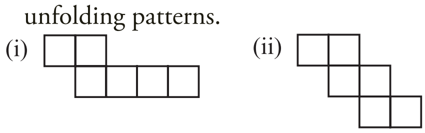
(iii) No – not a valid net.

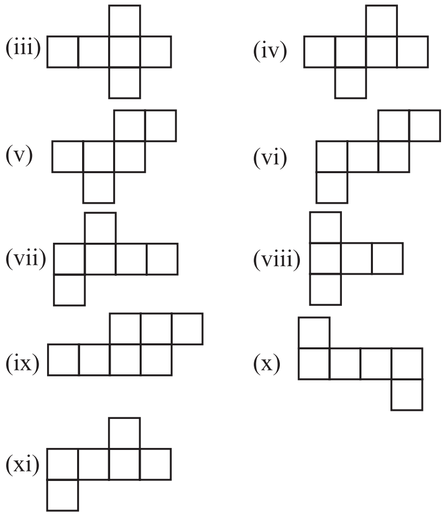
(iv) Yes – valid net.

(v) No – not a valid net.

(vi) Yes – valid net.

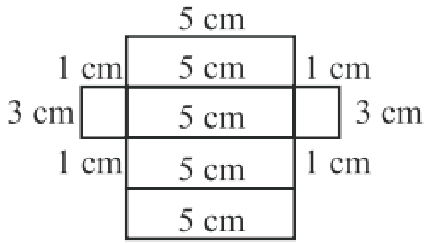
2. All 11 nets of a cube – these are unique unfolding patterns.



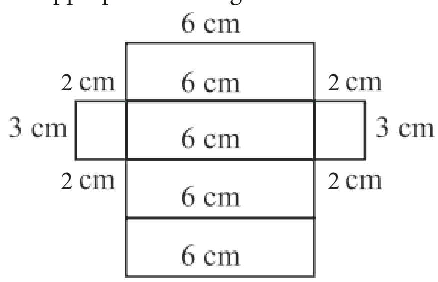


3. Draw net of cuboid :

(i) 5 cm, 3 cm, 1 cm: Draw cross-shaped net with appropriate rectangles.



(ii) 6 cm, 3 cm, 2 cm: Draw cross-shaped net with appropriate rectangles.



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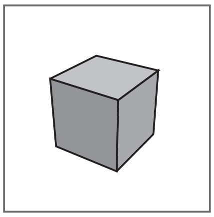
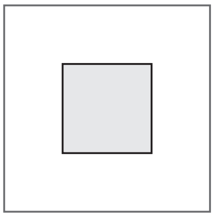
1. As the line is shifted, the lengths of its projections on the Front, Top, and Side planes keep changing. However, the projected length can never exceed the true length of the line. Therefore, the length of any projection is always less than or equal to the actual length of the line.

2.

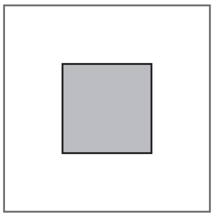
Cube (3D View)



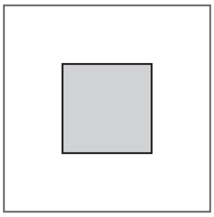
Top View



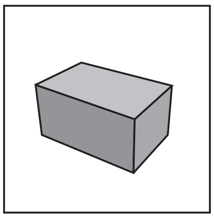
Front View



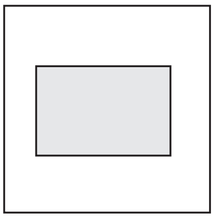
Side View



Cuboid (3D View)



Top View



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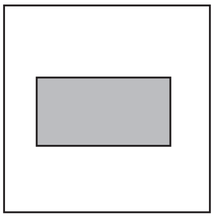
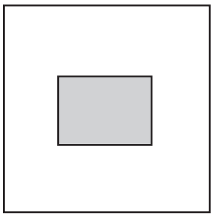
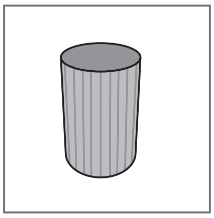


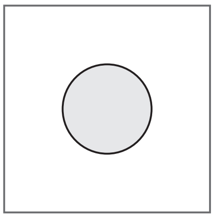
Side View



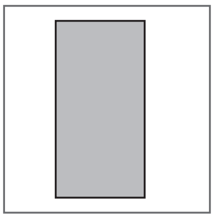
Cylinder (3D View)



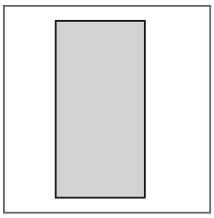
Top View



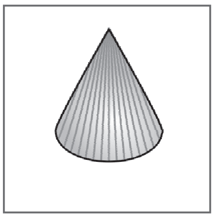
Front View



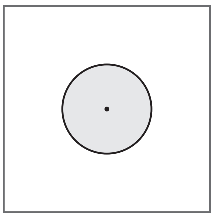
Side View



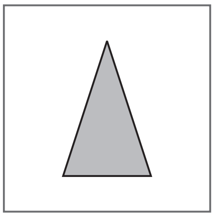
Cone (3D View)



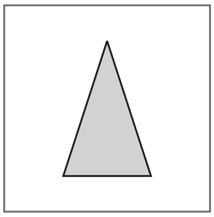
Top View



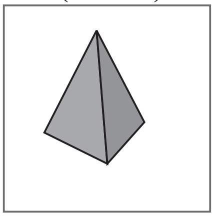
Front View



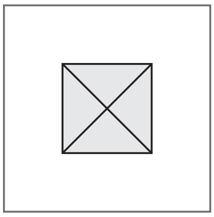
Side View



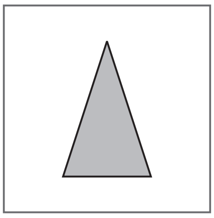
Square Pyramid (3D View)



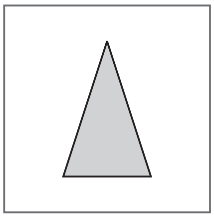
Top View



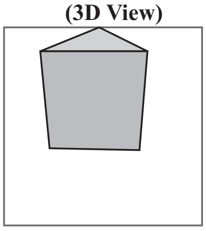
Front View



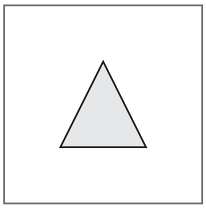
Side View



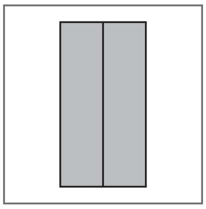
Triangula Prism (3D View)



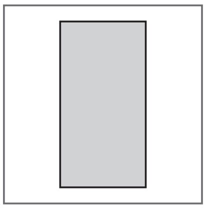
Top View



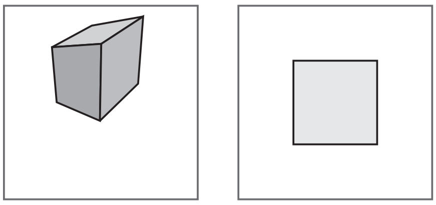
Front View



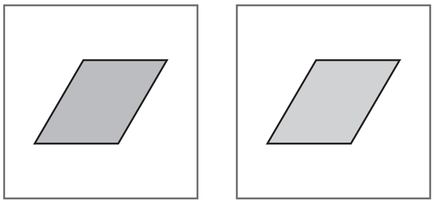
Side View



Parallelepiped (3D View) Top View



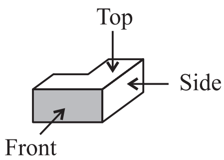
Front View Side View



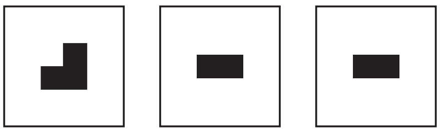
3. Do yourself

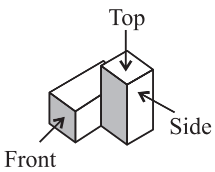
Page-95-97

1.

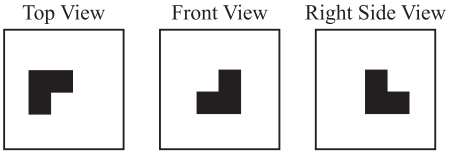


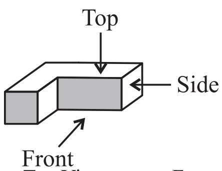
Top View Front View Right Side View



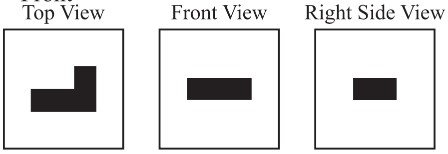


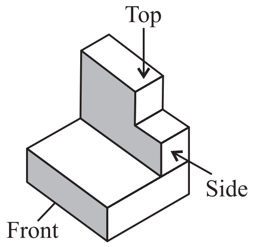
Top View Front View Right Side View



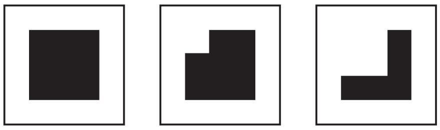


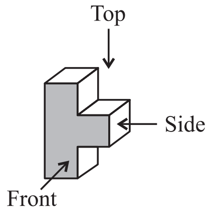
Top View Front View Right Side View



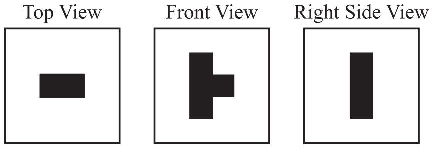


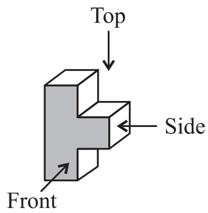
Top View Front View Right Side View



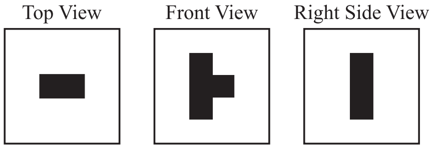


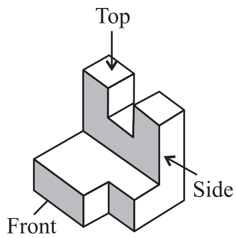
Top View Front View Right Side View



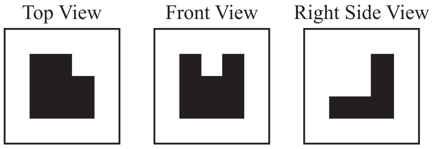


Top View Front View Right Side View

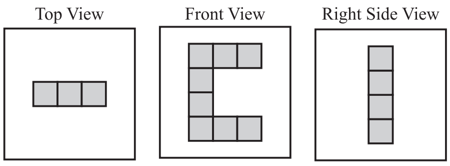




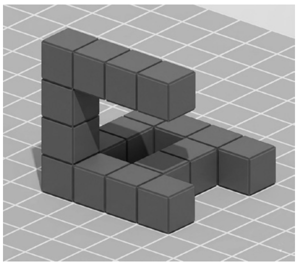
Top View Front View Right Side View

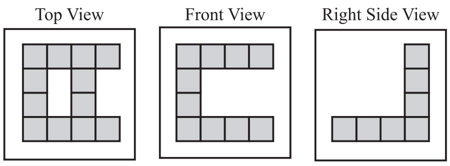


2. (i)

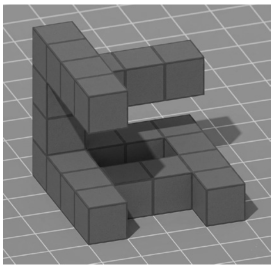


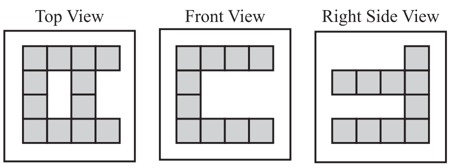
(ii)



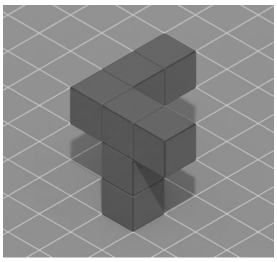


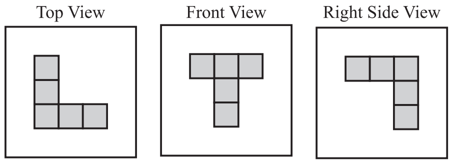
(iii)





(iv)





3. Step 1 : Front View Evaluation

The front view features a small gap in the upper right section. Because of this specific characteristic, options (i), (v), and (vii) can be ruled out immediately.

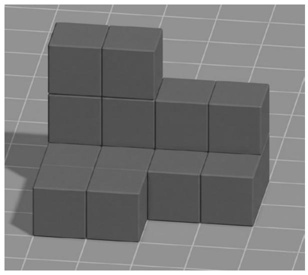
Step 2 : Top View Evaluation

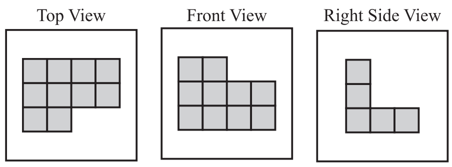
The top view shows a gap in the right corner. This implies that the solid itself must have a missing section at its front-right corner. Consequently, options (iii) and (vi) are incorrect.

Step 3 : Final Comparison

This leaves us with options (ii) and (iv). To determine the final answer, we should sketch both remaining figures to see which one aligns perfectly with all given perspectives.

(ii)

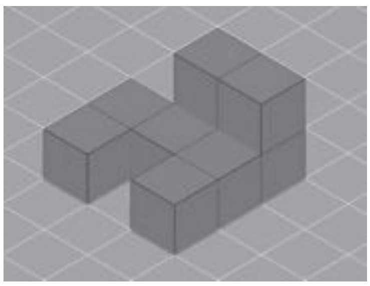




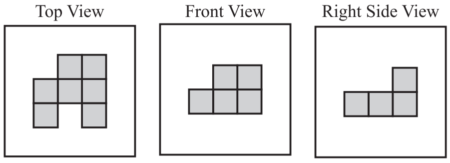
This matches our the views in the question

Thus, the correct answer is solid (ii).

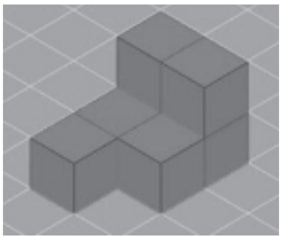
4. Using identical cubes (i), (ii) and (iii), it would look like



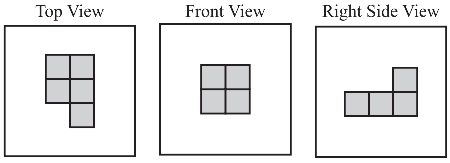
Top View Front View Right Side View



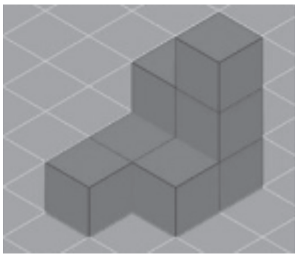
Using identical cubes (iv), (v) and (vi), it would look like



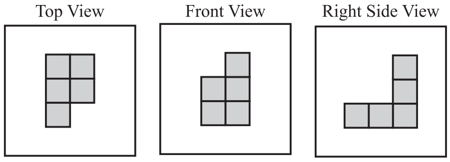
Top View Front View Right Side View



Using identical cubes (vii), (viii) and (ix), it would look like



Top View Front View Right Side View



5. The structure is a tetrahedral pyramid where the number of cubes in each layer follows the sequence of triangular numbers.

Number of cubes in the top layer = 1

Number of cubes in the second layer = 3

Number of cubes in the third layer = 6

Number of cubes in the bottom layer = 10

The total number of cubes is calculated by adding the cubes in each layer: 1 + 3 + 6 + 10 = 20.

Alternatively, for a pyramid with $n = 4$ layers, the formula for tetrahedral numbers is $\frac{[n(n + 1)(n + 2)]}{6}$.

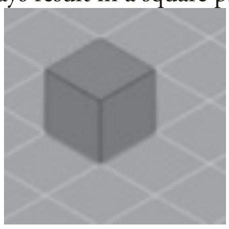
$$\text{Total cubes} = \frac{[4(4 + 1) \times (4 + 2)]}{6}$$

$$\text{Total cubes} = \frac{(4 \times 5 \times 6)}{6}$$

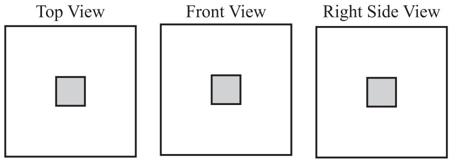
$$\text{Total cubes} = \frac{120}{6} = 20.$$

So, there are 20 cubes in total.

6. Viewing a cube from the top, front, or side will always result in a square projection.

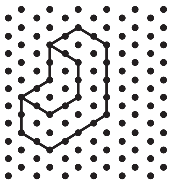


Top View Front View Right Side View

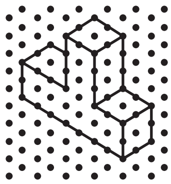


Page-100-102

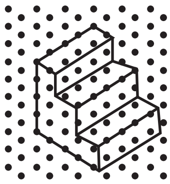
1. (i)



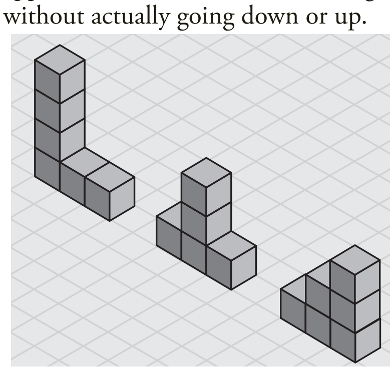
(ii)



(iii)



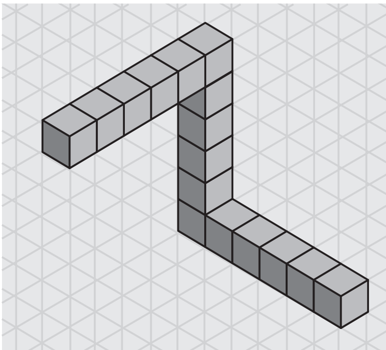
2. The arrows shows the ball moving continuously in one direction, but when we follow the path carefully, the ball appears to come back to its starting level without actually going down or up.



3. The arrows shows the ball moving continuously in one direction, but when we follow the path carefully, the ball appears to come back to its starting level without actually going down or up.

4. (i) No, Front view, Looks like a straight rectangular arrangement of cubes; Top view; Appears as a straight strip; side views; Appears consistent on its own.

(ii) It would look like this



(iii) The illusion works because

- **Lack of Perspective :** Unlike real life, objects in isometric drawings do not get smaller as they recede. This lack of depth perception tricks the eye into seeing distant objects as being on the same plane as near ones.
- **Cognitive Bias :** Our brains are programmed to interpret three intersecting lines as a 3D corner. Optical illusions exploit this by connecting these "corners" in a contradictory loop that would be impossible in physical space.

5. Tales By Dots and Lines

Work it Out—1

1. (i) First 20 even numbers: 2, 4, 6, ..., 40

Sum = 2 + 4 + ... + 40 = 2(1 + 2 + ... + 20)

$= 2 \times \left(20 \times \frac{21}{2}\right) = 2 \times 210 = 420$

Mean $= \frac{420}{20} = 21$

So, mean of first 20 even numbers = 21.

(ii) First 10 multiples of 6: 6, 12, 18, ..., 60

Sum = 6 + 12 + ... + 60 = 6(1 + 2 + ... + 10) = 6 × 55 = 330

Mean $= \frac{330}{10} = 33$

So, mean of first 10 multiples of 6 = 33.

(iii) First 10 prime numbers: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29

Sum = 2 + 3 + 5 + 7 + 11 + 13 + 17 + 19 + 23 + 29 = 129

Mean $= \frac{129}{10} = 12.9$

So, mean of first 10 prime numbers = 12.9.

Connect and Reflect

A. Multiple Choice Questions

1. (b) **2.** (c) **3.** (b) **4.** (a) **5.** (c)

B. Fill in the Blanks

1. sum **2.** median **3.** double
4. range **5.** change

C. State True or False

1. False **2.** True **3.** False **4.** True **5.** False

D. Subjective Questions

1. The mean is found by adding all values and dividing by the count of values.
2. When a value greater than the mean is added, the total sum increases by more than the average per item, so the mean increases.
3. The median is the middle value of sorted data. For an even number of observations, it is the average of the two middle values.
4. Mean with frequencies

$$= \frac{\text{Sum of (value} \times \text{frequence)}}{\text{Sum of frequencies}}.$$

5. A line graph connects data points with straight lines. It shows how a quantity changes over time.

NCERT EXERCISE

Figure It Out Questions

Page-113-114

1. (i) Mean of first 50 natural numbers

$$= \frac{\text{Sum of first 50 natural numbers}}{50}$$

Formula for sum of first n natural numbers,

$$S_n = \frac{n(n+1)}{2}$$

Sum of first 50 natural numbrs,

$$= \frac{50 \times 51}{2}$$

$$= 25 \times 51$$

Mean of first 50 natural numbers.

$$= \frac{25 \times 51}{50}$$

$$= 25.5$$

Hence, the mean of first 50 natural numbers = 25.5

(ii) Mean of first 50 odd numbers

The formula for the sum of first 50 odd numbers, $S_n = n^2$

For $n = 50$

$S_{50} = (50)^2 = 2500$

Mean of first 50 odd numbers

$$= \frac{\text{Sum of first 50 odd numbers}}{\text{Total number of terms}}$$

$$= \frac{2500}{50}$$

$$= 50$$

(iii) The first 50 multiple of 4

Multiples of 4 are 4, 8, 12, 16, ...

This shows that the multiples of 4 form an arithmetic progression with the first term 4 and common difference $d = 4$ and total number of terms, $n = 50$

Hence, Sum, $S_n = \frac{n}{2}(2a + (n-1)d)$

$$= \frac{50}{2}[2 \times 4 + (50-1)4]$$

$$= 25(8 + 49 \times 4)$$

$$= 25 \times 204$$

$$= 5100$$

Hence, the mean $= \frac{\text{Sum of terms}}{\text{Number of terms}}$

$$= \frac{5100}{50}$$

$$= 102$$

Hence, the mean of first 50 multiples of 4 is 102.

2. → from the picture, the visible dots are at: 4, 7, 8, 8, 9, 9, 9, 9, 11

So, there are 9 visible values in the picture.

→ finding the total of the values:

$4 + 7 + 8 + 8 + 9 + 9 + 9 + 9 + 11$
$= 74$

→ Using Mean formula:

Mean = 9 (given in the question) Total number in the picture = 9

After adding the missing term, the number will be 10

So, $\text{mean} = \frac{\text{Sum of number}}{\text{Total numbers}}$

$$9 = \frac{\text{Sum of number}}{10}$$

∴ Sum of number $= 9 \times 10$
$= 90$

So, the required total = 90

Hence, the missing number = 90 – 74
= 16

Hence, we should mark a dot at 16 to make mean 9.

3. It is given that there are 24 students in the class, the average height of students = 150.2 cm

∵ Each student was wearing shoe of height 1cm.

(i) No, the teacher do not need to measure the height again.

∵ Every student height is increased by 1, then the average is also increased by 1.

∵ To get the correct average height of the student, just decrease the height by 1cm.

(ii) Hence, the average height = 150. 2 cm – 1cm = 149.2 cm.

4. To find the correct option, just observe the dots carefully.

In option A : Most of the values are around 5 to 6.5 minutes.

∴ There are about 7 songs.

There values are centred around 5.5 – 5.6, So, mean = 5.57

In option B : Many values are around 0.5, 2.75, 1.5, 4.5 etc.

So, mean can not be 5.57

As the maximum in this option is 5. So, it is not possible to have mean = 5.57

In option C : In option C also all the values are bellow 5.57 and most of the values are around 3.5 – 4.5, 50, the mean can not be 5.57.

Therefore, album A has the mean of 5.57 minutes.

5. Given data is:

8, 10, 19, 23, 26, 34, 40, 41, 41, 48, 51, 55, 70, 84, 91, 92

Here, the total values are 16 which is an event number.

For even number.

$$\text{Median} = \frac{\left(\frac{n}{2}\right)^{th} \text{term} + \left(\frac{n}{2}+1\right)^{th} \text{term}}{2}$$

$$= \frac{\left(\frac{16}{2}\right)^{th} \text{term} + \left(\frac{16}{2}+1\right)^{th} \text{term}}{2}$$

$$= \frac{8^{th}\,\text{term} + 9^{th}\,\text{term}}{2}$$

$$= \frac{41+41}{2} = 41$$

Hence, the median of the data is 41.

(ii) If we add one value to the data, then the number of terms will become 17 which is an odd number.

$$\text{So, the median} = \left(\frac{n+1}{2}\right)^{th} \text{term}$$

$$= \left(\frac{17+1}{2}\right)^{th} \text{term}$$

$$= 9^{th} \text{ term}$$

And at the 9th term the value is 41, Hence the new value will not affect the median.

If we include one value to the data without affecting the median, the value can be any value which ≥ 41 or ≤ 41.

Hence, 41 is the appropriate value that can be added to the data.

(ii) Including two values to the data gives a new set of data containing 18 values, which is a even number

$$\text{So,Median} = \frac{\left(\frac{n}{2}\right)^{th} \text{term} + \left(\frac{n}{2}+1\right)^{th} \text{term}}{2}$$

$$= \frac{9^{th}\,\text{term} + 10^{th}\,\text{term}}{2}$$

But we don't want to affect the value of median,

$$\therefore \frac{9^{th}\,\text{term} + 10^{th}\,\text{term}}{2} = 41$$

$9^{th} + 10^{th}$ term = 82

So, any two values that sum to 82 can be added.

The new 9^{th} value should be ≤ 41

and 10^{th} value will be ≥ 41

For example, adding 41 and 41

40 and 42

35 and 47

39 and 43

all the pair will give the sum of 82, so we can take any of these pair.

(iii) Removing one value from the set, we will 15 values in the new set which will be an odd number

$$\text{So, the median} = \left(\frac{n+1}{2}\right)^{th} \text{term}$$

$$= 8^{th} \text{ term}$$

To keep the median at 41 the 8th term should be 41.

In the original data the 8 value and 9o value both are 41.

So, Removing any value from either of the sides leave the other at 8th position.

Hence, we can remove any value from the original data set.

6. (i) **Never true:** Because Removing a value smaller than the median shift the relative position of the median towards the larger number.

This causes the median to either stay the same or increase, but it will never decrease.

For example: In the data 2, 4, 6, 8, 10

Median is 6

If we remove 2 from the data

New data is 4, 6, 8, 10

Then, Median = 7

Hence, it is proved that median can be same or it may be increased, but it can't decrease.

(ii) **Always True:** Because adding any value lower than the current average will always "pull" the overall average down.

For example: In the data 5, 10, 15

Median is 10

If we add any value lower than the current median i.e. 2 then the new data is 5, 10, 15, 2 Median is 7.5 which is lower than the original one.

Therefore, it is always true.

(iii) **Some times true:** Because if we two values much smaller than the median and any two values much larger than the median, the median of the data remain unchanged.

But if we add 4 values larger than the median and 4 values smaller than the median, the median will definitely shift.

(iv) **Never true:** Because adding two values smaller than the median shift the data's centre towards the smaller side. This result in a median that is either lower than or equal to the original one.

For example; in the data 10, 20, 30, 40, 50 Median = 30

This shows that median is reduced.

Hence, it is Never true.

7. Given data is 8, 13, 10, 4, 5, 20, y, 10

Mean = 10.375

To find = y

$$\text{Mean} = \frac{8+13+10+4+5+20+y+10}{8}$$

$$10.375 = \frac{70+y}{8}$$

$$83.000 = 70 + y$$

$$y = 83 - 70$$

$$y = 13$$

Hence, the value of y is 13.

8. Total number of values = 15

Mean of data = 134

Sum of the data = ?

$$\text{Mean} = \frac{\text{sum of the data}}{\text{Total number of values}}$$

$$134 = \frac{\text{sum of the data}}{15}$$

Sum of the data = 134 × 15 = 2010

Hence, the sum of data is 2010.

9. Given, data is : 12, 47, 8, 73, 18, 35, 39, 8, 29, 25, p

Median of the data = 29

Total number of values = 11

So, median is $\left(\frac{n+1}{2}\right)^{th}$ term

= 6^{th} term

Arranging the data in ascending order.

8, 8, 12, 18, 25, 29, 35, 39, 47, 73, p

Here, 29 is already at 6th position.

So, we will take the value of p in such a way that the median will not change

Hence, the value of p could be, 40, 100, 29, 47 or 30.

10.

Number of times students rode their bicycle (x)	Number of students (f)	fx
0	3	0
1	1	1
2	4	8
3	7	21
4	7	28
5	5	25
6	4	24
7	6	42
8	3	24
9	0	0
10	2	20
Total number of students	42	193

(i) $$\text{Mean} = \frac{\Sigma fx}{\Sigma f}$$

$$= \frac{193}{42}$$

$$= 4.59 = 4.6$$

Hence, the average is 4.6.

(ii) To find the median $\frac{42}{2} = 21$. So, median lies between the 21^{st} and 22^{nd} observations.

$$\text{Median} = \frac{\left(\frac{n}{2}\right)^{th} + \left(\frac{n}{2}+1\right)^{th}}{2}$$

$$= \frac{21+22}{2} = \frac{43}{2} = 21.5 \approx 22 = 22^{th} \text{ term}$$

Using cumulative frequency:

Number of Students	Cumulative students
3	3
1	4
4	8
7	15
7	22

So 22 term comes on 4

So, median = 4

(iii) (a) **Invalid** because 3 students rode the bicycle 0 time ie., 3 students didn't rode the bicycle.

(b) This statement is **valid** as the majority of students and their cycle two or more time,

(c) This statement is **valid** because many students cycled 2, 4, 6, 8, or 10 times in a week, which implies more than once over the cource of the week.

(d) This statement is **invalid**. All students except 1 cycled more cycled more than once in the week.

(e) It is given that every student cycled 1 more time than they did in the previous week This shows that entire data increases by 1.

As we know that of 1 is added to each of this observation of the data then;

- Mean increased by
- Median increased by one.

If in the previous data.

Mean = 4.6

Median = 5

So, in the new week

New mean = 4.6 + 1 = 5.6

New median = 5 + 1 = 6

11.

Number of trials (x)	students (f)	fx
1	1	1
2	0	0
3	0	0
4	1	4
5	4	20
6	9	54
7	12	84
8	15	120
9	10	90
10	10	100
	$\Sigma f = 62$	$\Sigma fx = 473$

Here, the minimum value of the trial is 1.

The maximum value of the trail is 10.

Mean (average) = $\frac{\Sigma fx}{\Sigma f} = \frac{473}{62}$

= 7.63 trials

To find Median:

Total student = 62

Median position

$$= \frac{\left(\frac{n}{2}\right)^{\text{th}} \text{term} + \left(\frac{n}{2}+1\right)^{\text{th}} \text{term}}{2}$$

$$= \frac{31^{\text{th}} \text{term} + 32^{\text{th}} \text{term}}{2}$$

trials	frequency	cumulative frequency
1	1	1
4	1	2
5	4	6
6	9	15
7	12	27
8	15	42
9	10	52
10	10	62

∴ From the table we get to know that 31th term and 32th term lies on position 8.

Hence, the median is 8.

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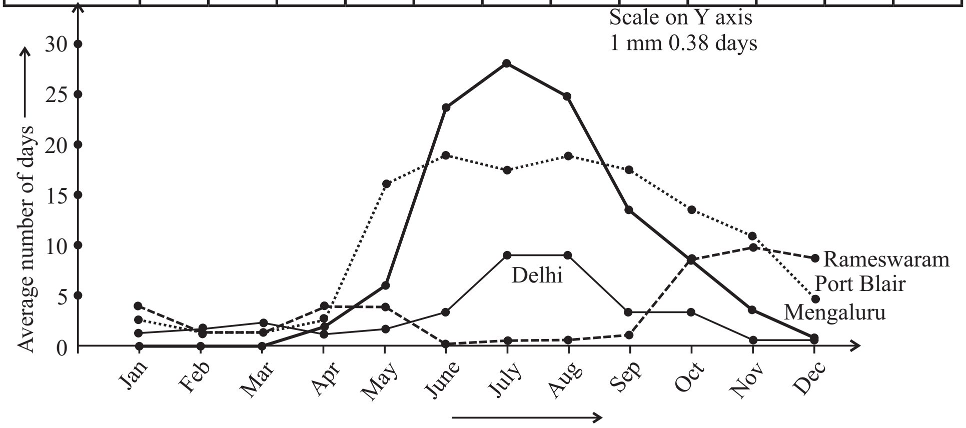
1.

2. The data is likely compiled by gathering historical weather records for each city and calculating the average number of rainy days for each specific months across those years.

Rounding of the values and making a Table

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Mengaluru	0	0	0	2	6	24	28	25	14	9	4	1.0
New Delhi	1.14	1.33	1.52	1.14	1.33	3.8	9.31	9.31	3.8	0.95	0.38	0.95
Port blair	2	1	1	3	16	19	17	19	17	14	11	5
Rameswaram	3	1	2	3	3	0	1	1	2	8	10	8



(iv) According to the table

Most rainfall days: Port blair

Least rainfall days: Rameswaram

(v) In New Delhi, Rainy season is from June to September

In Rameswaram. Rainy season is from October to December.

3. (i) The graph displays the number of birth in every month in India.

The graphs clearly shows that in the late summer there is a peak in the birth, and dip to their lowest level in winter months around December, January and February.

(ii) By looking at the graph, it is clear that birth in July 2017 lies between 1.5 M and 2M.

Therefore, the approximate value of birth 1.8 Millions.

(iii) The graph capture the time period from July 2017 to Jan 2020.

(iv) In January 2018: Number of birth is approximately 1.4 Millions.

In January 2019: Number of birth is slightly higher than the birth in January 2018. It is approximately 1.7 Million.

In January 2020: There is again a slight high in the birth in January 2020 as compared to January 2019, and January 2018.

It is approximately 1.8 Million.

(v) To estimate the total for the year, we can look at the average monthly birth for 2019, which appears to be roughly 1.75 million.

So, total birth = 1.75 million × 2

= 21.00 million

Hence, the estimated value of birth in 2019 is 21 million.

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1. (i) According to the question, average along each row, column and diagonal is 10. This means that sum along each row, column and diagonal is 30.

So the grid is

11	6	13
12	10	8
7	14	9

In the grid all the numbers are distinct and all rows, columns and diagonals sum to 30, with an average of 10.

(ii) Yes, we can change the numbers and still maintain the average of 10 in all rows, columns and diagonals (For example: using repeated the number like all 10s).

2. (i) To get a mean 8 of 3 numbers, The seem should be 24 (8 × 3 = 24)

Hence, the three number could be, 10, 8, 6 or 8, 9, 7.

(ii) For a median of 15.5 with four number, the two middle number must average to 15.5 for ex-number at the middle could be 15 and 16. 12 and 19. Hence, the four numbers are {10, 15, 16, 20), (7, 12, 19, 20).

(iii) Five numbers whose mean is 13.6. To get this mean of 15 6, the sum of five numbers should be 13.6 × 5 = 68.0

Hence, the examples are: (10, 12, 14, 16, 16) and (1, 2, 3, 2, 60)

(iv) 6 numbers whose mean = median are (i) {1, 2, 3, 4, 5, 6) and (10, 10, 10, 10, 10, 10)

(v) 6 numbers whose mean > median

For examples: (i) {1, 2, 3, 4, 5, 30)

Here, the mean = 7.5

Median = 3.5

Where, 7.5 > 3.5

i.e. Mean > median

(ii) {1, 1, 1, 1, 1, 100)

Here, Median = 1

Mean = 17.5

Here, 17.5 > 1

i.e., Mean > Median

3. In the data, arranging the number in ascending order, 5, 14, 21, —, —, —, for getting Median 13, the average value of the middle values should be 13, *i.e.* the sum of two values should be 26.

As one of the values is 21, then other value could be 5.

The other values for the median 13, could be 14 and 12 or 13 and 13.

If 13 and 13 then at the middle of the data values will be 13 and 14 whose median is 13.5. So, 13 and 13 is not correct answer.

So, we will take two values less than 14 and one value greater than 14 and less than 21.

Hence, the values could be, 5, 4, 12, 14, 17, 21.

4. Given Mean of the collection = 6.5

The values in data are, 3, 11, ×, 15, 6

$$\text{Mean} = \frac{\text{Sum of values}}{\text{Number of values}}$$

$$6.5 = \frac{3+11+x+15+6}{5}$$

$$32.5 = 35 + x$$

$$x = 32.5 - 35$$

$$x = -2.5$$

But in the question it is specified that only counting number is allowed so there are '0' possibilities.

5. (i) False

Lets take two even numbers $2n$ and $2m$

$$\text{Average} = \frac{2n+2m}{2} = m + n$$

If m is 2 and other n is 4, then the mean is 3 which is an odd number.

(ii) False

Let the multiple be $5a$, Sb, $5c$, $5d$.

Average of any two multiple of 5 are,

$$= \frac{5a+5b}{2}$$

$$= \frac{5(a+b)}{2}$$

$$= 2.5\ (a + b)$$

If $a = 3$, $b = 4$ then 2.5 (4+3)

$$= 2.5 \times 7$$

$$= 17.5$$

Which is not a multiple of 5.

(iii) True

Let the multiples are $5a$, $5b$, $5c$, $5d$, $5e$

Average of 5 multiples of 5 are

$$= \frac{5a+5b+5c+5d+5e}{5}$$

$$= a + b + c + d + e$$

So, here the sum of a, b, c, d, e should be a multiple of 5.

6. (i) The correct option is (c).

The height of the new students have to be measured to find the new average height.

(ii) The correct option is (b).

The average will increase.

Because the original average height is 150.2 cm.

The heights of new students are 149 cm and 152 cm.

Average of two new heights,

$= \frac{149+152}{2} = 150.5$ cm

The average of new students height is slightly higher than the average of original class heights.

Therefore, the overall class average should slightly increase. Hence, the correct answer is. (b).

(iii) The correct answer is option (d).

The information is not sufficient to make a claim about median.

Because the median is the middle value of the data set when it is in ascending order.

Adding two new data points changes the total number of students, which shift the position of the median.

Without knowing the original number of student in the class and their heights, it is S impossible to determine if the median will remain the same, increase or decrease.

7. No, 17 is not the average of the data shown in the dot plot.

<u>Method used to answer the question</u>:

Listing the dot points from the dot plot

14 : two ×

16 : two ×

16 : three ×

17 : five ×

18 : four ×

19 : four ×

20 : three ×

21 : one ×

22 : zero ×

23 : one ×

Hence, the data set is: 14, 14, 15, 15, 16, 16, 16, 17, 17, 17, 17, 17, 18, 18, 18, 18, 19, 19, 19, 19, 20, 20, 20, 21, 23

Calculating the sum of data: 443

Number of data points = 25

Average of the data points $= \frac{443}{25}$

$= 17.72$

Hence, 17 is not the average of the data points.

8. The mean weight will decrease, and the median weight can not be determined without the full dataset.

The mean weight is calculated by summing all weight dividing it by the number of people. The net change in total weight is – 2kg + 1kg + 1kg = 0 kg.

Since the total weight change is zero, the mean weight will not change from the previous month's average of 65.3kg.

The mean is still 65.3 kg, which is a decrease relative to the precious month's mean because there is not any increase in the weight as compared to the previous weight, this shows that mean is relatively decreased.

But according to the question, it is asked that, "what can we say about the change in mean weight and median weight this month?

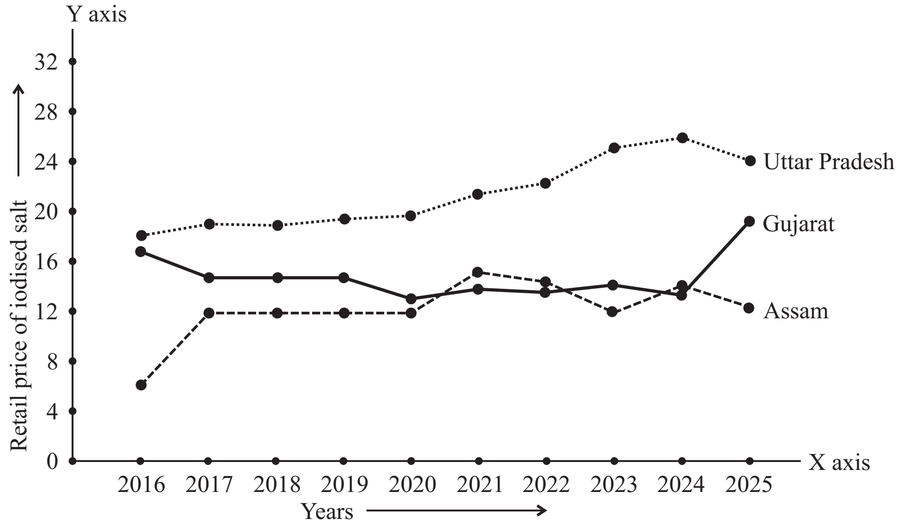
The mean weight has no change.

The median is the middle value in the ordered data. The specific weight that are changed and their position relative to the current median of 67 kg are unknown.

Therefore, the median can not be determined if it is changed or not.

9. We will select the data from Assam, Gujarat and Uttar Pradesh.

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Assam	6	12	12	12	12	15	14	12.02	13.72	12.35
Gujarat	16.5	14.75	14.75	14.75	13	14.45	14.28	14.54	14.8	19.2
Uttar Pradesh	16.15	16.97	16.18	18.24	18.96	20.63	21.3	25.39	26.9	24.81



A line graph is plotted with:

Years on X-axis

Retail price (₹) on Y-axis

(ii) Analyzing the data

Assam: Price remained relatively stable from 2017 to 2020 then a slight fluctuation and continued this fluctuation.

Gujarat: Initially prices decreased from 2016. and 2020 then a slow graded increase in the price.

Uttar Pradesh: Prices in Uttar Pradesh showed a consistent upward trend throughout the period, with a significant increase in later years.

(iii) Gujarat: The prices started at ₹ 16.50 in 2016 and ended at ₹ 19.20 in 2025 with a net increase of ₹ 2.70. In some yars, price got decreased continuously.

Uttar Pradesh: The price started at ₹16.15 in 2016 and ended at ₹ 24.81 in 2025. There is a net increase of 8.66 in the retail price of iodised salt in Uttar Pradesh.

There is a steady, significant increase in the prices over the decade.

(iv) In west Bengal the price increased the most.

₹ 23.99 – 9.47 = ₹ 14.52

There is an increase of ₹ 14.52 over the decade.

(v) Tam curious to explore the potential economic logistical or policy reasons that caused the price of iodised salt in West Bengal to increases so much more significantly than in the other listed states.

10. (i) Valid

In 1983, the urban line for kerosene is at the top of its graph and urban line for majority is at the top of its graph.

(ii) Valid

The line of kerosene in both rural and urban areas clearly trends downwards from 1983 to 2023.

(iii) Invalid

It is almost 90% of the urban household used electricity and 10% of the urban uses kerosene.

(iv) Invalid

There is 100% electricity in urban areas but it is not 100% in rural areas. So, we can not say that there were no power cuts.

11. (i) Children under aged 10 in urban areas spend each day on hobbies and games, for almost 2.1 hours.

(ii) 14 years

(iii) (a) is incorrect statement

(b) Can not be determined

Because the graph shows the average time spent not the exact time spent by every single individual.

12. Do yourself.

13. Do yourself.

14. (i) At Ghuar Moti the sunrise is earliest in January, at almost 06:00.

The approximate day length in Ghuar Moti is of 10 hours 15 minutes.

(ii) Ghuar Moti has the longest day length over the year

(iii) We observe that Day length fluctuate throughout the year, being shortest in December and January and longest around June/July.

15. (i) On Amavasya, the moon rises and sets almost with the sun.

In the graph, the moon rise and moon set times are closest to 00:00 (midnight) around day 1.

On Purnima, the moon rises around sunset about 18:00 and sets around 07:00 on Day 13.

Hence, the Purnima occur around the 13^{th} day.

(ii) We notice that

- The moon rise and moon set times change every day.
- The moon rises later each day.
- The moon sets later each day as well.

We wonder about:

- Why does the moon rises about 40-50 minutes later every day.
- Why do the phases of the moon changes form new moon to full moon?

6. Algebra Play

Work it Out—1

1. Largest digit as multiplier.

Remaining in decreasing order.

Largest digit = 9 (multiplier), then 64 as the two-digit number.

$64 \times 9 = 576$

So, the largest product is 576 (arrangement: 64×9).

2. Largest digit = 7 (multiplier).

Remaining digits: 5, 2 → form 52.

$52 \times 7 = 364$

So, the largest product is 364 (arrangement: 52×7).

Work it Out—2

1. $(10y + x) - (10x + y) = 10y + x - 10x - y = 9y - 9x = 9(y - x)$

So, the result is $9(y - x)$, which is still divisible by 9.

Connect and Reflect

A. Multiple Choice Questions

1. (c) **2.** (c) **3.** (c) **4.** (b) **5.** (c)

B. Fill in the Blanks

1. letters (or variables) **2.** 10

3. $4x + 16$ **4.** multiplier **5.** 9

C. State True or False

1. False **2.** True **3.** False **4.** True **5.** True

D. Subjective Questions

1. Algebra converts number puzzles into mathematical statements and proves why tricks always give fixed results, regardless of the starting number.

2. In a number pyramid, each block contains the sum of the two blocks directly below it.

3. For a 2 × 2 calendar grid with top-left date = n, the four dates are n, $n + 1$, $n + 7$, $n + 8$. Sum = $4n + 16$. Knowing the sum, we find n by : $n = \frac{(\text{Sum} - 16)}{4}$.

4. To get the largest product, place the largest digit as the multiplier and arrange the remaining digits in decreasing order to form the larger multi-digit number.

5. Any two-digit number = $10x + y$.

Its reverse = $10y + x$.

Difference = $9(x - y)$ or $9(y - x)$, which is a multiple of 9.

NCERT EXERCISE

Figure It Out Questions

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1. (i) Bottom row:

4	13	8

7	11	3

10	14	25

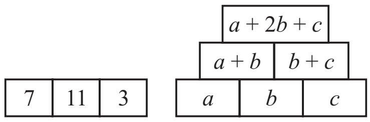
(i) If a = 4, b = 13 and c = 8, then

Top number = a + 2b + c

$= 4 + 2 \times 13 + 8$

$= 4 + 26 + 8 = 38$

Therefore, the number in the topmost row is 38.



(ii) If a = 7, b = 11, c = 3, then

Top number = 3 + 2b + c

= 7 + 2 × 11 + 3

= 7 + 22 + 3 = 32

Therefore, the number in the topmost row is 32.

(iii) If a = 10, b = 14, c = 25, then

Top number = a + 2b + c

= 10 + 2 × 14 + 25

= 10 + 28 + 25

= 63

Therefore, the number in the topmost row is 63.

2. Expression for topmost row of 4-row pyramid in terms of bottom row a, b, c, d:

Top = $a + 3b + 3c + d$ (using Pascal's triangle coefficients).

3. (i) Let the bottom row be a, b, c, d, and the number in the topmost row be ($a + 3b + 3c + d$).

Given bottom row: 8, 19, 21, 13

If $a = 8$, $b = 19$. $c = 21$, $d = 13$, then

Top number = $a + 3b + 3c + d$

8 + 3 × 19 + 3 × 21 + 13

= 8 + 57 + 63 + 13 = 141.

Therefore, the number in the topmost row is 141.

(ii) Let the bottom row be: a, b, c, d, and the number in the topmost row be ($a + 3b + 3c + d$).

Given bottom row: 7, 18, 19,6

If $a = 7$, $b = 18$, $c = 19$, $d = 6$, then Top number = $a + 3b + 3c + d$

= 7 + 3 × 18 + 3 × 19 + 6

= 7 + 54 +57 + 6 = 124.

Therefore, the number in the topmost row is 124.

(iii) Let the bottom row be a, b, c, d, and the number in the topmost row be ($a + 3b + 3c + d$).

Given bottom row: 9, 7, 5, 11

If $a = 9$, $b = 7$. $c = 5$, $d = 11$, then

Top number = $a + 3b + 3c + d$

= 9 + 3 × 7 + 3 × 5 + 11

= 9 + 21 + 15 + 11 = 56.

Therefore, the number in the topmost row is 56.

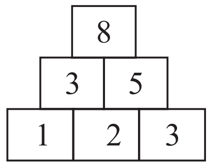
4. First three Virahanka-Fibonacci numbers (1, 2, 3) in bottom row of 3-row pyramid:

Bottom: 1, 2, 3

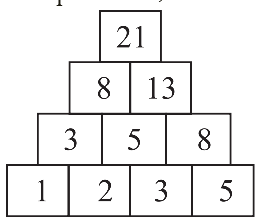
Middle: 1 + 2 = 3, 2 + 3 = 5

Top: 3 + 5 = 8

All are Virahanka-Fibonacci numbers (1, 2, 3, 5, 8...). Top = 8.



5. (i) Same as question 4;



(ii) If first n Virahanka-Fibonacci numbers in bottom row, every block is also a Virahanka-Fibonacci number, and the top equals the ($2n - 1$)th Virahanka-Fibonacci number.

where $n = 29$;

2 × 29 – 1 = 57

6. If first n Virahanka-Fibonacci numbers in bottom row, every block is also a Virahanka-Fibonacci number, and the top equals the $(2n - 1)^{th}$ Virahanka-Fibonacci number.

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1. Largest = 7 (multiplier). Remaining: 3, 1 → 31.

31 × 7 = 217. So, largest product = 217.

2. Largest = 9 (multiplier). Remaining: 5, 3 → 53.

53 × 9 = 477. So, largest product = 477.

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1. In the 2-digit reverse trick, quotient when dividing by 9 :

If number = $10x + y$, difference = $9(x - y)$, quotient = $x - y$ (the difference of the digits).

2. Sum of number and its reverse always divisible by 11:

$(10x + y) + (10y + x) = 11x + 11y = 11(x + y)$

Since 11 is a factor, the sum is always divisible by 11. Yes, always true.

3. Any 3-digit number abc = $100a + 10b + c$.

Other cycled versions: $bca = 100b + 10c + a$, $cab = 100c + 10a + b$.

Sum = $100a + 10b + c + 100b + 10c + a + 100c + 10a + b = 111a + 111b + 111c$

$= 111(a + b + c) = 3 \times 37 \times (a + b + c)$.

This is always divisible by 37 and by 3. Yes, always true.

4. Repeating abc as $abcabc = abc \times 1001 = abc \times 7 \times 11 \times 13$.

Dividing by 7, then 11, then 13 gives back abc.

Try with any number.

5. Let initial number of flowers = x

Let flowers dropped at each shrine = y

At the end, he has 0 flowers, so before Shrine 3 he had y flowers

Using the relation "before pond = $\frac{1}{2}$ × after pond", before pond 3, he had $\frac{y}{2}$ flowers

Before Shrine 2, using "before shrine = remaining + dropped", flowers = $y + \frac{y}{2} = \frac{3y}{2}$

Before Pond 2, flowers = $\frac{1}{2} \times \frac{3y}{2} = \frac{3y}{4}$

Before Shrine 1, flowers = $y + \frac{3y}{4} = \frac{7y}{4}$

At the start, flowers = $\frac{1}{2} \times \frac{7y}{4} = \frac{7y}{8}$

Since total flowers must be a whole number, $\frac{7y}{8}$ must be an integer, smallest $y = 8$

So, the initial number of flowers is 7.

6. Horses and hens: Total heads = 55, total legs = 150.

Let horses = h, hens = $55 - h$

$4h + 2(55 - h) = 150$

$4h + 110 - 2h = 150$

$2h = 40$, $h = 20$ horses

Hens = $55 - 20 = 35$ hens

So, there are 20 horses and 35 hens.

7. Mother is 5 times daughter's age now. In 6 years, mother is 3 times daughter.

Let daughter's age = d, mother's age = $5d$

In 6 years: $5d + 6 = 3(d + 6)$

$5d + 6 = 3d + 18$

$2d = 12$, $d = 6$ years

So, the daughter is currently 6 years old.

8. Gauri says to Naina: "You have twice as many cows."

Let Gauri's cows = g,

Naina's = $2g$.

If Naina gives 3 to Gauri: Gauri = $g + 3$, Naina = $2g - 3$.

These become equal: $g + 3 = 2g - 3 \rightarrow g = 6$,

Naina has $2 \times 6 = 12$ cows.

So, Gauri has 6 cows and Naina has 12 cows.

9. Dosa cart expenses: Rent = Rs 5000/day,

Cost per dosa = Rs 10.

(i) Selling 100 dosas, profit = Rs 2000.

Total revenue needed = 5000 (rent) + 100 × 10 (ingredients) + 2000 (profit) = 8000

Selling price per dosa = $\frac{8000}{100}$ = Rs 80

So, the selling price should be Rs 80 per dosa.

(ii) Customers pay Rs 50 per dosa.

Target profit = Rs 2000.

Revenue = $50x$, Expenses = $5000 + 10x$

$50x - (5000 + 10x) = 2000$

$40x = 7000$, $x = 175$ dosas

So, 175 dosas should be sold per day.

10. Sequence of fractions:

$\frac{1}{3}, \frac{(1 + 3)}{(5 + 7)}, \frac{(1 + 3 + 5)}{(7 + 9 + 11)}$

$= \frac{1}{3}, \frac{4}{12}, \frac{9}{27}$

$= \frac{1}{3}, \frac{1}{3}, \frac{1}{3}$

Observation: Each fraction equals $\frac{1}{3}$.

Explanation: Numerator = sum of first n odd numbers = n^2.

Denominator = sum of next n odd numbers.

The $(n + 1)^{th}$ to $(2n)^{th}$ odd numbers start at $(2n - 1)$ and end at $(4n - 1)$.

Their sum = $\frac{n \times (2n - 1 + 4n - 1)}{2}$

= $\frac{n \times (6n - 2)}{2}$ = $n \times (3n - 1)$.

Wait, actually = n^2 for each numerator and $3n^2$ would differ.

Rechecking by observation: $\frac{1}{3}, \frac{4}{12} = \frac{1}{3}, \frac{9}{27} = \frac{1}{3}$.

Pattern = $\frac{1}{3}$ always.

7. Area

Work it Out—1

1. (i) Unknown side = $\frac{\text{Area}}{\text{side}} = \frac{32}{4}$

$\Rightarrow x = 8$ in

(ii) Area $\Rightarrow$ $(5 + z) \times 5 = 60$

$\Rightarrow 5 + z = 60 \div 5$

$\Rightarrow 5 + z \pm 12$

$\Rightarrow z = 12 - 5 = 7$m

Work it Out—2

1. Area of right-angled triangle with legs 12 cm and 5 cm.

Area = $\left(\frac{1}{2}\right)$ × base × height = $\left(\frac{1}{2}\right) \times 12 \times 5 = 30$ cm²

So, area = 30 cm².

2. Area of obtuse triangle with base 6 cm and height 10 cm (measured outside).

Area = $\left(\frac{1}{2}\right)$ × base × height = $\left(\frac{1}{2}\right) \times 6 \times 10 = 30$ cm²

So, area = 30 cm².

3. Triangle area = 50 m², height = 5 m.

$50 = \left(\frac{1}{2}\right) \times \text{base} \times 5$

$50 = 2.5 \times \text{base}$

base = $\frac{50}{2.5} = 20$ m

So, the base is 20 m.

Work it Out—3

1. Area of quadrilateral where diagonal = 40 cm, perpendicular heights = 12 cm and 8 cm.

Area = $\left(\frac{1}{2}\right) \times \text{diagonal} \times (h_1 + h_2)$

= $\left(\frac{1}{2}\right) \times 40 \times (12 + 8)$

= $\left(\frac{1}{2}\right) \times 40 \times 20 = 400$ cm²

So, area = 400 cm².

Work it Out—4

1. Parallelogram area = 120 cm², base = 15 cm.

Area = base × height

120 = 15 × height

height = $\frac{120}{5} = 8$ cm

So, the height is 8 cm.

Connect and Reflect

A. Multiple Choice Questions

1. (b) **2.** (b) **3.** (b) **4.** (c) **5.** (b)

B. Fill in the Blanks

1. length, width **2.** congruent
3. base, height **4.** perpendicular
5. triangles

C. State True or False

1. False **2.** True **3.** True **4.** False **5.** True

D. Subjective Questions

1. Rectangle length 15 cm, breadth 8 cm.

Area = 15 × 8 = 120 cm²

Area of triangle formed by diagonal = $\left(\frac{1}{2}\right) \times 120 = 60$ cm²

So, area = 120 cm², triangle area = 60 cm².

2. Base 12 cm, height 7 cm.

Area = $\left(\frac{1}{2}\right) \times 12 \times 7 = 42$ cm²

So, area = 42 cm².

3. Base 14 cm, height 9 cm.

Area = 14 × 9 = 126 cm^2

So, area of parallelogram = 126 cm^2.

4. Rhombus diagonals 16 cm and 10 cm.

Area = $\left(\frac{1}{2}\right) \times 16 \times 10 = 80\ cm^2$

So, area = 80 cm^2.

5. Trapezium parallel sides 18 cm and 12 cm, height 6 cm.

Area = $\left(\frac{1}{2}\right) \times 6 \times (18 + 12) = \left(\frac{1}{2}\right) \times 6 \times$ 30 = 90 cm^2

So, area = 90 cm^2.

NCERT EXERCISE

Figure It Out Questions

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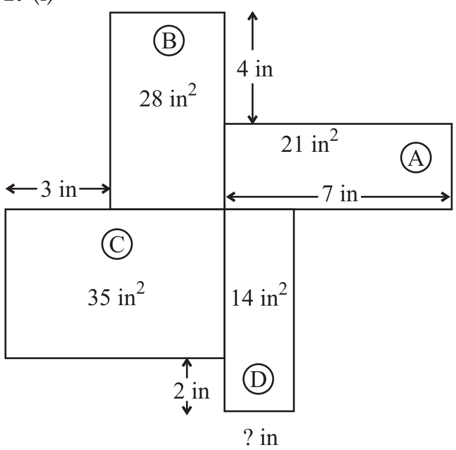
1. (i)



Let us divide the figure in 4 parts A, B, C, D.

In part A;

Length = 7 in

Area = 21 in^2

Breadth = ?

Area = Length × Breadth

21 in^2 = 7 in × breadth

Breadth = $\frac{21\ in^2}{7\ in}$ = 3 in

So, In part A, breadth = 3 inch

In part B;

Length = 4 in + 3 in

= 7 in

Area = 28 in^2

Breath = ?

Area = Length × Breadth

28 in^2 = 7 in × Breadth

Breadth = $\frac{28\ in^2}{7\ in}$ = 4 in

So, In part B, breadth = 4 in

In part C ;

Length = 3 in + 4 in

= 7 in

Area = 35 in^2

Breadth = ?

Area = Length × Breadth

35 in^2 = 7 in × Breadth

Breadth = $\frac{35\ in^2}{7\ in}$ = 5 in

So, In part C; breadth = 5 inch

In Part D ;

Length = 5 in + 2 in

= 7 in

Area = 14 in^2

Breadth = ?

Area = Length × Breadth

14 in^2 = 7 in × breadth

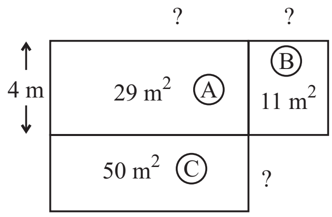
Breadth = $\frac{14\ in^2}{7\ in}$ = 2 in

∴ In part D,

Breadth = 2 inch

Hence, the missing side length = 2 inch

(ii)



Let us divide the figure in 3 parts A, B, C

In part A;

Area = 29 m^2

Breadth = 4 m

Length = ?

$$\text{Area} = l \times b$$

$$l = \frac{\text{Area}}{b}$$

$$l = \frac{29m^2}{4m} = 7.25 \text{ m}$$

In part B,

$$\text{Area} = 11 \text{ m}^2$$

$$\text{Length} = 4 \text{ m}$$

$$\text{Breadth} = ?$$

$$\text{Area} = l \times d$$

$$b = \frac{\text{Area}}{l}$$

$$b = \frac{11m^2}{4m}$$

$$b = 2.75 \text{ m}$$

In part C

$$\text{Length} = 7.25 \text{ m}$$

$$\text{Area} = 50 \text{ m}^2$$

$$\text{Breadth} = ?$$

$$\text{Area} = l \times b$$

$$b = \frac{\text{Area}}{l} = \frac{50m^2}{7.25m}$$

$$b = \frac{50m^2 \times 100}{7.25m}$$

$$b = 6.896 \text{ m} \approx 6.9\text{m}.$$

2. (i) To find the area of the path, we need to find the length and breadth of park EFGH and length and breadth of ABCD.

Let assume that length EF and breadth FG of the EFGH are 6 m and 5 m respectively and length AB and breadth BC of ABCD are 8 m and 7 m respectively.

To find the area of the path

= Area of bigger rectangle ABCD – Area of smaller rectangle EFGH

= 8m × 7m – 6m × 5m

=56 m^2 – 30 m^2

= 26 m^2

(ii) No, If only the width of the path is given, we can not find the area of the path. To find the area of the path, let assume the length EF of the park EFGH be 10 m and breadth be 8 m.

And the width of the path be 1 m.

∴ Area of the park EFGH

= Length × Breadth

= 10 m × 8 m

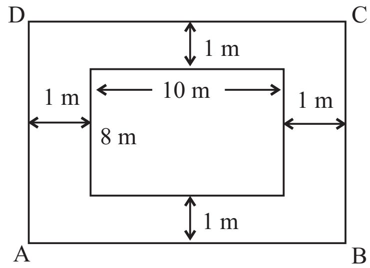
= 80 m^2

The length of AB = 10 m + 1m + 1m

= 12 m

The breadth of BC = 8 m + 1m + 1m

= 10 m



∴ The Area of ABCD = $l \times b$

= 12 m × 10 m

= 120 m^2

The Area of the path = Area of ABCD – Area of EFGH

=120 m^2 – 80 m^2

= 40 m^2

(iii) No, the area of the path does not change, when the outer rectangle is moved, while keeping the inner rectangular park EFGH inside it because the length and width of inner and outer rectangle are same, only the position of outer rectangle is moved.

So, it will not affect the area of the path.

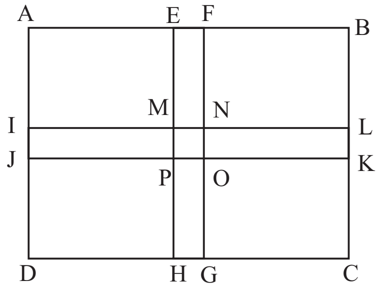
3. In the figure shown in the question, the length and width of the plot are given.

Measurement we need : To find the area of the crosspath, we required a path of width.

The horizontal length of the path = The length of the plot = 14 m.

The vertical length of the path = The width of the path = 12 m

Let us assume the width of the path = x m



The crosspath consist of:

A vertical strip EFGH

A horizontal strip UKL

Area of vertical path EFGH = $12 \times x$

Area of horizontal path IJKL = $14 \times x$

Area of crosspath = Area of EFGH + Area of IJKL – Area of MNOP

[Area of MNOP occurred twice, so we will subtract it once]

$= 12 \times x + 14 \times x - x.x$

$= 12x + 14x - x^2$

$= 26x - x^2$

For example:

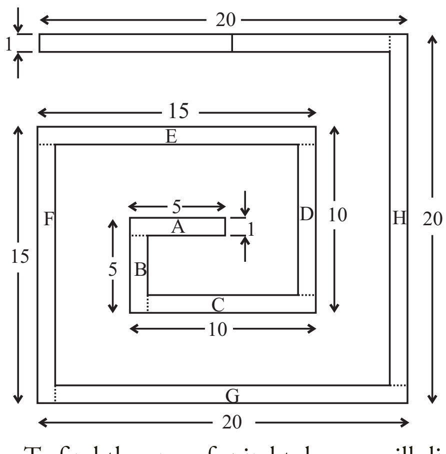
Let consider width of crosspath = 2 m

Area of crosspath $= 26 \times 2 - (2)^2$

$= 52 - 4$

$= 48 \text{ m}^2$

4.



To find the area of spiral tube, we will divide the tube in different parts such as A, B, C, D, E, F, G, H, I

Area of part A = $5 \times 1 = 5$

Area of part B = $4 \times 1 = 4$

Area of part C = $9 \times 1 = 9$

Area of part D = $9 \times 1 = 9$

Area of part E = $14 \times 1 = 14$

Area of part F = $14 \times 1 = 14$

Area of part G = $19 \times 1 = 19$

Area of part H = $19 \times 1 = 19$

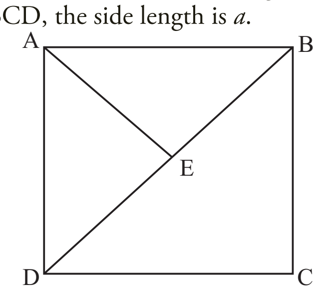
Area of part I = $19 \times 1 = 19$

Total Area = $5 + 4 + 9 + 9 + 14 + 14 + 19 + 19 + 19$

$= 112$

If we want a straight tube with the same area as of the bent tube, its length should be 112, if we keep the width of the straight tube same as of the bent tube, But if the width changes then length will also change.

5. Let us assume that in the given square ABCD, the side length is a.



Hence, the Area of the square

= Side × Side

$= a \times a = a^2$

According to the question, if we double the side length of the square, then the new side length

$= 2a$

Hence,

New area $= s \times s$

$= 2a \times 2a$

$= 4a^2$

Which is 4 times of the original area.

This shows that if we double the side length of the square the area becomes 4 times.

Hence, area of region 1, 2 and 3 also becomes 4 times

6. Do Yourself.

Page-157-159

1. (i) Area of triangle

$= \frac{1}{2} \times \text{base} \times \text{height}$

$= \frac{1}{2} \times 4 \times 3$

$= 6$ sq. units

(ii) Area of triangle

$= \frac{1}{2} \times$ base $\times$ height

$= \frac{1}{2} \times 5 \times 3.2$

$= 8.0$ sq. units

(iii) Area of triangle

$= \frac{1}{2} \times$ base $\times$ height

$= \frac{1}{2} \times 3 \times 4$

$= 6$ square units

2. Area of $\Delta ABC = \frac{1}{2} \times BC \times AX$

$= \frac{1}{2} \times 6 \times 4$

$= 12$ sq. units

Again, Area of ΔABC

$= \frac{1}{2} \times AC \times BY$

$12 = \frac{1}{2} \times 8 \times BY$

$\because \frac{1}{2} \times 8 \times BY = 12$

$BY = \frac{12 \times 2}{8}$

$BY = 3$ units

Hence, the length of altitude BY = 3 units

3. In the question, it is given that,

$SE \perp UB$

Area of ΔSEB 24 sq. units and ΔSUB is an isosceles triangle.

$\because \Delta SUB$ is an isosceles triangle

$\therefore$ SU = SB

and $SE \perp UB$

$\because$ In isosceles triangle, the perpendicular bisector divides the triangle into two equal half

So, area of $\Delta SUB = 2 \times$ Area of ΔSEB

$= 2 \times 24$ sq. units

$= 48$ sq. units

4. According to Sulbha-Sutras, to transform a rectangle into a triangle with the same area; the method is:

- Take a rectangle with length l and breadth b.
- Draw a triangle with the same base l, with a height which is double the breadth of the rectangle (b).
  i.e., height of triangle is $2b$.
- Area of rectangle $= l \times b$

  Area of triangle $= \frac{1}{2} \times l \times 2b$

  $= l \times b$

  Therefore, the area of triangle is equal to the area of rectangle.

5. To transform a triangle into a rectangle of the same area:

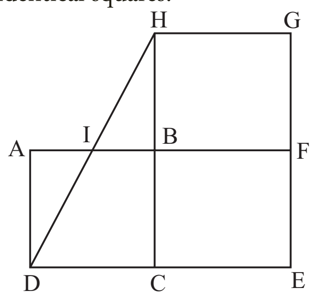
- Draw a triangle with base (b) and height (h).
- Draw a rectangle with the same base (b) and height $\left(\frac{h}{2}\right)$ *i.e.,* with the height of half of the height of triangle.
- Area of triangle $= \frac{1}{2} \times b \times h$

  Area of rectangle $= b \times \frac{h}{2}$

  $= \frac{1}{2} \times b \times h$

  Which is same as that of area of triangle.

6. In the given figure ABCD, BCEF, BFGH are identical squares.



This shows that side length of all the square are same.

Area of $\Delta HDC = 49$ sq. unit

$\because$ Square are identical

$$BC = HB$$
$$HC = 2\ BC$$

In square ABCD and triangle ΔHDC, both are having the same base and height of ΔHDC is double of the side length of square

$\therefore$ Area of square = Area of ΔHDC

Area of square is 49 sq. units

$\therefore$ Side × Side = 49 sq units

Side = 7 units

Let consider DH intersect AB at 1

$\because$ AB = 7 units

$$AI = \frac{7}{2} \text{ units}$$

So, Area of $\Delta AID = \frac{1}{2} \times b \times h$

$$= \frac{1}{2} \times \frac{7}{2} \times 7$$
$$= \frac{49}{4} \text{ sq. units}$$
$$= 12.25 \text{ sq units}$$

Thus, the area of blue region is 12.25 sq units (ii) If the total area enclosed by the blue and red region 180 sq units.

i.e., Area of ΔHDC + Area of ΔAID 180 sq. units.

Let, consider the sidelength of square a unit

$$\Rightarrow \frac{1}{2} \times DC \times HC + \frac{1}{2} \times AI \times AD = 180$$
$$\Rightarrow \frac{1}{2} \times a \times 2a + \frac{1}{2} \times \frac{a^2}{2} \times a = 180$$
$$\Rightarrow a^2 + \frac{a^2}{4} = 180$$
$$\Rightarrow \frac{5a^2}{4} = 180$$
$$\Rightarrow a^2 = \frac{180 \times 4}{5}$$
$$\Rightarrow a^2 = 36 \times 4$$
$$\Rightarrow a = 6 \times 2 = 12 \text{ units}$$

Hence, the sidelength of each square = 12 units

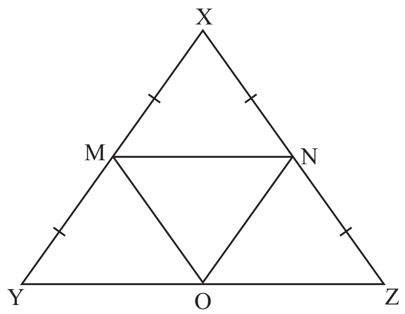
$\therefore$ The area of each square = side × side

$$= 12 \times 12$$
$$= 144 \text{ sq. units}$$

Hence, the area of each square = 144 sq. units.

7. It is given that M and N are the midpoint of XY and XZ. So, using midpoint theorem MN || YZ.

Take a point O on the mid point of YZ. *i.e.*, YO = OZ



Join MO and NO.

MO || XZ, NO || XY

$\because$ M is the mid point of XY

$\therefore$ XM = MY

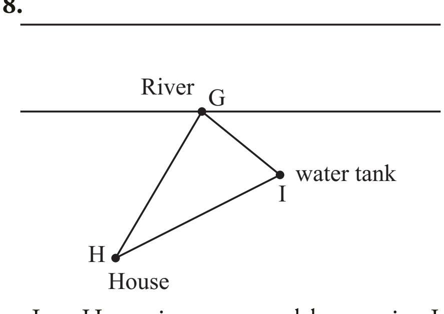
$\because$ N is the midpoint of XZ

$\therefore$ XN = NZ.

ΔXYZ is divided into four equal triangles.

So, Area of $\Delta XMN = \frac{1}{4} \times$ Area of AXYZ.

8.



Let, House is represented by a point H, water is represented by I and river is represented by G. The shortest path from H to G to I is created by the point G such that AHGI has minimum area. Hence, the shortest path is;

House (H) → River (G) → Water Tank (*l*)

Page 160

1. The area of quadrilateral ABCD

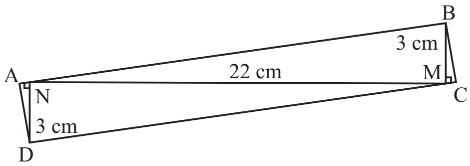
= Area of ΔABC + Area of ΔADC

$= \frac{1}{2} \times AC \times BM + \frac{1}{2} ND \times AC$

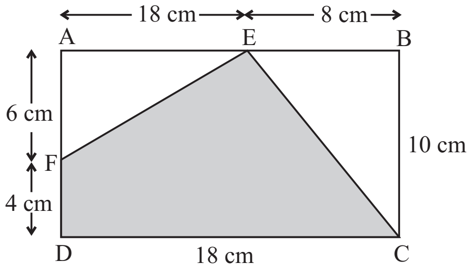
$= \frac{1}{2} \times 3 \times 22 + \frac{1}{2} \times 3 \times 22$

= 33 + 33

= 66 cm^2



2.



Area of the shaded region = Area of rectangle

ABCD – (Area of ΔEAF + Area of ΔEBC)

$= AB \times BC - \left(\frac{1}{2} \times AE \times AF + \frac{1}{2} \times EB \times BC\right)$

$= 18 \times 10 - \left(\frac{1}{2} \times 10 \times 6 + \frac{1}{2} \times 8 \times 10\right)$

= 180 – (30 + 40)

= 180 – 70

= 110 cm^2

3. To find the area of a regular hexagon, you only need to know one of the following measurement:

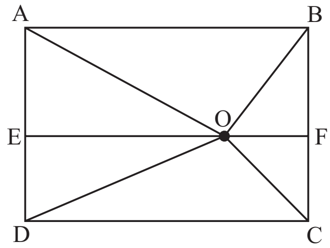
- The sidelength (s): Since all sides are equal in regular hexagon so by knowing one side, we can use the formula

  Area = $\frac{3\sqrt{3}s^2}{2}$

- The apothem (a): This is the distance from the centre of the hexagon to the mid point of any side. If we have side-length and apothem, we can find the area by using the formula:

  Area = $\frac{1}{2}$ × Perimeter × apothem

4. It is given that there is a rectangle ABCD. In a rectangle ABCD there are two triangles ΔABO and ΔDCO meet at point O.



Construction: Draw a line EF at point O parallel to AB and CD.

Area of rectangle ABCD = Area of rectangle ABFE + Area of rectangle EFCD.

∵ Δ ABO and rectangle ABFE are at the same base and having same height.

∴ Area of ΔABO = $\frac{1}{2}$ × Area of rectangle ABFE ...(i)

Similarly, ΔDCO and rectangle DCFE are at the same base and have same height.

∴ Area of ΔDCO = $\frac{1}{2}$ × Area of rectangle DCFE ...(ii)

Adding (i) and (ii),

Area of ΔABO + Area of ΔCO = $\frac{1}{2}$ (Area of rectangle ABFE+ Area of rectangle DCFE)

= $\frac{1}{2}$ Area of rectangle ABCD

Hence, Area of blue region is exactly $\frac{1}{2}$ (one-half) of the total area of rectangle.

5. The most common way to obtain a quadrilateral whose area is half that of a given quadrilateral is by connecting the mid-points of the sides of the original quadrilateral

- Take any quadrilateral ABCD.

- Find the midpoints of sides AB, BC, CD, DA and label them as P, Q, R and S.
- Connect these midpoints to form a new quadrilateral PORS.
- The area of the new quadrilateral PQRS is always exactly half of the area of original quadrilateral ABCD.

Page 162-164

1. (i) All the given parallelogram have equal area.

Reason: Each parallelogram is, drawn on the same base and between the same parallel lines. As we know

Area of parallelogram = base × height

Since base and height are same for all, their areas are also equal.

(ii) Perimeters of the parallelogram:

The perimeter of parallelogram are not equal.

Reason: Perimeter depends on the length of all sides

∴ Perimeter = 2 × (base + side)

In some figure given in the question the slanted side is longer, so the perimeter of those figure increases.

While in some figure, the slanted side is shorter, so the perimeter will decrease.

∴ The most tilted parallelogram have maximum perimeter [figure g]

The least tilted parallelogram have minimum perimeter [figure a]

2. (i) Area of parallelogram = base × height

$= 7 \times 4$

$= 28 \text{ cm}^2$

(ii) Area of parallelogram = base × height

$= 5 \times 3 \text{ cm}^2$

$= 15 \text{ cm}^2$

(iii) Area of parallelogram = base × light

$= 5 \times 4.8$

$= 24.0 \text{ cm}^2$

(iv) Area of parallelogram = base × height

$= 2 \times 4.4$

$= 8.8 \text{ cm}^2$

3. In parallelogram PQRS;

Area = base × height

$= 12 \times 6 \text{ cm}^2$

$= 72 \text{ cm}^2$

If we take PS as a base then its corresponding height will be QN.

But the area will be equal in both the case so taking PS as base;

Area = base × height

= PS × QN

$\Rightarrow$ $7.6 \text{ cm} \times QN = 72 \text{ cm}^2$

$$\Rightarrow \quad QN = \frac{72 \text{ cm}^2}{7.6 \text{ cm}} = 9.473 \text{ cm}$$

4. Let us consider a rectangle and a parallelogram of the same side length 5 cm and 4 cm.

So, Area of rectangle = base × height

$= 5 \times 4$

$= 20 \text{ cm}^2$

[Here, base is the length of the rectangle and height is the breadth of it.]

For a parallelogram slant height is 4 cm.

In parallelogram the height is the perpendicular distance between the bases. Hence, In this parallelogram the height is shorter than 4 cm, because perpendicular is the shortest distance.

∴ Area of parallelogram = base × height

= 5 cm × (less than 4 cm)

= less than 20 cm^2

So, the rectangle has the greater area than parallelogram.

5. The Area of triangle = $\frac{1}{2}$ × base × height

To get a rectangle whose area is twice of the area of the triangle

$$i.e. \text{ Area of rectangle} = 2\left(\frac{1}{2} \times \text{base} \times \text{height}\right)$$

= base × height

To construct such rectangle :

Method 1: Construct a rectangle of the same base (b) as that of triangle and that of the same height (h) as in triangle.

∴ Area of rectangle = $b \times h$

Since the Area of triangle is $\frac{1}{2} \times b \times h$.

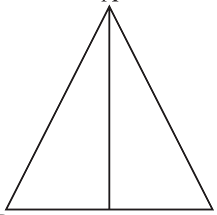
The area of rectangle is twice of that of rectangle.

Method 2:

- Take a triangle.
- Construct one more identical triangle.
- Join both triangles along the same base.
- We will get a parallelogram and if arranging it properly, it will become a rectangle.

6. To obtain a rectangle of the same area as a given triangle

A



B D C

Method 1:

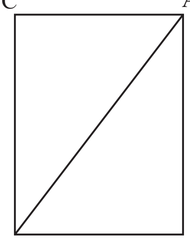
- Take a triangle ABC.
- Draw a line from the top vertex to the midpoint of the base.
- Cut the triangle into two parts.
- Rearrange them to form a rectangle.

This rectangle will have the same area as that of given triangle.

7. Let us consider an isosceles ΔABC.

- Draw a perpendicular AD, from A to base BC.
- This perpendicular AD divides the isosceles triangle into 2 equal triangle, ΔABD and ΔACD.
- Now, cut along AD.
- Flip one triangle and place beside the other.
- Now, a rectangle is formed, rectangle ADBC

C A

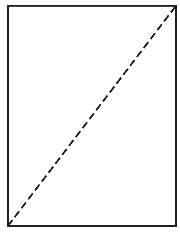


B D

∵ Each small triangle is half of a rectangle.
∴ Together they will make a whole rectangle.

8. Let us consider a rectangle ABCD

A B



D C

- Join the diagonal BD of rectangle.
- Cut the rectangle along the diagonal BD.
- We will get two triangles AABD and ACBD.
- Flip one triangle and place beside the other along the same perpendicular height.
- We will get an isosceles triangle ΔBDA.

9. In this question:

(i) We can comparing the area of an equilateral triangle and square of the same sidelength.

Let us consider the sidelength of an equilateral triangle and of an square is a.

So, Area of square = $a \times a = a^2$

Area of triangle = $\frac{\sqrt{3}}{4}a^2$

$$\text{Since, } a^2 > \frac{\sqrt{3}}{4}a^2$$

Hence, area of square will be greater than area of equilateral triangle of the same sidelength.

(ii) Comparing the area of two equilateral triangle and a square,

Area of square = a^2

Area of two equilateral triangle

$$= 2\times\frac{\sqrt{3}}{4}a^2$$

$$= \frac{\sqrt{3}}{2}a^2$$

in this case also

$$a^2 > \frac{\sqrt{3}}{2}a^2$$

Hence, square will have greater area as compared to the area of two equilateral triangle of the same sidelength.

Page-169-170

1. Diagonals of Rhombus are

d_1 = 20 cm and d_2 = 15 cm

To find : Area of Rhombus

Solution: Area of Rhombus

$= \frac{1}{2} \times d_1 \times d_2$

$= \frac{1}{2} \times 20 \text{ cm} \times 15 \text{ cm}$

$= 150 \text{ cm}^2$

Hence, the area of Rhombus is 150 square cm.

2. To convert a rectangle into a rhombus we should follow the following steps:

- Take a rectangle ABCD
- Mark the Midpoints E, F, G, H of all four sides.
- Join these midpoints in order to get a diamond shaped figure inside a rectangle.
- Now, cut the four corner triangles.

  The figure formed is a Rhombus of the same area as of rectangle.

3. (i) Area of trapezium

$= \frac{1}{2} \times$ surn of parallel sides $\times$ distance between parallel sides

$= \frac{1}{2} \times (10 + 7) \times 16$

$= \frac{1}{2} \times 17 \times 16$

= 136 square ft

(ii) Area of trapezium

$= \frac{1}{2} \times$ sum of parallel sides $\times h$

$= \frac{1}{2} \times (24 + 36) \times 14$

$= 60 \times 7$

= 420 sq.m

(iii) Area of trapezium

$= \frac{1}{2} \times$ sum of parallel sides $\times$ height

$= \frac{1}{2} \times (14 + 6) \times 10$

$= 20 \times 5$

= 100 sq. in

(iv) Area of trapezium

$= \frac{1}{2} \times$ sum of parallel sides $\times$ height

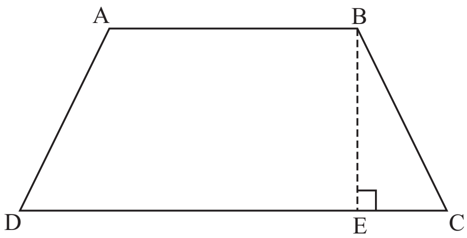
$= \frac{1}{2} (12 + 18) \times 8$

$= \frac{1}{2} \times 30 \times 8$

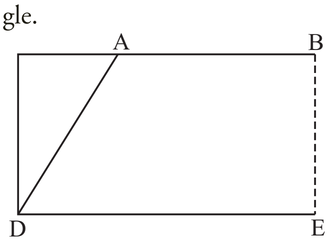
= 120 sq. ft

4. To convert an isosceles trapezium into a rectangle:

- Let consider an isosceles trapezium ABCD



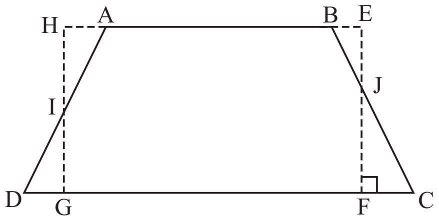
- From one top vertices *ie.*, B draw a perpendicular BE on DC. This create a right triangle on one side of trapezium.
- Cut along this perpendicular line and separate S that triangle from trapezium.
- Now, flip this triangle and rearrange it on the other side of the trapezium.
- So, the new figure formed is a rectangle.



5. To convert the trapezium ABCD into rectangle EFGH,

- Locate the midpoints I and I, non-parallel side AD and BC.

- From point 1, draw line perpendicular to the base DC. This perpendicular intersect to extended base and bottom base at H and G respectively.
- Similarly from midpoint 1, draw a line perpendicular to the base CD, which intersect the extended top base at E and bottom base at F.



- These new vertices EFGH, form the vertices of a rectangle.

6. By using the idea of converting a trapezium into a rectangle of equal area, we can construct a trapezium of area 144 cm^2.

This shows that area of rectangle is 144 cm^2

Let consider any height i.e. h = 8 cm, for the rectangle, which is the breadth (b) of rectangle.

So, the length of rectangle = ?

Area of rectangle = $l \times b$

$$144 \text{ cm}^2 = l \times 8 \text{ cm}$$

$$l = \frac{144 \text{ cm}^2}{8 \text{ cm}}$$

$$l = 18 \text{ cm}$$

This is the length of rectangle = 18 cm

Now, we can keep the height of trapezium and rectangle same.

Let the paralleled sides of trapezium are a and b.

$\because$ Area of Rectangle = Area of trapezium

$$l \times b = \frac{1}{2} \text{ (sum of parallel sides)} \times h$$

$$l \times h = \frac{1}{2} = (a + b) \times h$$

$$\frac{1}{2} (a + b) = l$$

This shows that length of rectangle should be equal to the mean of parallel sides of trapezium.

$\because$ l of rectangle = 18 cm

$\therefore$ Mean of parallel sides = 18 cm

$$\frac{1}{2} (a + b) = 18 \text{ cm}$$

$$a + b = 36 \text{ cm}$$

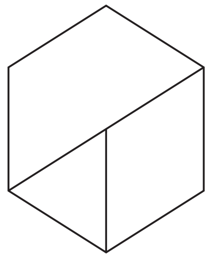
So, we can take any two values whose sum is 36 cm

i.e. we can take values like.

$$a = 20 \text{ cm}, b = 16 \text{ cm}$$

Draw two parallel lines a = 20 cm, b = 16 cm, at a perpendicular distance of 8 cm from each other. Then connect the ends of these parallel sides to form a trapezium.

7. It is given that a regular hexagon is divided into a trapezium, an equilateral triangle and a rhombus.



A regular Hexagon can be divided into 6 congruent equilateral triangles meeting at the centre.

Let the area of each triangle is k

Hence, the triangle of 6 triangles is $6k$

Rhombus is made by two equilateral triangle.

Hence, area of Rhombus $2k$

The remaining part of the hexagon is trapezium, which consist of three triangles.

$\therefore$ The area of trapezium = $3k$

Hence, the ratio of their area

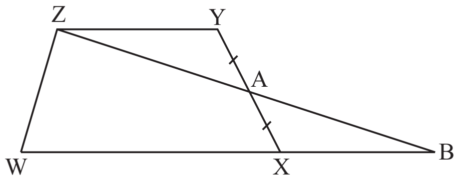
Area, Trapezium: Area of triangle : Area of Rhombus

$$= 3k : 1k : 2k$$

$$= 3 : 1 : 2$$

8. It is given that

ZYXW is a trapezium in which ZY || WX, A is the midpoint of YX.



To show:

Area of trapezium ZYXW = Area of ΔZWB

Solution: In ΔYAZ and ΔXAB

$$YA = XA$$
$$\angle YAZ = \angle XAB$$
$$\angle ZYA = \angle BXA$$

$$\left[\begin{array}{c} \because ZY \parallel WB \\ \therefore \angle ZYA = \angle BXA \\ \text{(Alternate angles)} \end{array}\right]$$

$\because \quad \Delta YZA = \Delta XAB$

(using ASA property)

$\therefore \quad YZ = XB$ (CPCT)

$AZ = AB$ (CPCT)

$\therefore$ Area of ΔYAZ = Area of ΔXAB ...(i)

Area of trapezium = Area of quadrilateral ZAXW + Area of AZAY using (i)

Area of trapezium ZYXW = Area of quadrilateral ZAXW + Area of ΔBAX

= Area of ΔZBW

This shows that area of trapezium ZYXW is equal to the area of triangle ZWB.

❑❑