

Passage 1: Business Partnership and Profit Sharing

Three friends, Arjun, Bhavana, and Chetan, started a business venture on January 1, 2024. Arjun invested ₹4,00,000, Bhavana invested ₹6,00,000, and Chetan invested ₹5,00,000. After 4 months, Arjun withdrew 25% of his investment to fund another project. Two months later, Bhavana increased her investment by 50% of her original amount. Chetan maintained his investment throughout the year.

At the end of the year, the business made a total profit of ₹8,40,000. Before distributing the profit, the partners agreed to set aside 15% of the profit as a reserve fund for future expansion. Additionally, they decided that 10% of the remaining profit would be distributed equally among all three partners as a management bonus, and only the balance would be distributed in proportion to their effective capital contributions (investment $\times$ time).

During the year, the business also incurred operational expenses that were shared in the ratio 2:3:2 among Arjun, Bhavana, and Chetan respectively. The total expenses amounted to ₹1,20,000, which were deducted from each partner's share after profit distribution.

Q1. What is the ratio of effective capital contributions (investment $\times$ time in months) of Arjun, Bhavana, and Chetan for the year 2024?

- A. 4:9:6 B. 3:7:5 C. 5:8:6 D. 4:8:5

Q2. After setting aside the reserve fund and management bonus, what amount (in ₹) is available for distribution according to capital contributions?

- A. ₹6,42,600 C. ₹5,98,500
B. ₹6,17,400 D. ₹6,73,200

Q3. What is Bhavana's total share (in ₹) from the profit distribution before deducting expenses?

- A. ₹3,04,389 C. ₹3,42,600
B. ₹3,28,189 D. ₹2,98,450

Q4. After deducting each partner's share of expenses, what is Arjun's final net gain (in ₹) from the business?

- A. ₹1,24,798 C. ₹1,59,084
B. ₹1,35,284 D. ₹1,42,500

Q5. If the partners had distributed the entire profit (without reserve or bonus) strictly in proportion to capital contributions, how much more (in ₹) would Bhavana have received compared to her actual total share?

- A. ₹69,706 C. ₹45,180
B. ₹52,340 D. ₹38,920

Passage 2: Mixtures and Concentrations

A chemical laboratory has three solutions: Solution A contains 30% acid, Solution B contains 45% acid, and Solution C contains 60% acid. The lab technician needs to prepare 120 liters of a new solution with exactly 45% acid concentration by mixing these three solutions.

The technician decides to use Solution A and Solution C in equal quantities. The remaining volume will be filled with Solution B. After completing the mixture, the lab supervisor realized that the target concentration should have been 48% acid, not 45%. The technician then decided to replace a certain volume of the 45% mixture with Solution C (60% acid) to achieve the correct 48% concentration, without changing the total volume of 120 liters.

Q6. If the technician uses 30 liters each of Solutions A and C, what volume of Solution B is needed, and what is the resulting concentration?

- | | |
|-------------|-------------|
| A. 60L, 45% | C. 70L, 43% |
| B. 50L, 47% | D. 60L, 48% |

Q7. What volume (in liters) of the 45% mixture must be replaced with Solution C (60% acid) to achieve 48% concentration in 120 liters?

- | | |
|--------------|--------------|
| A. 24 liters | C. 30 liters |
| B. 20 liters | D. 18 liters |

Q8. If the technician had replaced the same volume (from Q2) with Solution A (30% acid) instead of Solution C, what would be the final concentration?

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|--------|----------|
| A. 42% | C. 43.5% |
| B. 40% | D. 41% |

Q9. What is the minimum volume of Solution C that must be added to 120 liters of 45% mixture (without removing any) to achieve at least 48% concentration, if total volume can exceed 120 liters?

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|--------------|--------------|
| A. 30 liters | C. 40 liters |
| B. 24 liters | D. 36 liters |

Q10. If equal volumes of all three solutions are mixed, and then 20% of the mixture is replaced with Solution B, what is the final concentration?

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|--------|--------|
| A. 45% | C. 44% |
| B. 46% | D. 47% |

Passage 3: Time, Speed, Distance with Multiple Objects

Two trains, Train X and Train Y, start simultaneously from stations A and B respectively, traveling towards each other on parallel tracks. The distance between A and B is 600 km. Train X travels at a constant speed of 80 km/h, while Train Y travels at 70 km/h.

A third train, Train Z, starts from station A exactly 1 hour after Train X, traveling in the same direction as Train X at a speed of 100 km/h. Train Z is scheduled to overtake Train X and then continue to station B.

Meanwhile, a bird starts flying from Train X towards Train Y at the moment Train X departs from station A. The bird flies at a constant speed of 120 km/h, instantly turning around upon reaching either train, and continues flying back and forth between the two trains until they meet.

Q11. At what distance (in km) from station A do Train X and Train Y meet?

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|-----------|-----------|
| A. 320 km | C. 340 km |
| B. 300 km | D. 280 km |

Q12. What is the total distance (in km) flown by the bird before the trains meet?

- | | |
|-----------|-----------|
| A. 480 km | C. 500 km |
| B. 420 km | D. 450 km |

Q13. At what time (in hours after Train X's departure) does Train Z overtake Train X?

- | | |
|------------|------------|
| A. 4 hours | C. 6 hours |
| B. 5 hours | D. 3 hours |

Q14. How far (in km) from station A is Train Z when Train X and Train Y meet?

- | | |
|-----------|-----------|
| A. 320 km | C. 280 km |
| B. 300 km | D. 340 km |

Q15. At the moment Train Z overtakes Train X, how far (in km) is Train Y from station B?

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|-----------|-----------|
| A. 250 km | C. 300 km |
| B. 280 km | D. 320 km |

Passage 4: Statistics and Data Interpretation

A company conducted a performance review of its 80 employees across four departments: Sales, Marketing, Operations, and Finance. Each employee was rated on a scale of 1 to 10, and the ratings were compiled into the following summary:

The overall average rating across all 80 employees was 6.5. The Sales department had 25 employees with an average rating of 7.2. The Marketing department had 20 employees with an average rating of 6.8. The Operations department had 20 employees, and the Finance department had 15 employees.

It was also known that the average rating of Operations employees was 0.5 points lower than that of Finance employees. Additionally, the median rating for the entire company was 6.5, and the mode (most frequent rating) was 7.

The company decided to give a bonus to all employees with ratings above the overall average. The bonus amount was ₹5,000 for each point above 6.5, rounded to the nearest integer rating.

Q16. What is the average rating of employees in the Operations department? (rounded to one decimal place)

- A. 5.6 B. 5.8 C. 6.0 D. 5.3

Q17. What is the combined total rating points of employees in Operations and Finance departments?

- A. 204 C. 210
B. 196 D. 188

Q18. If exactly 45 employees have ratings above 6.5, what is the minimum possible total bonus payout (in ₹), assuming $\text{bonus} = ₹5,000 \times (\text{rating} - 6.5)$ rounded to nearest integer?

- A. ₹1,12,500 C. ₹1,35,000
B. ₹1,25,000 D. ₹1,00,000

Q19. What is the average rating of the Finance department? (rounded to one decimal place)

- A. 6.0 C. 5.8
B. 6.3 D. 6.1

Q20. If the company removes the 5 lowest-rated and 5 highest-rated employees, what happens to the overall average?

- A. It remains unchanged B. It increases
C. It decreases D. Cannot be determined

Passage 5: Geometry and Mensuration

A rectangular garden has a length that is 1.5 times its width. A circular fountain with a diameter of 8 meters is located at the center of the garden. The area of the garden excluding the fountain is 436 square meters (use $\pi = 3.14$).

Around the garden, a pathway of uniform width 2 meters is constructed. The pathway extends equally on all four sides of the rectangular garden. The cost of landscaping the garden (excluding fountain) is ₹150 per square meter, while the pathway costs ₹200 per square meter to construct.

Additionally, a triangular flower bed is created in one corner of the garden, with its base along the width of the garden and its height equal to one-third of the garden's length. The flower bed is part of the garden area and is landscaped at the same rate as the rest of the garden.

Q21. What are the dimensions (length $\times$ width in meters) of the rectangular garden?

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|-------------------|-------------------|
| A. 24×16 | C. 30×20 |
| B. 27×18 | D. 21×14 |

Q22. What is the area (in square meters) of the pathway?

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|----------|----------|
| A. 196 m | C. 224 m |
| B. 208 m | D. 180 m |

Q23. What is the total cost (in ₹) of landscaping the garden and constructing the pathway?

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|--------------|--------------|
| A. ₹1,04,600 | C. ₹98,500 |
| B. ₹1,06,700 | D. ₹1,11,900 |

Q24. What is the area (in square meters) of the triangular flower bed?

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|---------|---------|
| A. 54 m | C. 81 m |
| B. 72 m | D. 63 m |

Q25. If the circular fountain's radius is increased by 50%, what is the new area (in m) of the garden excluding the fountain?

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|------------|------------|
| A. 372.9 m | C. 398.2 m |
| B. 386.5 m | D. 405.0 m |

Passage 6: Percentages, Profit & Loss, and Compound Growth

A startup company's revenue grew over 5 years. In Year 1, the revenue was ₹50 lakhs. The revenue increased by 20% in Year 2, decreased by 10% in Year 3, increased by 25% in Year 4, and increased by 15% in Year 5.

The company's profit margin (profit as a percentage of revenue) was 15% in Year 1. Each subsequent year, the profit margin increased by 2 percentage points until Year 4, after which it decreased by 3 percentage points in Year 5.

The company paid taxes at 30% on its profit. After taxes, the company reinvested 40% of the remaining profit into research and development (R&D), and distributed the rest as dividends to shareholders.

Q26. What was the company's revenue (in ₹ lakhs) at the end of Year 5?

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|-----------|-----------|
| A. 77.625 | C. 75.00 |
| B. 82.50 | D. 80.125 |

Q27. What was the company's profit (in ₹ lakhs) in Year 4 before taxes?

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|-----------|-----------|
| A. 14.175 | C. 13.50 |
| B. 12.15 | D. 15.525 |

Q28. What is the total amount (in ₹ lakhs) reinvested in R&D over all 5 years?

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|----------|----------|
| A. 15.71 | C. 14.25 |
| B. 17.93 | D. 16.84 |

Q29. What was the total dividend (in ₹ lakhs) distributed to shareholders in Year 5?

- | | |
|---------|---------|
| A. 5.87 | C. 5.03 |
| B. 6.42 | D. 7.15 |

Q30. What is the overall CAGR (compound annual growth rate) of revenue from Year 1 to Year 5?

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|----------|----------|
| A. 11.5% | C. 12.2% |
| B. 10.8% | D. 9.5% |

Passage 7: Work, Time, and Efficiency with Multiple Workers

A construction project can be completed by 12 workers in 20 days, working 8 hours per day. After 8 days of work, 4 workers left the project. To compensate, the remaining workers agreed to work overtime, increasing their daily working hours.

The work efficiency of each worker is not constant: workers are 20% more productive in the first 4 hours of each day compared to the subsequent hours. This means if a worker's base efficiency is 1 unit/hour for hours 5-8, it is 1.2 units/hour for hours 1-4.

The project deadline was extended by 5 days from the original 20-day schedule. The remaining workers needed to complete the project within this extended deadline.

Q31. What is the total work required for the project in worker-hours (assuming constant efficiency)?

- A. 1920 worker-hours
- B. 1680 worker-hours
- C. 2040 worker-hours
- D. 1800 worker-hours

Q32. What fraction of the work was completed in the first 8 days?

- A. $\frac{2}{5}$
- B. $\frac{1}{2}$
- C. $\frac{3}{5}$
- D. $\frac{8}{20}$

Q33. How many worker-hours of work remain after 8 days?

- A. 1152 worker-hours
- B. 1080 worker-hours
- C. 1200 worker-hours
- D. 1056 worker-hours

Q34. If the remaining 8 workers work 8 hours per day for the remaining 17 days (extended deadline), can they complete the work considering the variable efficiency?

- A. Yes, with approximately 45 worker-hours surplus
- B. No, short by approximately 64 worker-hours
- C. Yes, exactly on time
- D. No, short by approximately 100 worker-hours

Q35. What is the minimum number of hours per day the 8 workers must work (with the same efficiency pattern) to complete the remaining work in exactly 17 days?

- A. 7.5 hours
- B. 8.0 hours
- C. 7.0 hours
- D. 8.5 hours

Passage 8: Algebra, Equations, and Number Theory

Three positive integers A, B, and C satisfy the following conditions:

1. $A + B + C = 120$
2. $A : B = 3 : 4$
3. $B : C = 4 : 5$
4. The product $A \times B \times C$ is divisible by 1000

Additionally, these numbers represent the ages (in years) of three siblings. The sum of the squares of their ages is used to calculate an inheritance amount, where each square year is worth ₹100.

The siblings also discovered that if they each reduce their age by 5 years (hypothetically), the new ratio of their ages would change, but the sum would still be divisible by a certain prime number.

Q36. What are the values of A, B, and C?

- | | |
|---------------|---------------|
| A. 24, 32, 64 | C. 27, 36, 57 |
| B. 30, 40, 50 | D. 25, 35, 60 |

Q37. What is the product $A \times B \times C$?

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|-----------|-----------|
| A. 48,000 | C. 55,296 |
| B. 60,000 | D. 52,500 |

Q38. What is the total inheritance amount (in ₹) based on the sum of squares of their ages?

- | | |
|--------------|--------------|
| A. ₹5,00,000 | C. ₹5,20,000 |
| B. ₹4,50,000 | D. ₹4,80,000 |

Q39. If each sibling's age is reduced by 5 years, what is the new sum of their ages, and which prime numbers divide it?

- | | |
|------------------------------|-------------------------------|
| A. 105, divisible by 3, 5, 7 | C. 100, divisible by 2, 5 |
| B. 115, divisible by 5, 23 | D. 110, divisible by 2, 5, 11 |

Q40. What is the ratio of the new ages (after reducing by 5 years) in simplest form?

- | | |
|----------|----------|
| A. 5:7:9 | C. 5:6:8 |
| B. 3:5:7 | D. 4:6:9 |

Answers**1. Answer: Option A**

Explanation: Arjun: $(4,00,000 \times 4) + (3,00,000 \times 8) = 16,00,000 + 24,00,000 = 40,00,000$. Bhavana: $(6,00,000 \times 6) + (9,00,000 \times 6) = 36,00,000 + 54,00,000 = 90,00,000$. Chetan: $5,00,000 \times 12 = 60,00,000$. Ratio = $40:90:60 = 4:9:6$.

2. Answer: Option A

Explanation: Total profit = ₹8,40,000. Reserve fund (15%) = $8,40,000 \times 0.15 = ₹1,26,000$. Remaining = $8,40,000 - 1,26,000 = ₹7,14,000$. Management bonus (10% of remaining) = $7,14,000 \times 0.10 = ₹71,400$. Amount for capital-based distribution = $7,14,000 - 71,400 = ₹6,42,600$.

3. Answer: Option B

Explanation: Capital distribution amount = ₹6,42,600. Ratio = 4:9:6, total parts = 19. Bhavana's capital share = $(9/19) \times 6,42,600 = ₹3,04,389$. Management bonus (equal among 3) = $71,400/3 = ₹23,800$. Bhavana's total = $3,04,389 + 23,800 = ₹3,28,189$.

4. Answer: Option A

Explanation: Arjun's capital share = $(4/19) \times 6,42,600 = ₹1,35,284$. Management bonus = ₹23,800. Total before expenses = $1,35,284 + 23,800 = ₹1,59,084$. Expenses shared in ratio 2:3:2, total parts = 7. Arjun's expense share = $(2/7) \times 1,20,000 = ₹34,286$. Net gain = $1,59,084 - 34,286 = ₹1,24,798$.

5. Answer: Option A

Explanation: Without reserve/bonus: Full ₹8,40,000 in 4:9:6 ratio. Bhavana's share = $(9/19) \times 8,40,000 = ₹3,97,895$. Actual Bhavana share = ₹3,28,189. Difference = $3,97,895 - 3,28,189 = ₹69,706$ more.

6. Answer: Option A

Explanation: A=30L, C=30L, so B=120-60=60L. Acid = $0.30(30) + 0.45(60) + 0.60(30) = 9 + 27 + 18 = 54$ L. Concentration = $54/120 = 45\%$.

7. Answer: Option A

Explanation: Initial acid = 54L. Let y = volume replaced. After replacement: $54 - 0.45y + 0.60y = 57.6$ (target). So $54 + 0.15y = 57.6$, giving y = 24 liters.

8. Answer: Option A

Explanation: Replacing 24L with A (30%): Acid = $54 - 0.45(24) + 0.30(24) = 54 - 10.8 + 7.2 = 50.4$ L. Concentration = $50.4/120 = 42\%$.

9. Answer: Option A

Explanation: Let z = volume of C added. New total = $120+z$. New acid = $54 + 0.60z$. Target: $(54+0.60z)/(120+z) \geq 0.48$. So $54+0.60z \geq 57.6+0.48z$. Therefore $0.12z \geq 3.6$, $z \geq 30$ liters.

10. Answer: Option A

Explanation: Equal volumes (40L each) gives 45% (from Q1). Replacing 20% (24L) with B (45%): Since B has same concentration as the mixture (45%), the concentration remains 45%.

11. Answer: Option A

Explanation: Relative speed = $80 + 70 = 150$ km/h. Time to meet = $600/150 = 4$ hours. Distance from A = $80 \times 4 = 320$ km.

12. Answer: Option A

Explanation: Bird flies for 4 hours (until trains meet) at 120 km/h. Total distance = $120 \times 4 = 480$ km.

13. Answer: Option B

Explanation: When Z starts (1 hour after X), X has traveled 80 km. Relative speed of Z with respect to X = $100 - 80 = 20$ km/h. Time to catch up = $80/20 = 4$ hours after Z starts. Total time from X's departure = $1 + 4 = 5$ hours.

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14. Answer: Option B

Explanation: Trains meet at $t=4$ hours. Z started at $t=1$, so Z has traveled for 3 hours. Distance = $100 \times 3 = 300$ km from A.

15. Answer: Option A

Explanation: Z overtakes X at $t=5$ hours. In 5 hours, Y has traveled $70 \times 5 = 350$ km from B towards A. Distance from B = 350 km. Wait, that's from B. Distance remaining to B = $600 - 350 = 250$ km. So Y is 250 km from B.

16. Answer: Option A

Explanation: Let F = Finance average, O = Operations average. $O = F - 0.5$. Total sum = $80 \times 6.5 = 520$. Sales sum = $25 \times 7.2 = 180$. Marketing sum = $20 \times 6.8 = 136$. So $O \times 20 + F \times 15 = 520 - 180 - 136 = 204$. Substituting $F = O + 0.5$: $20O + 15(O + 0.5) = 204$. So $35O = 196.5$, giving $O = 5.61 \approx 5.6$.

17. Answer: Option A

Explanation: Total sum = $80 \times 6.5 = 520$. Sales + Marketing = $25 \times £7.2 + 20 \times £6.8 = 180 + 136 = 316$. Operations + Finance = $520 - 316 = 204$.

18. Answer: Option A

Explanation: Minimum occurs when all 45 have the lowest rating above 6.5, which is 7.
Bonus per employee = $(7 - 6.5) \times 5000 = ₹2,500$. Total = $45 \times 2500 = ₹1,12,500$.

19. Answer: Option D

Explanation: From Q1, $O = 5.6$. $F = O + 0.5 = 6.1$. Verification: $20(5.6) + 15(6.1) = 112 + 91.5 = 203.5 \approx 204 \checkmark$

20. Answer: Option D

Explanation: Without knowing the specific values of the 5 lowest and 5 highest ratings, we cannot determine the effect on the average. The change depends on whether the removed values are symmetrically distributed around the mean.

21. Answer: Option B

Explanation: Fountain area = $\pi \times 4 = 3.14 \times 16 = 50.24$ m. Garden area = $436 + 50.24 = 486.24$ m. Let width = w , length = $1.5w$. So $1.5w = 486.24$, $w = 324.16$, $w = 18.01 \approx 18$ m. Length = 27 m.

22. Answer: Option A

Explanation: Garden: $27 \times 18 = 486$ m. With 2m pathway: $(27+4) \times (18+4) = 31 \times 22 = 682$ m. Pathway area = $682 - 486 = 196$ m.

23. Answer: Option A

Explanation: Garden (excluding fountain) = 436 m. Cost = $436 \times 150 = ₹65,400$. Pathway = 196 m. Cost = $196 \times 200 = ₹39,200$. Total = $65,400 + 39,200 = ₹1,04,600$.

24. Answer: Option C

Explanation: Base = width = 18 m. Height = $(1/3) \times 27 = 9$ m. Area = $(1/2) \times 18 \times 9 = 81$ m.

25. Answer: Option A

Explanation: Original fountain: $r = 4$, area = 50.24 m. New fountain: $r = 6$, area = $3.14 \times 36 = 113.04$ m. Garden area = 486 m. New garden excluding fountain = $486 - 113.04 = 372.96 \approx 372.9$ m.

26. Answer: Option A

Explanation: Year 1: 50. Year 2: $50 \times 1.20 = 60$. Year 3: $60 \times 0.90 = 54$. Year 4: $54 \times 1.25 = 67.5$. Year 5: $67.5 \times 1.15 = 77.625$ lakhs.

27. Answer: Option A

Explanation: Year 4 revenue = ₹67.5 lakhs. Profit margin = $15\% + 3(2\%) = 21\%$. Profit = $67.5 \times 0.21 = ₹14.175$ lakhs.

28. Answer: Option A

Explanation: Year 1: $7.5 \times 0.7 \times 0.4 = 2.1$. Year 2: $10.2 \times 0.7 \times 0.4 = 2.856$. Year 3: $10.26 \times 0.7 \times 0.4 = 2.8728$. Year 4: $14.175 \times 0.7 \times 0.4 = 3.969$. Year 5: $13.9725 \times 0.7 \times 0.4 = 3.9123$. Total = $15.7101 \approx ₹15.71$ lakhs.

29. Answer: Option A

Explanation: Year 5: Profit = 13.9725. After 30% tax = 9.78075. Dividend (60% of after-tax) = $9.78075 \times 0.6 = 5.86845 \approx ₹5.87$ lakhs.

30. Answer: Option A

Explanation: Initial = 50, Final = 77.625, $n = 4$ growth periods. CAGR = $(77.625/50)^{(1/4)} - 1 = 1.5525^{0.25} - 1 = 1.115 - 1 = 11.5\%$.

31. Answer: Option A

Explanation: $12 \text{ workers} \times 20 \text{ days} \times 8 \text{ hours} = 1920 \text{ worker-hours}$.

32. Answer: Option A

Explanation: Work done = $12 \times 8 \times 8 = 768 \text{ worker-hours}$. Fraction = $768/1920 = 0.4 = 2/5$.

33. Answer: Option A

Explanation: Remaining = $1920 - 768 = 1152 \text{ worker-hours}$.

34. Answer: Option A

Explanation: With variable efficiency: daily output per worker = $4 \times 1.2 + 4 \times 1.0 = 4.8 + 4 = 8.8$ effective hours. Total capacity = $8 \times 17 \times 8.8 = 1196.8 \text{ worker-hours}$. Remaining work = 1152. Surplus = $1196.8 - 1152 = 44.8 \approx 45 \text{ worker-hours}$.

35. Answer: Option A

Explanation: Let $h = \text{hours/day}$. Effective hours = $4 \times 1.2 + (h-4) \times 1.0 = h + 0.8$ (for $h \geq 4$). Equation: $8 \times 17 \times (h + 0.8) = 1152$. So $136(h + 0.8) = 1152$. $h + 0.8 = 8.47$, $h = 7.67$ hours. Since h must be at least 4 for the formula to work, and $7.67 > 4$, the answer is approximately 7.5 hours (Option A).

36. Answer: Option B

Explanation: From ratios: $A:B = 3:4$ and $B:C = 4:5$, so $A:B:C = 3:4:5$. Total parts = 12. Each part = $120/12 = 10$. Therefore $A = 30$, $B = 40$, $C = 50$.

37. Answer: Option B

Explanation: Product = $30 \times 40 \times 50 = 60,000$. This is divisible by 1000 ($60,000/1000 = 60$).

38. Answer: Option A

Explanation: Sum of squares = $30 + 40 + 50 = 900 + 1600 + 2500 = 5000$. Inheritance = $5000 \times ₹100 = ₹5,00,000$.

39. Answer: Option A

Explanation: New ages: 25, 35, 45. Sum = 105. Prime factorization: $105 = 3 \times 5 \times 7$. Divisible by 3, 5, and 7.

40. Answer: Option A

Explanation: New ages: 25:35:45. HCF = 5. Simplified ratio: 5:7:9.

