CLASS IX – MATHEMATICS

Chapter Test: How Quantities Combine – Understanding Data

Step-by-Step Solutions and Marking Scheme | M. M.: 40

Ideas used

Combined average = (sum of all values) ÷ (number of values) = $(a \cdot n + b \cdot m)/(n + m)$, where a, b are the averages and n, m the sizes of two collections.

Weighted mean = $(w_1x_1 + w_2x_2 + \ldots + w_nx_n)/(w_1 + w_2 + \ldots + w_n)$. Concentration of a mixture = quantity of the substance ÷ quantity of the mixture.

A stacked bar chart shows actual amounts and totals; a 100% stacked bar chart shows only shares within each bar (it cannot compare actual quantities across bars).

Section A (1 mark each)

Q	Ans	Reason
1	(C)	$(20 \times 60 + 30 \times 70)/(20 + 30) = (1200 + 2100)/50 = 3300/50 =$ **66**. (The simple average 65 is wrong because the sizes differ.)
2	(B)	With equal sizes p, $(ap + bp)/(2p) = (a + b)/2$, so the simple average works only when the **collections have the same size**.
3	(D)	Jaggery = $300 \times 0.10 + 200 \times 0.20 = 30 + 40 = 70$ mL in 500 mL: 70/500 = **14%**.
4	(A)	$(50 \times 2 + 60 \times 3 + 80 \times 5)/(2 + 3 + 5) = (100 + 180 + 400)/10 =$ **68**.
5	(B)	Equal quantities, so the concentration is midway: $(12 + 18)/2 =$ **15%**.
6	(C)	$(4 \times 5 + 5 \times 3 + 3 \times 2)/(5 + 3 + 2) = (20 + 15 + 6)/10 =$ **4.1**.
7	(A)	Sum of five numbers = $12 \times 5 = 60$. New sum = 60 + 18 = 78 for 6 numbers: 78/6 = **13**.
8	(C)	Shop B total = 30 + 30 + 60 = 120. Oil share = 60/120 = **50%**.
9	(D)	Within Garden P, roses (45%) exceed jasmine (35%), so this can be inferred. Comparing across gardens or totals needs the actual numbers, which a 100% chart does not give. So **(D)**.
10	(B)	A stacked bar chart compares totals (the whole bar) and shows the components (the segments): **stacked bar chart**.
11	(D)	A is false: the correct average is $(10 \times 40 + 40 \times 60)/50 = 2800/50 = 56$, not 50, because the sizes differ. R is true. → **(D)**.
12	(A)	A is true: (10 + 20)/2 = 15%. R is true and is exactly why this happens (equal quantities). → **(A)**.

Section B (2 marks each)

Q.13 (2 marks)

Sum of marks = $24 \times 55 + 16 \times 70 = 1320 + 1120 = 2440$. [1]

Ans. Average = 2440/(24 + 16) = 2440/40 = 61. [1]

Q.14 (2 marks)

(A) Salt in the first solution = $400 \times 0.05 = 20$ mL; in the second = $100 \times 0.20 = 20$ mL. [1]

Ans. Concentration = (20 + 20)/(400 + 100) = 40/500 = 8%. [1]

OR (B) Total cost = $4 \times 300 + 6 \times 400 = 1200 + 2400 =$ ₹3600. [1]

Ans. Cost per kg = 3600/(4 + 6) = ₹360. [1]

Q.15 (2 marks)

Weighted mean = $(70 \times 2 + 80 \times 3 + 60 \times 5)/(2 + 3 + 5) = (140 + 240 + 300)/10$. [1]

Ans. = 680/10 = 68%. [1]

Q.16 (2 marks)

(A) Sum of 9 numbers = 24 × 9 = 216. [1]

Ans. New average = (216 + 34)/10 = 250/10 = 25. [1]

OR (B) Runs in 9 overs = 7 × 9 = 63. [1]

Ans. Run rate after 10 overs = (63 + 17)/10 = 80/10 = 8. [1]

Section C (3 marks each)

Q.17 (3 marks)

(A) Let Batch C weigh y kg. Copper in A = 0.7 × 120 = 84 kg; in B = 0.5 × 80 = 40 kg; in C = 0.4y kg. [1]

(84 + 40 + 0.4y)/(120 + 80 + y) = 0.56 ⇒ 124 + 0.4y = 0.56(200 + y) = 112 + 0.56y. [1]

12 = 0.16y ⇒ y = 75. Batch C weighs **75 kg**. [1] *(Check: (124 + 30)/275 = 0.56 (verified))*

OR (B) Acid in the solution = 15% of 20 = 3 L. Let w litres of water be added. [1]

3/(20 + w) = 10/100 = 0.1 ⇒ 20 + w = 30. [1]

w = **10 litres**. [1]

Q.18 (3 marks)

(A) Profit on pens = 25% of 6000 = ₹1500. Profit on notebooks = 40% of 4000 = ₹1600. [1]

Total profit = ₹3100; total sales = ₹10,000. [1]

Ans. Overall profit % = 3100/10000 × 100 = 31%. [1] *(Not the simple average 32.5%, since the sales differ.)*

OR (B) Total distance in 15 days = 40 × 15 = 600 km. [1]

Total distance in 16 days = 600 + 56 = 656 km. [1]

Ans. Average = 656/16 = 41 km. [1]

Section D (5 marks each)

Q.19 (5 marks)

(A)

(i) Number of langurs: **x + y = 50**. [1] Total weight: 18x + 14y = 15.6 × 50, i.e. **18x + 14y = 780**. [1]

(ii) From the first equation y = 50 − x. Then 18x + 14(50 − x) = 780 ⇒ 4x + 700 = 780 ⇒ 4x = 80 ⇒ x = 20. [1]

So there are **20 male and 30 female langurs**. [1] *(Check: 20 × 18 + 30 × 14 = 360 + 420 = 780 (verified))*

(iii) Total weight of the females = 30 × 14 = 420 kg. After the two join: (420 + 20 + 12)/(30 + 2) = 452/32 = **14.125 kg**. [1]

OR (B)

(i) Acid in the first = 0.08 × 300 = 24 mL; in the second = 0.2x mL. Equation: **(24 + 0.2x)/(300 + x) = 0.12**. [2]

(ii) 24 + 0.2x = 36 + 0.12x ⇒ 0.08x = 12 ⇒ **x = 150**. [2]

(iii) Total volume = 300 + 150 = **450 mL**; acid = 24 + 30 = **54 mL** (= 12% of 450). [1]

Q.20 (5 marks)

(A)

(i) Family X: 2400 + 4000 + 1600 + 2000 = **₹10,000**. Family Y: 2640 + 5000 + 3000 + 1360 = **₹12,000**. [1]

(ii) Family X: 1600/10000 × 100 = **16%**. Family Y: 3000/12000 × 100 = **25%**. [2]

(iii) Family X spends 24% of 10,000 = ₹2400 on food. Family Y spends 22% of 12,000 = ₹2640. [1]

So **no**: Family X has the higher percentage but spends fewer rupees (2400 < 2640), because the totals are different. [1]

OR (B)

(i) Food = (5 × 5 + 3 × 4 + 2 × 3)/10 = 43/10 = **4.3**. [1] Ambience = (4 × 4 + 5 × 3 + 1 × 2)/10 = 33/10 = **3.3**. [1] Service = (1 × 5 + 2 × 4 + 2 × 3 + 4 × 2 + 1 × 1)/10 = 28/10 = **2.8**. [1]

(ii) Overall = (4.3 × 5 + 3.3 × 3 + 2.8 × 2)/(5 + 3 + 2) = (21.5 + 9.9 + 5.6)/10 = 37/10 = **3.7**. [2]

Section E (4 marks)

Q.21 (4 marks)

(i) 2025 total = 80 + 320 + 160 + 240 = **800 kWh**. **[1]**

(ii) 2015 total = 100 + 120 + 60 + 120 = 400 kWh. Cooling share: 2015: 120/400 = **30%**; 2025: 320/800 = **40%**. **[1]**

(iii) (A) Lighting in 2015 = 100 kWh (25% of 400) and in 2025 = 80 kWh (10% of 800). [1]

The actual consumption fell only from 100 to 80 kWh (a 20% fall), but its *share* fell by 15 percentage points because the total consumption doubled. So **no**. [1]

OR (iii) (B)

2015: 30% of 400 = 120 kWh. 2025: 30% of 800 = 240 kWh. [1]

The share is the same but the actual consumption **doubled** (120 → 240 kWh), because the total doubled. A 100% chart shows only shares, not actual amounts. [1]

— End of Solutions —