

Turn averages back into totals

Find missing observations, subgroup values and shifted means using $\text{Total} = \text{Mean} \times \text{Count}$

• Mean and Total Conversion

01 Convert Mean into Total Sum

- Because $\text{Mean} = \text{Sum} \div n$, every average statement immediately gives $\text{Sum} = \text{Mean} \times n$.
- Totals let you combine or separate groups while keeping their counts explicit.
- Eight numbers with mean 10 must sum to $8 \times 10 = 80$; five years with mean 36.66 sum to 183.3.



02 Isolate a Missing Observation

- Missing value $x = (\text{Required total of all } n \text{ items}) - (\text{Sum of the known } n - 1 \text{ items})$.
- Check by substitution: $(64 + 16) / 8 = 10$.
- Eight items average 10, with known sum 64: missing value $= 8 \times 10 - 64 = 16$.



03 Subtract Disjoint Subgroup Sums

- When a list is split into non-overlapping parts, $\text{Whole Sum} = \text{Part 1 Sum} + \text{Part 2 Sum} + \text{Remainder}$.
- The 8th number is simply the leftover total: $336 - (160 + 132) = 336 - 292 = 44$.
- Eight items sum to 336; the first four sum to 160 and the next three to 132.



04 Shift the Mean by Added Terms

- Adding a constant c to every existing observation changes the mean by c .
- Adding 5, 10, 15, ..., 50 to $x_1 \dots x_{10}$ (mean 20) adds $(5 + 50) / 2 = 27.5$, giving new mean 47.5.
- Add one offset to each existing datum: new mean $= \text{old mean} + \text{average offset}$.

REMEMBER Offsets to existing values shift the mean by their average; new observations need a new total and count.