

Rate & Ratio

A printable practice booklet for ratio, equivalent ratio, unit rate, average rate, speed, simple interest, currency exchange and real-world comparison problems.



What this PDF covers

- 9.1 Ratio
- 9.2 Rate
- 9.3 Speed
- Real-world applications
- Answers and teacher notes

How to use it

1. Read the key reminders first.
2. Try the diagnostic questions without notes.
3. Mark answers and redo wrong questions.
4. Use the review section for mixed practice.

9.1 · Ratio

Key ideas for ratio

A ratio compares two or more quantities. For a ratio to be meaningful, the quantities should refer to the same kind, or they should be written clearly with their units.

Idea	Useful form	Reminder
Ratio notation	$a : b$	The order matters. $a : b$ is not usually the same as $b : a$.
Equivalent ratios	$a : b = ka : kb$	Multiply or divide all parts by the same positive number.
Simplest form	divide all parts by common factor	For quantities with units, convert to the same unit first.
Ratio and fraction	$a : b$ corresponds to a/b	Useful when finding unknowns in a ratio.

Teacher note

Students often rush into calculation before checking whether the units match. In this chapter, unit checking is part of the mathematics, not a separate afterthought.

Worked example: simplifying a ratio with units

Find the ratio of 600 s to 1.6 min.

Convert 1.6 min to seconds first: $1.6 \times 60 = 96$ s. Then $600 : 96 = 25 : 4$.

Practice A1 · Ratio basics

1. Find the ratio of 18 boys to 24 girls.
2. Find the ratio of 12 red pens to 30 blue pens.
3. Find the ratio of 45 cm to 1.2 m.
4. Find the ratio of 2.5 kg to 750 g.
5. Simplify 36 : 60.
6. Simplify 0.24 : 0.36.
7. Simplify $\frac{2}{3}$: $\frac{5}{6}$.
8. Simplify 1.5 : 2.25 : 3.
9. Write a ratio equivalent to 3 : 7 with the first term 18.
10. Write a ratio equivalent to 5 : 8 with the total number of parts 52.
11. Given $4 : x = 12 : 21$, find x .
12. Given $y : 15 = 8 : 10$, find y .
13. The ratio of boys to girls is 7 : 5. There are 36 students. Find the number of boys.
14. The ratio of red beads to blue beads is 2 : 3. There are 45 beads. Find the number of blue beads.

Practice A2 · Ratio problem solving

15. Ali and Ben share \$96 in the ratio 5 : 7. How much does Ben receive?
16. A recipe uses flour and sugar in the ratio 4 : 3. If 360 g of flour is used, how much sugar is needed?
17. The ratio of adults to children at an event is 3 : 8. There are 99 people altogether. Find the number of children.
18. A map uses a scale of 1 : 50 000. How many kilometres does 6 cm on the map represent?
19. Three numbers are in the ratio 2 : 5 : 8. Their sum is 120. Find the largest number.
20. The ratio of $x : y : z$ is 4 : 7 : 9. If $y = 42$, find x and z .
21. After \$30 is added to each of A and B, their amounts are in the ratio 5 : 6. Initially $A : B = 2 : 3$. Find the initial amounts.
22. A sum is shared among A, B and C in the ratio 3 : 4 : 5. If C receives \$90 more than A, find the total sum.
23. Two classes have boys and girls in the ratios 2 : 3 and 5 : 7 respectively. Class 1 has 30 students and Class 2 has 36 students. Find the total number of girls.
24. A solution has concentrate and water in the ratio 1 : 4. How much water is needed for 250 ml of concentrate?
25. A drink is mixed in the ratio syrup : water = 2 : 9. If 550 ml of drink is made, find the amount of syrup.
26. The ratio of a rectangle's width to height is 16 : 9. If its width is 48 cm, find its height.
27. The ratio of the angles in a triangle is 2 : 3 : 4. Find the largest angle.
28. A prize is divided among Mei, Raj and Tom in the ratio 6 : 5 : 4. Mei receives \$84. Find the total prize.

9.2 · Rate

Key ideas for rate

A rate compares how one quantity changes with another quantity. The quantities can be of the same kind or different kinds. Rates are often written as “per” one unit.

Type	Example	Meaning
Unit rate	\$4.80/kg	\$4.80 for 1 kg
Rate of work	88 words/min	88 words typed in 1 minute
Average rate	total amount / total time	Useful when a rate changes during a journey or activity
Same-kind rate	2.1% unemployment rate	Can compare a part of a population against the whole

Worked example: better value

Shop A sells 6 eggs for \$1.50. Shop B sells 12 eggs for \$2.40. Compare the cost per egg.

Shop A: $\$1.50 \div 6 = \$0.25$ per egg. Shop B: $\$2.40 \div 12 = \$0.20$ per egg. Shop B gives better value.

Common trap

Do not compare total prices alone when the quantities are different. Convert to a common unit such as cost per item, per kg, per litre or per 100 g.

Practice B1 · Rates and unit rates

29. A typist types 900 words in 12 minutes. Find the typing rate in words per minute.
30. A printer prints 360 pages in 45 minutes. Find the rate in pages per minute.
31. A packet of 500 g cereal costs \$6.40. Find the cost per 100 g.
32. A 1.5 kg bag of rice costs \$4.80. Find the cost per kg.
33. Tin A contains 250 ml of paint and costs \$8. Tin B contains 600 ml and costs \$18. Which tin has the lower cost per ml?
34. A car uses 36 litres of petrol to travel 540 km. Find the petrol consumption in km per litre.
35. A bus fare is \$2.70 for 18 km. Find the average cost per km.
36. An office worker earns \$96 for 8 hours of work. Find the hourly wage.
37. A machine packs 240 boxes in 30 minutes. Find the rate in boxes per minute.
38. A school canteen sells 5 buns for \$3.50. Find the cost per bun.
39. A worker paints 42 m^2 in 7 hours. Find the painting rate in m^2 per hour.
40. A family uses 24 m^3 of water in 8 days. Find the average daily water usage.
41. A cyclist covers 18 km in 45 minutes. Find the average speed in km/h.
42. A runner covers 400 m in 50 s. Find the speed in m/s.

Practice B2 · Rates in real-world applications

43. Compare: 900 g for \$12.50 or 1.45 kg for \$17.90. Which is better value per kg?
44. Compare: 1 litre for \$2.80 or 1.5 litres for \$3.90. Which is better value per litre?
45. Simple interest: Find the interest on \$1500 at 4% per annum for 3 years.
46. Simple interest: A savings account pays 2% per annum. How much interest is earned on \$800 for 5 years?
47. A loan of \$12 000 is charged simple interest at 3.5% per annum for 2 years. Find the total amount payable.
48. A phone costs \$960. A customer pays a 20% deposit and the rest over 12 equal monthly instalments. Find each monthly instalment before interest.
49. Hire purchase: A washing machine costs \$450. A buyer pays 15% down payment and the remainder is charged 10% per annum simple interest for 2 years. Find the total amount paid.
50. Currency exchange: SGD 1 = USD 0.74. Convert SGD 500 to USD.
51. Currency exchange: SGD 1 = JPY 110. Convert JPY 55 000 to SGD.
52. Currency exchange: A money changer sells USD at SGD 1.35 per USD. How many Singapore dollars are needed for USD 800?
53. Income tax: Taxable income is \$52 000. First \$40 000 tax is \$550 and next income is taxed at 7%. Find tax payable.
54. Income tax: Taxable income is \$80 000. First \$40 000 tax is \$550, next \$40 000 taxed at 7%. Find tax payable using this simplified table.
55. A town has 36 000 working adults. If the unemployment rate is 2.5%, estimate the number unemployed.
56. A clinic saw 480 patients in 6 days. Find the average number of patients per day.

9.3 · Speed

Key ideas for speed

Speed is a special type of rate. It compares distance travelled with time taken.

Formula	Meaning	Useful warning
speed = distance / time	How fast an object travels	Units must match the question.
distance = speed × time	Total distance travelled	Convert minutes to hours when using km/h.
time = distance / speed	Time taken	State answer in the required unit.
average speed = total distance / total time	For a whole journey	Do not average speeds unless the times are equal.

Worked example: average speed

Nadia travels 40 km at 40 km/h and then 30 km at 60 km/h. Find her average speed for the whole journey.

Time for first part = $40 \div 40 = 1$ h. Time for second part = $30 \div 60 = 0.5$ h. Total distance = 70 km, total time = 1.5 h. Average speed = $70 \div 1.5 = 46\frac{2}{3}$ km/h.

Common trap

The average of 40 km/h and 60 km/h is 50 km/h, but that is not the average speed here because the time spent at each speed is different.

Practice C1 · Speed basics

57. A train travels 16.8 km in 25 minutes. Find its speed in km/h.
58. A car travels 90 km in 1.5 hours. Find its speed.
59. A cyclist travels 24 km in 80 minutes. Find the speed in km/h.
60. A runner covers 1500 m in 6 minutes. Find the speed in m/s.
61. An MRT train travels at 72 km/h. Convert this speed to m/s.
62. A car travels at 25 m/s. Convert this speed to km/h.
63. A ferry travels 20 km in 40 minutes. Find the speed in km/h.
64. A plane travels 765 km in 1.5 hours. Find its average speed.
65. A taxi travels 18 km at 45 km/h. Find the time taken in minutes.
66. A bus travels 60 km at 50 km/h. Find the time taken.
67. A delivery rider travels 12 km in 24 minutes. How far will he travel in 1 hour at the same rate?
68. A car travels 50 km at 25 m/s and then 120 km at 80 km/h. Find the average speed for the whole journey in km/h.
69. A triathlete swims 1.5 km at 2.5 km/h, cycles 40 km in 1.5 hours and runs 10 km at 8 km/h. Find the average speed for the whole event.
70. A wheel has diameter 0.75 m. If it turns 420 times, find the distance travelled, correct to the nearest metre. Use $\pi = 3.142$.

Practice C2 · Average speed and algebraic speed problems

71. A capsule travels around a circular track of radius 75 m once every 30 minutes. Find its speed in m/min.
72. Two towns are 90 km apart. A car travels from A to B at 60 km/h and returns at 72 km/h. Find the average speed for the round trip.
73. A car leaves Town A at 9:00 a.m. travelling at 70 km/h. Another car leaves the same town at 9:30 a.m. travelling at 85 km/h. When will the second car catch up?
74. Two cyclists start 120 km apart and ride towards each other at 18 km/h and 22 km/h. How long will they take to meet?
75. A passenger train travels at 72 km/h and a goods train travels at 54 km/h in the opposite direction. If they pass each other in 10 s, find the combined length of the trains in metres.
76. A car travels x km at 60 km/h and $2x$ km at 80 km/h. Write an expression for the total time taken in hours.
77. On a journey, Ali travels at s km/h for 2 hours. He then increases his speed by 6 km/h and travels for another 1.5 hours. Write an expression for the total distance travelled.
78. A bus completes a route at an average speed of 48 km/h in 1 h 15 min. Find the route distance.
79. An object travels 100 m in 8 s. It then travels another 200 m in 20 s. Find its average speed.
80. A train at 90 km/h passes a pole in 12 s. Find the length of the train.
81. A 180 m train passes a platform in 20 s. If its speed is 54 km/h, find the length of the platform.
82. Two runners are on a 400 m track. Runner A runs at 5 m/s and Runner B at 4 m/s. If they start together, how long before A is one full lap ahead?
83. A drone flies 3 km north and then 4 km east in 20 minutes. Find its average speed based on total distance travelled.
84. Challenge: A car travels from A to B. If it increases its average speed by 10 km/h, it saves 30 minutes on a 120 km journey. Find its original speed.

Review · Mixed exam-style practice

85. A and B share money in the ratio 5 : 8. B receives \$45 more than A. Find the total sum.
86. A solution contains acid and water in the ratio 3 : 7. How much acid is needed to make 500 ml of solution?
87. Find the cost per 100 g if 1.2 kg of coffee powder costs \$26.40.
88. A car consumes 8 litres of petrol for 96 km. Find the distance travelled per litre.
89. A sum of money is shared among L, M and N in the ratio 2 : 3 : 5. M receives \$72. Find the sum of money.
90. After a 10% service charge and 9% GST on the subtotal, a meal costs \$119.90. What was the original meal cost before service charge?
91. A currency exchange rate is SGD 1 = MYR 3.45. Convert SGD 260 to MYR.
92. Find the simple interest on \$8000 at 3.2% per annum for 4 years.
93. A motorist travels 180 km in 2 h 15 min. Find the average speed.
94. A bus travels the first 40 km at 50 km/h and the next 60 km at 75 km/h. Find the average speed for the whole trip.
95. The ratio of boys to girls is 4 : 5. If 6 more boys join, the ratio becomes 2 : 2. Find the original number of boys and girls.
96. Two taps fill a tank. Tap A fills 12 litres per minute and Tap B fills 18 litres per minute. How much water enters the tank in 25 minutes?
97. A man pays a 25% deposit on a \$1280 laptop. The balance is paid in 10 equal instalments. Find each instalment before interest.
98. A wheel with radius 0.35 m makes 500 revolutions. Find the distance travelled in metres, correct to the nearest metre.
99. A train travelling at 72 km/h passes a 180 m platform in 24 s. Find the length of the train.

Answers 1 · Answer key

Use these answers to mark the practice. Students should still show clear working, especially when units need to be converted.

1. 3 : 4	2. 2 : 5
3. 3 : 8	4. 10 : 3
5. 3 : 5	6. 2 : 3
7. 4 : 5	8. 2 : 3 : 4
9. 18 : 42	10. 20 : 32
11. 7	12. 12
13. 21 boys	14. 27 blue beads
15. \$56	16. 270 g
17. 72 children	18. 3 km
19. 64	20. $x = 24$, $z = 54$
21. A = \$60, B = \$90	22. \$540
23. 33 girls	24. 1000 ml
25. 100 ml	26. 27 cm
27. 80°	28. \$210
29. 75 words/min	30. 8 pages/min
31. \$1.28 per 100 g	32. \$3.20/kg
33. Tin B	34. 15 km/litre
35. \$0.15/km	36. \$12/h
37. 8 boxes/min	38. \$0.70 per bun
39. 6 m ² /h	40. 3 m ³ /day
41. 24 km/h	42. 8 m/s
43. 1.45 kg for \$17.90	44. 1.5 litres for \$3.90
45. \$180	46. \$80
47. \$12 840	48. \$64
49. \$464.10	50. USD 370

Answers 2 - Answer key

51. SGD 500	52. SGD 1080
53. \$1390	54. \$3350
55. 900 people	56. 80 patients/day
57. 40.32 km/h	58. 60 km/h
59. 18 km/h	60. 4.17 m/s
61. 20 m/s	62. 90 km/h
63. 30 km/h	64. 510 km/h
65. 24 min	66. 1.2 h
67. 30 km	68. 60 km/h
69. ≈ 19.39 km/h	70. 989 m
71. 15.71 m/min	72. 65.45 km/h
73. 12:20 p.m.	74. 3 h
75. 350 m	76. $x/60 + 2x/80 = x/60 + x/40$
77. $2s + 1.5(s + 6)$	78. 60 km
79. 10.71 m/s	80. 300 m
81. 120 m	82. 400 s
83. 21 km/h	84. 40 km/h
85. \$195	86. 150 ml
87. \$2.20 per 100 g	88. 12 km/litre
89. \$240	90. \$100
91. MYR 897	92. \$1024
93. 80 km/h	94. 62.5 km/h
95. 24 boys, 30 girls	96. 750 litres
97. \$96	98. 1099 m
99. 300 m	

Teacher Notes · Common misconceptions and teaching sequence

1. Ratio order matters.

Students may treat $2 : 3$ and $3 : 2$ as interchangeable. Ask them to write the sentence represented by each ratio.

2. Units must be matched before simplifying.

For example, $45 \text{ cm} : 1.2 \text{ m}$ should first become $45 \text{ cm} : 120 \text{ cm}$.

3. Unit rate is a comparison tool.

In price questions, convert each option to a common basis such as per item, per kg, per litre or per 100 g.

4. Average speed uses total distance and total time.

Students should not simply average two speeds unless the time spent at each speed is the same.

5. Simple interest is not compound interest.

The practice here uses simple interest, where interest is based on the original principal.

6. Real-world rate questions require interpretation.

Currency exchange, tax and hire purchase questions reward careful reading more than memorised formulae.

Suggested lesson flow

- 1 Start with ratio as comparison and ratio order.
- 2 Move into equivalent ratios and unknowns in ratios.
- 3 Introduce unit rate using simple price and speed examples.
- 4 Compare same-kind and different-kind rates.
- 5 Teach average rate and average speed using $\text{total amount} \div \text{total time}$.
- 6 Finish with mixed real-world applications: interest, hire purchase, currency exchange and tax.