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SOLUTIONS BOOK

CLASS 8

Mathematics · Ganita Prakash

CHAPTER 3

Proportional Reasoning–2

Complete Exercise Solutions

Figure it Out · Set 1 | Figure it Out · Set 2 | Figure it Out · Set 3 | Figure it Out · Set 4 | Solved Examples | In-Text Questions

Contents

Class 8 · Mathematics · Ganita Prakash · Chapter 3 — Proportional Reasoning–2

F1 **Figure it Out · Set 1**
5 questions · Q1 Q2 Q3 Q4 Q5 — 3

F2 **Figure it Out · Set 2**
3 questions · Q1 Q2 Q3 — 6

F3 **Figure it Out · Set 3**
2 questions · Q1 Q2 — 9

F4 **Figure it Out · Set 4**
12 questions · Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 — 11

EX **Solved Examples**
11 questions · E1 E2 E3 E4 E5 E6 E7 E8 E9 E10 E11 — 19

IT **In-Text Questions**
14 questions · T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12 T13 T14 — 25

Every question is followed by its answer. Question numbers above are clickable and the PDF bookmarks panel lets you jump to any exercise set or question.

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F1

CLASS 8 MATHS · GANITA PRAKASH · CHAPTER 3

Figure it Out · Set 1

Sections 3.3–3.4 · 5 questions

QUESTION 1

A cricket coach schedules practice sessions that include different activities in a specific ratio — time for warm-up/cool-down : time for batting : time for bowling : time for fielding :: 3 : 4 : 3 : 5. If each session is 150 minutes long, how much time is spent on each activity?

ANSWER

The 150 minutes are to be divided in the ratio 3 : 4 : 3 : 5. The sum of the terms is 3 + 4 + 3 + 5 = 15, so 1 part = 150 ÷ 15 = 10 minutes.

Warm-up/cool-down = 150 × 3/15 = 30 minutes
Batting = 150 × 4/15 = 40 minutes
Bowling = 150 × 3/15 = 30 minutes
Fielding = 150 × 5/15 = 50 minutes
Check: 30 + 40 + 30 + 50 = 150 minutes

Warm-up/cool-down: 30 min, batting: 40 min, bowling: 30 min, fielding: 50 min.

QUESTION 2

A school library has books in different languages in the following ratio — no. of Odiya books : no. of Hindi books : no. of English books :: 3 : 2 : 1. If the library has 288 Odiya books, how many Hindi and English books does it have?

ANSWER

The Odiya books correspond to 3 parts of the ratio 3 : 2 : 1. So 3 parts = 288 books and 1 part = 288 ÷ 3 = 96 books.

Hindi books = 2 × 96 = 192
English books = 1 × 96 = 96
Check: 288 : 192 : 96 = 3 : 2 : 1 (divide each term by 96)

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The library has 192 Hindi books and 96 English books.

QUESTION 3

I have 100 coins in the ratio — no. of ₹10 coins : no. of ₹5 coins : no. of ₹2 coins : no. of ₹1 coins :: 4 : 3 : 2 : 1. How much money do I have in coins?

ANSWER

The sum of the terms is 4 + 3 + 2 + 1 = 10, so 1 part = 100 ÷ 10 = 10 coins.

₹10 coins: 4 × 10 = 40 coins → 40 × 10 = ₹400
₹5 coins: 3 × 10 = 30 coins → 30 × 5 = ₹150
₹2 coins: 2 × 10 = 20 coins → 20 × 2 = ₹40
₹1 coins: 1 × 10 = 10 coins → 10 × 1 = ₹10
Number of coins: 40 + 30 + 20 + 10 = 100
Total money = 400 + 150 + 40 + 10 = ₹600

The coins are worth ₹600 in all.

QUESTION 4

Construct a triangle with sidelengths in the ratio 3 : 4 : 5. Will all the triangles drawn with this ratio of sidelengths be congruent to each other? Why or why not?

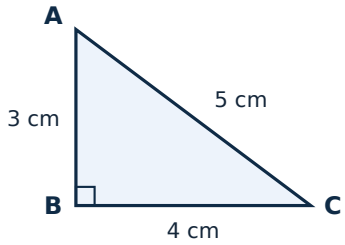
ANSWER

Let the sidelengths be 3k, 4k and 5k. Taking k = 1 cm gives the sides 3 cm, 4 cm and 5 cm. These can form a triangle because the sum of any two sides is greater than the third (3 + 4 = 7 is greater than 5).

Construction of the triangle (k = 1 cm)

1. Draw BC = 4 cm.
2. With B as centre and radius 3 cm, draw an arc above BC.
3. With C as centre and radius 5 cm, draw an arc cutting the first arc at A.
4. Join AB and AC. Then AB = 3 cm, BC = 4 cm, CA = 5 cm.

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Since $3^2 + 4^2 = 9 + 16 = 25 = 5^2$, this triangle is right-angled at B.

? Will all such triangles be congruent?

No. For every value of k, the sides 3k, 4k, 5k give a triangle of the same shape (the angles stay the same), but its size depends on k. For example, k = 1 gives sides 3, 4, 5 and k = 2 gives sides 6, 8, 10. These two triangles have equal angles but different sidelengths, so they are not congruent.

No. They have the same shape but are congruent only when they use the same value of k.

QUESTION 5

Can you construct a triangle with sidelengths in the ratio 1 : 3 : 5? Why or why not?

ANSWER

Let the sides be k, 3k and 5k. In a triangle, the sum of any two sides must be greater than the third side. Here the two smaller sides give k + 3k = 4k, which is less than the longest side 5k.

$1 + 3 = 4$, which is less than 5 (for $k = 1$)

For every k: $4k$ is less than $5k$

For example, draw a segment of 5 cm and try to meet arcs of radius 1 cm and 3 cm drawn from its two ends. The arcs do not meet, because 1 + 3 = 4 is less than 5.

No, a triangle with sidelengths in the ratio 1 : 3 : 5 cannot be constructed, since the two shorter sides together are shorter than the longest side.

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F2

CLASS 8 MATHS · GANITA PRAKASH · CHAPTER 3

Figure it Out · Set 2

Section 3.5 · 3 questions

QUESTION 1

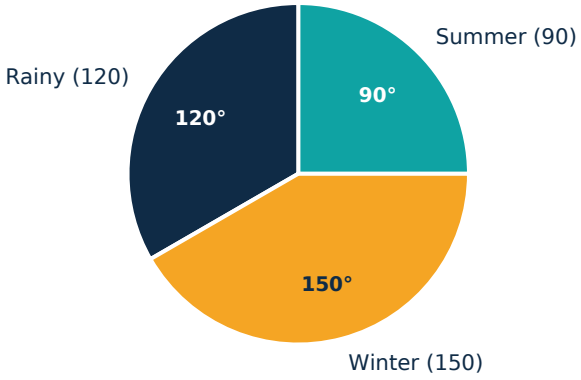
A group of 360 people were asked to vote for their favourite season from the three seasons — rainy, winter and summer. 90 liked the summer season, 120 liked the rainy season, and the rest liked the winter. Draw a pie chart to show this information.

ANSWER

Winter = 360 − (90 + 120) = 150 people. The total is 360 people and a full circle is 360°, so each person is represented by 1°. The angle of each slice equals the number of votes.

Summer: 90/360 × 360° = 90°
Rainy: 120/360 × 360° = 120°
Winter: 150/360 × 360° = 150°
Check: 90° + 120° + 150° = 360°

Draw a circle with centre A and a radius AB. Measure 90° from AB (anti-clockwise) for summer, then 120° from that radius for rainy. The remaining 150° is winter. Colour and label the slices.



Angles at the centre: Summer 90°, Rainy 120°, Winter 150°.

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QUESTION 2

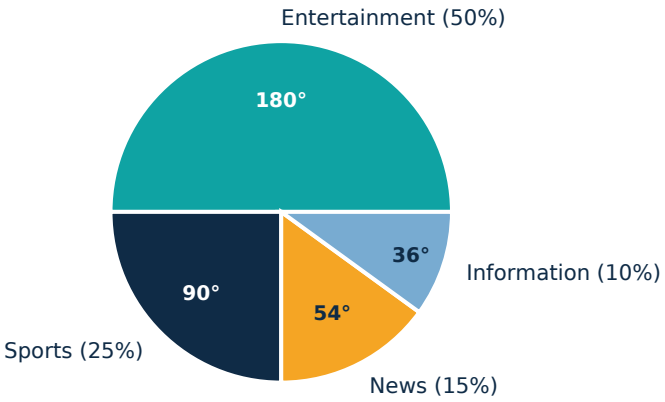
Draw a pie chart based on the following information about viewers' favourite type of TV channel: Entertainment — 50%, Sports — 25%, News — 15%, Information — 10%.

ANSWER

The percentages add up to 50 + 25 + 15 + 10 = 100%. A whole circle is 360°, so 1% corresponds to 360° ÷ 100 = 3.6°.

Entertainment: 50/100 × 360° = 180°
Sports: 25/100 × 360° = 90°
News: 15/100 × 360° = 54°
Information: 10/100 × 360° = 36°
Check: 180° + 90° + 54° + 36° = 360°

Draw a circle, mark a radius, and measure these angles one after another from it, as in Section 3.5.



Angles at the centre: Entertainment 180°, Sports 90°, News 54°, Information 36°.

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QUESTION 3

Prepare a pie chart that shows the favourite subjects of the students in your class. You can collect the data of the number of students for each subject shown in the table (each student should choose only one subject). Then write these numbers in the table and construct a pie chart:

ANSWER

This is a data-collection activity, so the numbers come from your own class. The table to be filled is:

Subject	Language	Arts Education	Vocational Education	Social Science	Physical Education	Maths	Science
Number of Students							

Method

1. Ask every student to choose exactly one subject; count the students for each subject.
2. Find the total number of students N (the sum of all counts).
3. Angle for a subject = (students who chose it ÷ N) × 360°.
4. Check that all the angles add up to 360°.
5. Draw a circle and mark the angles one after another with a protractor; colour and label each slice.

Illustration with sample data (not from the textbook): suppose 36 students choose as shown. Then 360° ÷ 36 = 10° for each student.

Subject	Students	Angle
Language	6	6 × 10° = 60°
Arts Education	4	4 × 10° = 40°
Vocational Education	3	3 × 10° = 30°
Social Science	5	5 × 10° = 50°
Physical Education	6	6 × 10° = 60°
Maths	7	7 × 10° = 70°
Science	5	5 × 10° = 50°
Total	36	360°

Angle of a slice = (number of students for the subject ÷ total number of students) × 360°.

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F3

CLASS 8 MATHS · GANITA PRAKASH · CHAPTER 3

Figure it Out · Set 3

Section 3.6 · 2 questions

QUESTION 1

Which of these are in inverse proportion?

ANSWER

Two quantities are in inverse proportion if the product x × y is the same (constant) for every pair of values. We find x × y for each table.

(i) **x : 40, 80, 25, 16 y : 20, 10, 32, 50**

x	40	80	25	16
y	20	10	32	50
x × y	800	800	800	800

The product is always 800, so x and y are in inverse proportion.

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

x	40	80	25	16
y	20	10	12.5	8
x × y	800	800	312.5	128

The products are not all equal (800, 800, 312.5, 128), so x and y are not in inverse proportion.

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

x	30	90	150	10
y	15	5	3	45
x × y	450	450	450	450

The product is always 450, so x and y are in inverse proportion.

(i) and (iii) are in inverse proportion; (ii) is not.

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QUESTION 2

Fill in the empty cells if x and y are in inverse proportion.

ANSWER

For inverse proportion, $x \times y = k$ is constant. From the complete pair $x = 16$, $y = 9$: $k = 16 \times 9 = 144$.

$x = 12$: $12 \times y = 144 \rightarrow y = 144 \div 12 = 12$
$y = 48$: $x \times 48 = 144 \rightarrow x = 144 \div 48 = 3$
$x = 36$: $36 \times y = 144 \rightarrow y = 144 \div 36 = 4$

x	16	12	3	36
y	9	12	48	4
x × y	144	144	144	144

The empty cells are y = 12 (for x = 12), x = 3 (for y = 48) and y = 4 (for x = 36).

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F4

CLASS 8 MATHS · GANITA PRAKASH · CHAPTER 3

Figure it Out · Set 4

Section 3.6 · 12 questions

QUESTION 1

Which of the following pairs of quantities are in inverse proportion? (i) The number of taps filling a water tank and the time taken to fill it. (ii) The number of painters hired and the days needed to paint a wall of fixed size. (iii) The distance a car can travel and the amount of petrol in the tank. (iv) The speed of a cyclist and the time taken to cover a fixed route. (v) The length of cloth bought and the price paid at a fixed rate per metre. (vi) The number of pages in a book and the time required to read it at a fixed reading speed.

ANSWER

Two quantities are in inverse proportion when one increases by a factor n and the other decreases by the factor 1/n (their product stays constant).

Pair	Type	Reason
(i)	Inverse	More taps fill the tank faster, so the time decreases (taps × time is constant).
(ii)	Inverse	More painters need fewer days for the same wall (painters × days is constant).
(iii)	Direct	More petrol lets the car travel a longer distance; the ratio distance ÷ petrol is constant.
(iv)	Inverse	A greater speed takes less time on the same route (speed × time = distance is constant).
(v)	Direct	More cloth costs proportionally more; price ÷ length is constant.
(vi)	Direct	More pages take proportionally more time; time ÷ pages is constant.

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

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QUESTION 2

If 24 pencils cost ₹120, how much will 20 such pencils cost?

ANSWER

More pencils cost more money, so the quantities are directly proportional: 24 : 20 :: 120 : x.

$x = (20 \times 120) \div 24 = 2400 \div 24 = 100$

Check: 1 pencil costs $120 \div 24 = ₹5$, so 20 pencils cost $20 \times 5 = ₹100$

20 pencils will cost ₹100.

QUESTION 3

A tank on a building has enough water to supply 20 families living there for 6 days. If 10 more families move in there, how long will the water last? What assumptions do you need to make to work out this problem?

ANSWER

There will be 20 + 10 = 30 families. More families use the water up faster, so the number of days decreases: the quantities are inversely proportional, and $x_1y_1 = x_2y_2$.

$20 \times 6 = 30 \times y$

$y = 120 \div 30 = 4$

Assumptions: every family uses the same amount of water each day; the amount used per family does not change when the new families arrive; the tank is not refilled and nothing is lost to leakage or wastage; and all 30 families use the water from the same day.

The water will last 4 days.

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QUESTION 4

Fill in the average number of hours each living being sleeps in a day by looking at the charts. Select the appropriate hours from this list : 15, 2.5, 20, 8, 3.5, 13, 10.5, 18.

ANSWER

In each ring chart the purple part shows the share of the 24-hour day spent sleeping. Matching the sizes of the purple parts with the list (the larger the purple part, the more hours of sleep) gives the table below. The last column is hours ÷ 24.

Living being	Sleep (hours per day)	Share of the day
Giraffe	2.5	about 10%
Elephant	3.5	about 15%
Human	8	one-third (about 33%)
Dog	10.5	about 44%
Cat	13	about 54%
Squirrel	15	about 63%
Snake	18	three-quarters (75%)
Bat	20	about 83%

Giraffe 2.5 h, Elephant 3.5 h, Human 8 h, Dog 10.5 h, Cat 13 h, Squirrel 15 h, Snake 18 h, Bat 20 h.

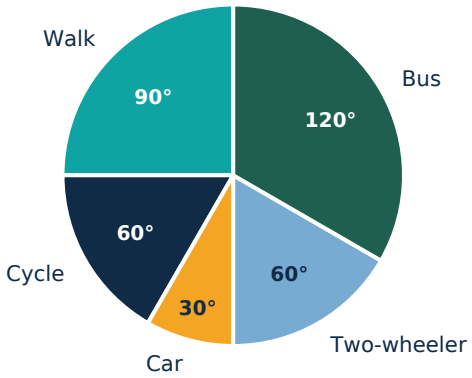
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QUESTION 5

The pie chart on the right shows the result of a survey carried out to find the modes of transport used by children to go to school. Study the pie chart and answer the following questions. (i) What is the most common mode of transport? (ii) What fraction of children travel by car? (iii) If 18 children travel by car, how many children took part in the survey? How many children use taxis to travel to school? (iv) By which two modes of transport are equal numbers of children travelling?

ANSWER

The chart gives the angles Walk 90°, Bus 120°, Two-wheeler 60° and Cycle 60°. The Car sector has no label, but the angles at the centre add up to 360°, so Car = 360° − (90° + 120° + 60° + 60°) = 30°.



(i) Most common mode

The largest sector is the Bus sector (120°), so the bus is the most common mode of transport.

(ii) Fraction travelling by car

Fraction = 30°/360° = 1/12.

(iii) Number of children

18 children = 1/12 of all children

Total number of children = 18 × 12 = 216

Walk: 90/360 × 216 = 54; Bus: 120/360 × 216 = 72

Two-wheeler: 36; Cycle: 36; Car: 18

Check: 54 + 72 + 36 + 36 + 18 = 216

The chart has no separate sector for taxis. If taxis are counted together with cars, 18 children use taxis (or cars); the chart cannot separate the two.

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(iv) **Equal numbers**

The Cycle and Two-wheeler sectors are both 60°, so equal numbers of children (36 each) travel by cycle and by two-wheeler.

(i) Bus (ii) 1/12 (iii) 216 children took part; 18 travel by car (the chart has no separate taxi sector) (iv) Cycle and Two-wheeler.

QUESTION 6

Three workers can paint a fence in 4 days. If one more worker joins the team, how many days will it take them to finish the work? What are the assumptions you need to make?

ANSWER

There will be 3 + 1 = 4 workers. More workers finish sooner, so the quantities are inversely proportional: 3 × 4 = 4 × y.

$$y = (3 \times 4) \div 4 = 3$$

Assumptions: all workers paint at the same speed and work the same number of hours each day; the new worker joins from the beginning and does not get in the way of the others; and the fence to be painted is the same.

It will take 3 days.

QUESTION 7

It takes 6 hours to fill 2 tanks of the same size with a pump. How long will it take to fill 5 such tanks with the same pump?

ANSWER

More tanks take more time with the same pump, so the quantities are directly proportional: 2 : 5 :: 6 : x.

$$x = (5 \times 6) \div 2 = 15$$

Check: 1 tank takes 6 ÷ 2 = 3 hours, so 5 tanks take 5 × 3 = 15 hours

It will take 15 hours.

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QUESTION 8

A given set of chairs are arranged in 25 rows, with 12 chairs in each row. If the chairs are rearranged with 20 chairs in each row, how many rows does this new arrangement have?

ANSWER

The total number of chairs is fixed. More chairs in a row means fewer rows, so the number of rows and the chairs per row are inversely proportional: $25 \times 12 = y \times 20$.

Total chairs $= 25 \times 12 = 300$

$y = 300 \div 20 = 15$

The new arrangement has 15 rows.

QUESTION 9

A school has 8 periods a day, each of 45 minutes duration. How long is each period, if the school has 9 periods a day, assuming that the number of school hours per day stays the same?

ANSWER

The total school time is fixed. More periods mean shorter periods, so the quantities are inversely proportional: $8 \times 45 = 9 \times y$.

Total time $= 8 \times 45 = 360$ minutes (6 hours)

$y = 360 \div 9 = 40$

Each period will be 40 minutes long.

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QUESTION 10

A small pump can fill a tank in 3 hours, while a large pump can fill the same tank in 2 hours. If both pumps are used together, how long will the tank take to fill?

ANSWER

Treat filling the whole tank as 1 unit of work and find the work done in 1 hour.

Small pump: 1/3 of the tank in 1 hour
Large pump: 1/2 of the tank in 1 hour
Together: 1/3 + 1/2 = 2/6 + 3/6 = 5/6 of the tank in 1 hour

The work done and the time taken are directly proportional: 5/6 : 1 :: 1 : x.

(5/6) × x = 1 × 1
x = 1 ÷ (5/6) = 6/5 hours = 1.2 hours = 1 hour 12 minutes

Together the pumps fill the tank in 6/5 hours, that is, 1 hour 12 minutes.

QUESTION 11

A factory requires 42 machines to produce a given number of toys in 63 days. How many machines are required to produce the same number of toys in 54 days?

ANSWER

To finish in fewer days, more machines are needed, so the quantities are inversely proportional: 42 × 63 = y × 54.

y = (42 × 63) ÷ 54 = 2646 ÷ 54 = 49
Check: 49 × 54 = 2646 = 42 × 63

49 machines are required.

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QUESTION 12

A car takes 2 hours to reach a destination, travelling at a speed of 60 km/h. How long will the car take if it travels at a speed of 80 km/h?

ANSWER

For the same distance, a greater speed takes less time, so the quantities are inversely proportional: 60 × 2 = 80 × y.

Distance = 60 × 2 = 120 km

y = 120 ÷ 80 = 1.5

The car will take 1.5 hours, that is, 1 hour 30 minutes.

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EX

CLASS 8 MATHS · GANITA PRAKASH · CHAPTER 3

Solved Examples

Sections 3.3–3.6 · 11 examples

EXAMPLE 1 · SEC 3.3

To make a special shade of purple, paint must be mixed in the ratio, Red : Blue : White :: 2 : 3 : 5. If Yasmin has 10 litres of white paint, how many litres of red and blue paint should she add to get the same shade of purple?

ANSWER

In the ratio 2 : 3 : 5, the white paint corresponds to 5 parts. If 5 parts is 10 litres, then 1 part is 10 ÷ 5 = 2 litres.

Red = 2 parts = 2 × 2 = 4 litres
Blue = 3 parts = 3 × 2 = 6 litres
White = 5 parts = 5 × 2 = 10 litres (as given)

Yasmin should add 4 litres of red and 6 litres of blue paint (total purple paint = 20 litres).

EXAMPLE 2 · SEC 3.3

Cement concrete is a mixture of cement, sand, and gravel, and is widely used in construction. The ratio of the components in the mixture varies depending on how strong the structure needs to be. For structures that need greater strength like pillars, beams, and roofs, the ratio is 1 : 1.5 : 3, and the construction is also reinforced with steel rods. Using this ratio, if we have 3 bags of cement, how many bags of concrete mixture can we make?

ANSWER

Bags of cement : bags of sand : bags of gravel :: 1 : 1.5 : 3. With 3 bags of cement, every term is multiplied by 3.

cement : sand : gravel = 3 × 1 : 3 × 1.5 : 3 × 3 = 3 : 4.5 : 9
Total = 3 + 4.5 + 9 = 16.5 bags

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We can make 16.5 bags of concrete mixture.

EXAMPLE 3 · SEC 3.4

For some construction, 110 units of concrete are needed. How many units of cement, sand, and gravel are needed if these are to be mixed in the ratio 1 : 1.5 : 3?

ANSWER

One set of the mixture is 1 + 1.5 + 3 = 5.5 units. We need 110 ÷ 5.5 = 20 such sets, so each term of the ratio is multiplied by 20.

Cement = 1 × 20 = 20 units
Sand = 1.5 × 20 = 30 units
Gravel = 3 × 20 = 60 units
Check: 20 + 30 + 60 = 110 units

20 units of cement, 30 units of sand and 60 units of gravel are needed.

EXAMPLE 4 · SEC 3.4

You get a particular shade of purple paint by mixing red, blue, and white paint in the ratio 2 : 3 : 5. If you need 50 ml of purple paint, how many ml of red, blue, and white paint will you mix together?

ANSWER

The sum of the terms is 2 + 3 + 5 = 10. Using the formula x × a/(a + b + c):

Red = 50 × 2/10 = 10 ml
Blue = 50 × 3/10 = 15 ml
White = 50 × 5/10 = 25 ml
Check: 10 + 15 + 25 = 50 ml

Mix 10 ml of red, 15 ml of blue and 25 ml of white paint.

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EXAMPLE 5 · SEC 3.4

Construct a triangle with angles in the ratio 1 : 3 : 5.

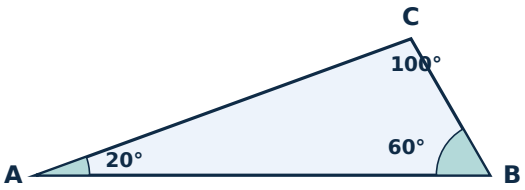
ANSWER

The angles of a triangle add up to 180°, and 1 + 3 + 5 = 9.

∠A = 180° × 1/9 = 20°
∠B = 180° × 3/9 = 60°
∠C = 180° × 5/9 = 100°
Check: 20° + 60° + 100° = 180°

Construction

1. Draw a line segment AB (of any convenient length, e.g. 5 cm).
2. At A, draw a ray making an angle of 20° with AB.
3. At B, draw a ray making an angle of 60° with BA, on the same side of AB.
4. The two rays meet at C. Then ∠C = 180° − 20° − 60° = 100°.



The angles are 20°, 60° and 100°. (Any length of AB works; the triangles obtained are similar.)

EXAMPLE 1 · SEC 3.6

If 5 workers can move 4500 bricks in a day, how many workers are needed to move 18000 bricks in a day?

ANSWER

More bricks need more workers, so the quantities are directly proportional: 4500 : 18000 :: 5 : x.

x = (18000 × 5) ÷ 4500 = 90000 ÷ 4500 = 20
Check: 18000 is 4 times 4500, so the workers are also 4 times 5 = 20

20 workers are needed.

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EXAMPLE 2 · SEC 3.6

Puneeth’s father went from Lucknow to Kanpur in 3 hours by riding his motorcycle at a speed of 30 km/h. If he takes a car instead and drives at 60 km/h, how long will it take him to reach Kanpur?

ANSWER

The distance is fixed, so speed and time are inversely proportional: $x_1y_1 = x_2y_2$.

$30 \times 3 = 60 \times y$

$y = 90 \div 60 = 1.5$

(The distance between Lucknow and Kanpur is $30 \times 3 = 90$ km.)

By car it will take 1.5 hours, that is, 1 hour 30 minutes.

EXAMPLE 3 · SEC 3.6

20 workers take 4 days to complete laying a road. How many days will 10 workers take to complete laying the same length of road?

ANSWER

Fewer workers need more days, so the quantities are inversely proportional: $x_1y_1 = x_2y_2$.

$20 \times 4 = 10 \times y$

$y = 80 \div 10 = 8$

10 workers will take 8 days. (Halving the workers doubles the days.)

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EXAMPLE 4 · SEC 3.6

2 pumps can fill a tank in 18 hours. How much time will it take to fill the tank if we add 2 more pumps of the same kind?

ANSWER

With 2 more pumps there are 4 pumps. More pumps fill the tank in less time, so the quantities are inversely proportional.

$2 \times 18 = 4 \times x$

$x = 36 \div 4 = 9$

It will take 9 hours to fill the tank.

EXAMPLE 5 · SEC 3.6

A school has food provisions to feed 80 students for 15 days. If 20 more students join the school, for how many days will the provisions last?

ANSWER

There will be 80 + 20 = 100 students. More students means the provisions last fewer days, so the quantities are inversely proportional.

$80 \times 15 = 100 \times x$

$x = 1200 \div 100 = 12$

The provisions will last for 12 days.

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EXAMPLE 6 · SEC 3.6

If Ram takes 1 hour to cut a given quantity of vegetables and Shyam takes 1.5 hours to cut the same quantity of vegetables, how much time will they take to cut the vegetables if they do it together?

ANSWER

Take the whole job as 1 unit of work and find the work done by each person in 1 hour.

Ram: 1 unit of work in 1 hour
Shyam: $1 \div 1.5 = 2/3$ unit of work in 1 hour
Together in 1 hour: $1 + 2/3 = 5/3$ units of work

Work and time are directly proportional: $5/3 : 1 :: 1 : x$.

$(5/3) \times x = 1 \times 1$
$x = 1 \div (5/3) = 3/5$ hour = 36 minutes

Working together they will finish in 3/5 hour, that is, 36 minutes.

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IT

CLASS 8 MATHS · GANITA PRAKASH · CHAPTER 3

In-Text Questions

Sections 3.1–3.6 · 14 questions

SECTION 3.1

Viswanath made idlis by mixing 6 cups of rice with 3 cups of urad dal, while Puneet made idlis by mixing 4 cups of rice with 2 cups of urad dal. If cooked in the same way, would their idlis taste the same?

ANSWER

Viswanath's mixture is 6 : 3 and Puneet's mixture is 4 : 2. Check with cross-multiplication:

$6 \times 2 = 12$ and $3 \times 4 = 12$

The two products are equal, so 6 : 3 and 4 : 2 are proportional.

(Also $6 : 3 = 2 : 1$ and $4 : 2 = 2 : 1$.)

Yes, both mixtures are in the ratio 2 : 1, so the idlis would taste the same, if all the other ingredients are proportional too.

SECTION 3.2 · Q1

Have you noticed that in many maps there is a ratio given, usually in the lower right corner of the map? It usually contains 1 and a very large number, such as 1 : 60,00,000. What does RF 1 : 60,00,000 mean? What does it indicate? Can you guess?

ANSWER

RF stands for Representative Fraction. It is the ratio between a distance on the map and the corresponding actual distance on the ground.

RF 1 : 60,00,000 → 1 cm on the map = 60,00,000 cm on the ground = 60 km

It means that 1 cm on the map represents a geographical (straight-line) distance of 60,00,000 cm = 60 km on the ground; it is not the road distance.

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SECTION 3.2 · Q2

Convert 60,00,000 cm to kilometres.

ANSWER

60,00,000 cm ÷ 100 = 60,000 m
60,000 m ÷ 1000 = 60 km
(Or: 1 km = 1,00,000 cm, so 60,00,000 ÷ 1,00,000 = 60 km)

60,00,000 cm = 60 km.

SECTION 3.2 · Q3

Using the map above, can you find the geographical distance between Bengaluru and Chennai? Also, find the geographical distance between Mangaluru and Chennai. [Hint: Use a ruler to find the distance between the cities on the map. Then, use the ratio given on the map to find the actual geographical distance.]

ANSWER

Measure the straight-line distance between the two city marks with a ruler (in cm) and multiply it by 60 km, because on this map (RF 1 : 60,00,000) every 1 cm stands for 60 km.

Actual distance = map distance (cm) × 60 km

The printed map is marked “Map not to scale”, so a ruler reading depends on how large your copy is printed. To check your answer, the straight-line distances worked out from the cities’ latitudes and longitudes are about 290 km for Bengaluru–Chennai and about 590 km for Mangaluru–Chennai. At RF 1 : 60,00,000 these would measure about 290 ÷ 60 ≈ 4.8 cm and 590 ÷ 60 ≈ 9.8 cm on the map.

Bengaluru to Chennai: about 290 km. Mangaluru to Chennai: about 590 km (geographical distance, not road distance).

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SECTION 3.2 · Q4

Try to find the distances between the same two pairs of cities with different maps that have different scales (ratios). Do they all give the same geographical distance, approximately?

ANSWER

Yes, approximately. A map with a different RF shows a different map length, but multiplying by its own scale gives the same ground distance. For example, a map with RF 1 : 30,00,000 shows each distance twice as long as the 1 : 60,00,000 map (1 cm = 30 km), so a distance of 9.6 cm there is 9.6 × 30 = 288 km, the same as 4.8 × 60 = 288 km.

Small differences of a few kilometres can occur because of measuring errors with the ruler, the way the map is drawn (projection) and the rounding of scales. Large differences would point to a mistake, for example reading the wrong scale or the wrong unit.

Different maps give about the same geographical distance, because actual distance = map distance × scale.

SECTION 3.2 · ACTIVITY

Map Making Activity: Guide students to make a sketch of their classroom with an accurate scale (ratio of 1 : 50). They should mark the location of various objects in the classroom like the teacher's desk, blackboard, fans and lights, according to scale. Students can use appropriate symbols to represent different objects like fans, lights, tables, chairs, and so on.

ANSWER

A scale of 1 : 50 means that 1 cm on the sketch stands for 50 cm (= 0.5 m) in the classroom. So every real length (in cm) is divided by 50 to get its length on the sketch.

Sketch length = actual length ÷ 50

Measure the length and breadth of the room, the desk, the board, etc. in cm.

Divide each length by 50, draw the room as a rectangle, and place each object at the scaled position using symbols.

Illustration with sample measurements (replace them by the measurements of your own classroom):

Object	Actual size	Size on the sketch (÷ 50)
Classroom	7 m × 6 m = 700 cm × 600 cm	14 cm × 12 cm
Teacher's desk	1.2 m × 0.6 m = 120 cm × 60 cm	2.4 cm × 1.2 cm
Blackboard (length)	3 m = 300 cm	6 cm

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On a 1 : 50 sketch, every 50 cm of the classroom is drawn as 1 cm.

SECTION 3.3

Puneet has only 2 red chillies in his kitchen. But he wants to make spice mix powder that tastes the same as Viswanath's spice mix powder. How much of the other ingredients should Puneet use to make his spice mix powder?

ANSWER

Viswanath's ratio is coriander seeds : red chillies : toor dal : fenugreek seeds = 8 : 4 : 2 : 1. Puneet has 2 red chillies, which is half of 4, so every other quantity must also be halved.

Coriander seeds = 8 × 1/2 = 4 spoons
Red chillies = 4 × 1/2 = 2
Toor dal = 2 × 1/2 = 1 spoon
Fenugreek seeds = 1 × 1/2 = 0.5 spoon
Check: 8/4 = 4/2 = 2/1 = 1/0.5 = 2, so 8 : 4 : 2 : 1 :: 4 : 2 : 1 : 0.5

Puneet should use 4 spoons of coriander seeds, 1 spoon of toor dal and half a spoon of fenugreek seeds (with his 2 red chillies); the ratio is 4 : 2 : 1 : 0.5.

SECTION 3.3 · EXAMPLE 1

What is the total volume of this purple paint?

ANSWER

From Example 1, the purple paint contains 4 litres of red, 6 litres of blue and 10 litres of white paint.

Total volume = 4 + 6 + 10 = 20 litres

The total volume of the purple paint is 20 litres.

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SECTION 3.5 · Q1

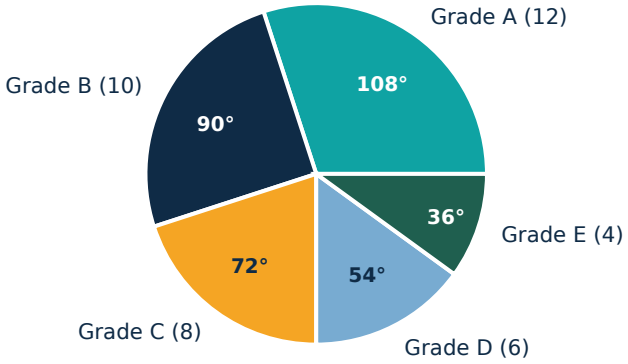
How do we mark the different slices of the pie chart?

ANSWER

The angle of a slice must be proportional to the number of students with that grade. The total angle in a circle is 360°, so we divide 360° in the ratio 12 : 10 : 8 : 6 : 4 (the numbers of students with grades A, B, C, D, E; total 40).

Grade A = 12/40 × 360° = 108°
Grade B = 10/40 × 360° = 90°
Grade C = 8/40 × 360° = 72°
Grade D = 6/40 × 360° = 54°
Grade E = 4/40 × 360° = 36°

Draw a circle and a radius AB. Measure 108° from AB (anti-clockwise) to mark AC (Grade A); measure 90° from AC to mark AD (Grade B); measure 72° from AD to mark AE (Grade C); then 54° (Grade D) and 36° (Grade E) in the same way. Colour and label each slice.



The slices have angles 108°, 90°, 72°, 54° and 36°, which add up to 360°.

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SECTION 3.5 · Q2

Can we reduce this ratio to its simplest form?

ANSWER

Yes. Divide all the terms of 12 : 10 : 8 : 6 : 4 by their HCF, which is 2.

$12 \div 2 : 10 \div 2 : 8 \div 2 : 6 \div 2 : 4 \div 2 = 6 : 5 : 4 : 3 : 2$

Sum of the terms $= 6 + 5 + 4 + 3 + 2 = 20$, and $360° \div 20 = 18°$ for each part

Angles: $6 \times 18° = 108°$, $5 \times 18° = 90°$, $4 \times 18° = 72°$, $3 \times 18° = 54°$, $2 \times 18° = 36°$

The simplest form is 6 : 5 : 4 : 3 : 2, and it gives the same angles as before.

SECTION 3.6 · MATH TALK 1

Can we represent this problem with the following statement of proportionality — 30 : 60 :: 3 : x ? Will the travel time increase or decrease as the speed of the motorcycle increases?

ANSWER

No. The statement 30 : 60 :: 3 : x is a direct proportion. It would give $x = (60 \times 3) \div 30 = 6$ hours, which is more than 3 hours, but a car at 60 km/h (double the speed) cannot take longer. The travel time decreases as the speed increases, so the quantities are in inverse proportion.

Correct statement: $30 \times 3 = 60 \times x \rightarrow x = 90 \div 60 = 1.5$ hours

As a proportion, one ratio must be reversed: $30 : 60 :: x : 3 \rightarrow x = (30 \times 3) \div 60 = 1.5$

No. The travel time decreases as the speed increases; the correct relation is 30 × 3 = 60 × x, giving x = 1.5 hours.

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SECTION 3.6 · Q1

Does it decrease by the same rate (or factor)? Check if this is the case for the other modes of transport.

ANSWER

Yes. Compare the speeds and times for each pair of modes (speed in km/h, time in hours):

Change of mode	Speed changes by	Time changes by
Walk → Bicycle (5 → 15; 18 → 6)	× 3	× 1/3
Walk → Motorcycle (5 → 30; 18 → 3)	× 6	× 1/6
Walk → Car (5 → 60; 18 → 1.5)	× 12	× 1/12
Bicycle → Motorcycle (15 → 30; 6 → 3)	× 2	× 1/2
Bicycle → Car (15 → 60; 6 → 1.5)	× 4	× 1/4
Motorcycle → Car (30 → 60; 3 → 1.5)	× 2	× 1/2

Products: $5 \times 18 = 90$, $15 \times 6 = 90$, $30 \times 3 = 90$, $60 \times 1.5 = 90$ (always 90 km)

In every case the speed increases by a factor n and the time decreases by the factor 1/n, so speed and time are inversely proportional.

SECTION 3.6 · Q2

Let us check if this is true for other modes of transport, such as walking and by car. Let us use x to represent speed and y to represent time. $x_1 = 5$, $x_2 = 60$, $y_1 = 18$, $y_2 = 1.5$. $x_1/x_2 = 5/60 = 0.083333\ldots$ What is the value of 1.5/18 (y_2/y_1)?

ANSWER

$x_1/x_2 = 5/60 = 1/12 = 0.083333\ldots$
$y_2/y_1 = 1.5/18 = 15/180 = 1/12 = 0.083333\ldots$

1.5/18 = 0.083333… (= 1/12), the same as 5/60, so $x_1/x_2 = y_2/y_1$ holds.

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SECTION 3.6 · MATH TALK 2

How much time will it take them to complete 1 unit of work? Is the quantity of work and time taken to complete it directly or inversely proportional?

ANSWER

Ram and Shyam together do 5/3 units of work in 1 hour. At a fixed working speed, more work takes more time (twice the work takes twice the time), so work and time are directly proportional.

$5/3 : 1 :: 1 : x$

$(5/3) \times x = 1 \times 1$

$x = 1 \div (5/3) = 3/5$ hour $= 36$ minutes

Work and time are directly proportional, and they will complete 1 unit of work in 3/5 hour (36 minutes).

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