Year 10 Maths

Unit 2: Ratio and scale

MATHOPEDIA

simplifying ratios...

EXAMPLE:
Simplify the ratio 15 : 20

15 : 20
÷ 5 ÷ 5
3 : 4

5 is a factor of both 15 and 20

3 and 4 have no more common factors

EXAMPLE:
Simplify 2.4 : 3 : 4.8

First get rid of the decimals

2.4 : 3 : 4.8
x 10 x 10
24 : 30 : 48
÷ 2 ÷ 2
12 : 15 : 24
÷ 3 ÷ 3
4 : 5 : 8

Keep going if there's still a common factor

EXAMPLE: Simplify
2 hours : 40 minutes

Convert to a common unit (e.g. minutes)

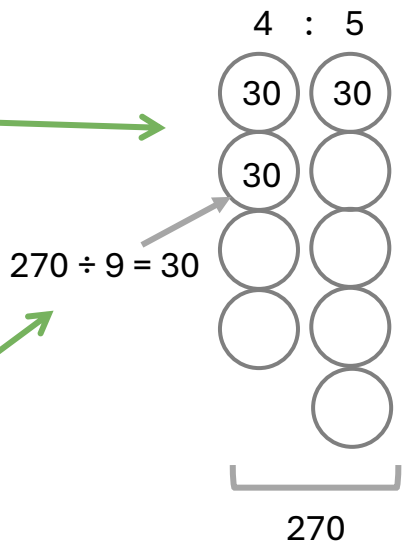
120 : 40
÷ 10 ÷ 10
12 : 4
÷ 3 ÷ 3
3 : 1

Simplify further if possible

sharing in a ratio...

EXAMPLE: Fran and Elle share 270 lego bricks in the ratio 4 : 5. How many does each get?

Draw a diagram



270 ÷ 9 = 30

Work out the value of each circle

Count up the circles

4 x 30 = 120
5 x 30 = 150

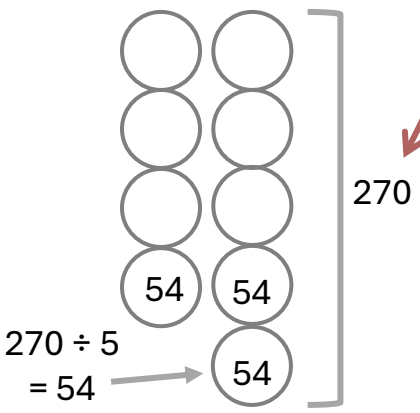
Fran gets 120
Elle gets 150

Answer in context

one part is given...

EXAMPLE:
Fran and Elle share some lego bricks in the ratio 4 : 5.
Elle gets 270. How many does Fran get?

4 : 5



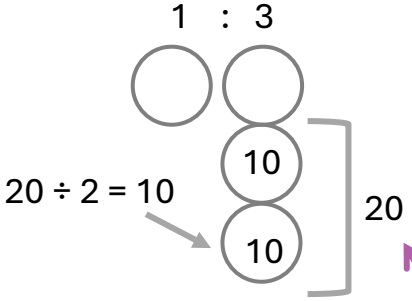
4 x 54 = 216
Elle gets 216

This time the 5 circles are worth 270

a difference is given...

EXAMPLE: Pete and Sam share some sweets in the ratio 1 : 3.
Sam gets **20 more** than Pete. How many do they have in total?

1 : 3



4 x 10 = 40
They have 40

The 2 circles here represent the '20 more'

Notice that 'spoons' appear twice

Arrange all the information

Scale up the spoons

combined ratios...

EXAMPLE:
The ratio of forks to **spoons** is 2 : 5
The ratio of knives to **spoons** is 1 : 4
Find the ratio of knives to forks.

K : F : S
2 : 5
1 : 4
x 4

K : F : S
8 : 20
5 : 20
x 5

The ratio of knives to forks is 5 : 8

EXAMPLE:
In a restaurant, the ratio of **pizzas** to burgers served is 2 : 5.
The ratio of salads to **pizzas** is 1 : 3.
If 4 salads are sold, how many burgers are sold?

Arrange and scale up the information

P : B : S
2 : 5
3 : 1

P : B : S
6 : 15
6 : 2

A circle diagram could be used for this part

The ratio of salads to burgers is

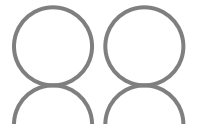
x 2 (2 : 15) x 2
(4 : 30)

30 burgers are sold

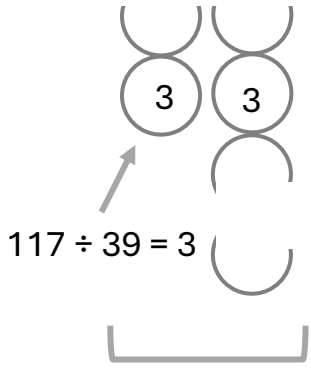
complex problems...

EXAMPLE:
Sam and Eve share £117 in the ratio 12 : 27.
Sam gives 30% of his share to Jack.
Eve gives a quarter of her share to Jack.
How much does Jack receive altogether?

12 : 27



We don't need to draw all 39 circles!



Sam: 12 x 3 = £36
Eve: 27 x 3 = £81

Sam gives:
0.3 x 36 = £10.80

30% of Sam's amount

Eve gives:
81 ÷ 4 = £20.25

A quarter of Eve's amount

Jack gets:
10.80 + 20.25
= £31.05

A **map scale** can be written using units
e.g. 1cm to 10 miles
or as a ratio
e.g. 1 : 50 000
For this ratio, 1 cm on the map represents 50 000 cm in real life.
(or 1mm and 50 000 mm, etc.)

map scales...

EXAMPLE: A map has a scale 1cm : 6km
A road is 15km long.
How long does it appear on the map, in cm?

Scale to the same units

MAP : REAL LIFE

1cm : 6km

1cm : 6000m

1cm : 600 000cm

÷ 40 (1 : 600 000) ÷ 40

0.025 : 15 000

Use the 15km in the question (in metres here)

Road on the map,

0.025 metres) x 100

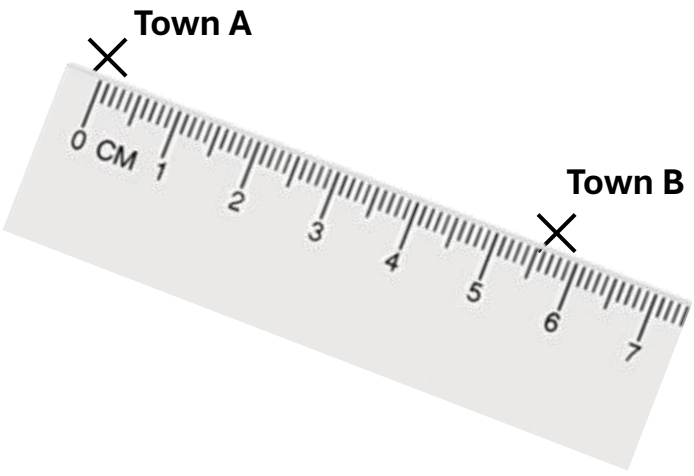
2.5 cm

The question asked for the answer in cm

scale drawings...

EXAMPLE:

The accurate scale diagrams shows two towns, Town A and Town B.
Find the actual distance between the two towns, in kilometres.



Scale:
1 : 50 000

5.7 cm on diagram → (x 50 000) → 285000 cm in real life → (÷100) → 2850 m → (÷1000) → **2.85 km**

Measure the distance accurately with a ruler

Use the scale from the diagram

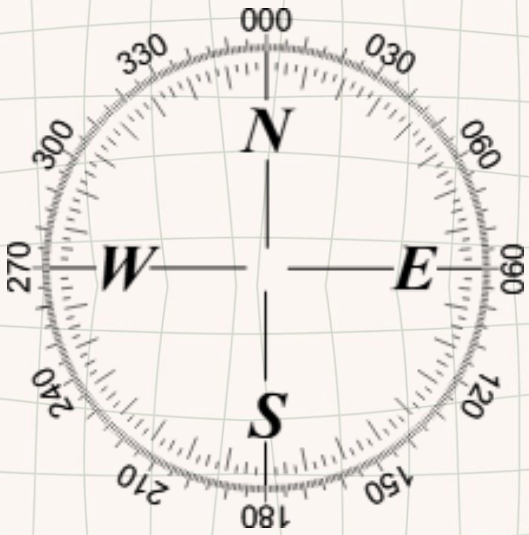
The question asked for the answer in kilometres

A **bearing** is used to represent direction accurately, such as for navigation.

Bearings are measured:

- clockwise from north
- in degrees
- using 3 digits (e.g. 042°)

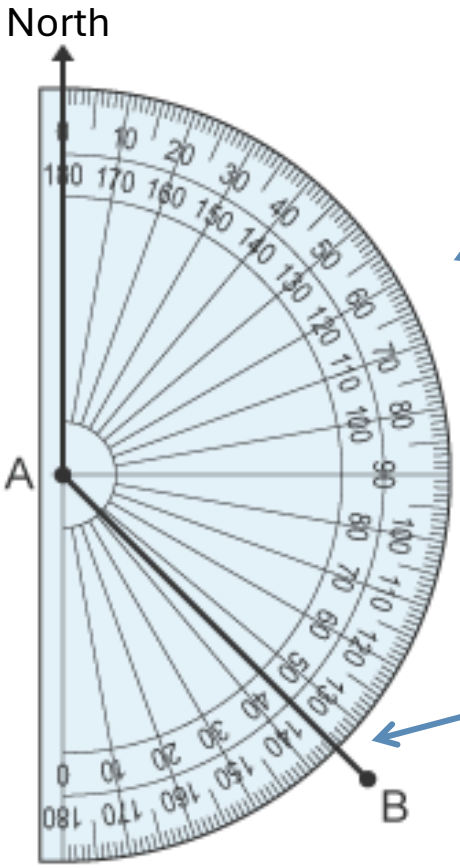
The bearing of **A <u>from B</u>** is the direction to travel to get <u>from B</u> to A.



measuring...

EXAMPLE:
Measure the bearing of **B from A**.

This means the direction to get <u>from A</u> to B



We're travelling <u>from A</u>, so place the centre of a protractor at A

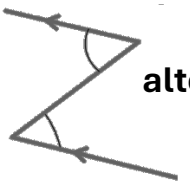
Measure the angle accurately, clockwise from north

Remember to use 3 digits for angles less than 100°

135°

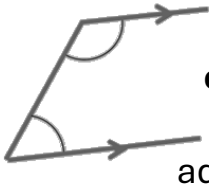
parallel lines...

Calculating bearings can involve using the rules for angles on parallel lines:



alternate angles are equal

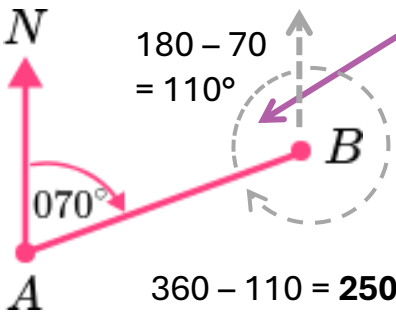
corresponding angles are equal



co-interior angles add up to 180°

calculating...

EXAMPLE: The bearing of B from A is 70°. Calculate the bearing of A from B.



360 – 110 = **250°**

Now find the required angle: clockwise from north

Find this angle using the rule for co-interior angles

Add in a second north line

constructing

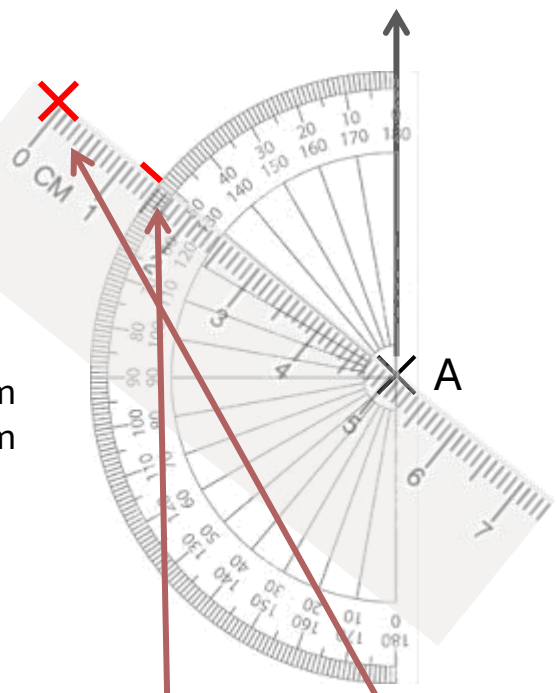
EXAMPLE:
Josh is at point A.
He runs 500m on a bearing of 310°.
Plot his finishing position with a cross.

Scale 1 cm : 100 m

360 – 310 = 50°

The bearing needs to be clockwise from north

North



1 cm : 100m
5 cm : 500m

Calculate the distance using the scale

Use a protractor to mark the correct angle

Then use a ruler to mark the answer at the correct distance