NAPLAN Numeracy Year 5: Measurement and Geometry

This document contains Year 5 Measurement and Geometry resources including items for:

- Using units of measurement
- Shape
- Location and transformation

These items aim to develop and test Year 5 students' proficiency with the content of these sub-strands.

Please note that these resources do not encompass all that should be taught and learned for Measurement and Geometry in Year 5. Not all of the content of the curriculum can be effectively assessed in a written test format.

Measuring area on grids using whole and half units

Background information/teaching focus

For students to understand how 'measuring' works they need to internalise the following ideas:

- We can use numbers to describe the size of something by selecting and counting the number of repeated units. The units need to be matched as closely together as possible.
- A unit of measure is the quantity itself; for example the area of a tile is the unit not the tile itself.
- The number of measurement units change when different sized units are used, not the thing being measured.
- Two things can be compared to find which is bigger or smaller when the same unit is used.

When these ideas are developed students can then see why:

- we should use the same unit repeatedly to measure an object
- when comparing two things, the same unit should be chosen for each.

For further related information see *First Steps in Mathematics*: *Measurement* (book one):

- Chapter 3: Understand units
  - Key understanding 3: To measure something means to say how much of a particular attribute it has. We measure by choosing a unit and working out how many of the unit it takes to match the thing. p.28

Rigby Harcourt Education, Australia

Western Australian Curriculum

- Year 4 – Compare objects using familiar metric units of area and volume (ACMMG290).
- Year 5 – Calculate the perimeter and area of rectangles using familiar metric units (ACMMG109).
- Year 6 – Solve problems involving the comparison of lengths and areas using appropriate units (ACMMG137).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

For further ideas for activities see *First Steps in Mathematics*: Measurement (book one):

- Snail trails p. 32
- Hungry cow p. 32
- Body measurements p. 33
- One tile p. 33
- Garden plots p. 34

Revised October 2016

Question 1

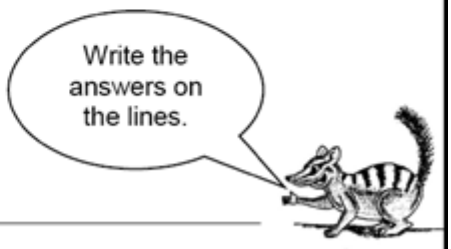
Karen, Joel and Maria tried to find the area of a pin board using pieces of paper.

Karen Joel Maria

Their results were different.

Who was correct?_____

Explain why.



_____

_____

Skill: Students recognise that there should be no gaps or overlaps when finding area of a shape.
Answer key: Maria, there are no gaps or overlaps.
Notes: This question requires both an answer to the first question and an explanation. When an extended response is required students should provide a complete explanation – not just one or two words. Share responses and use these to paraphrase and model a structure for writing an explanation, eg Maria was correct because…

Additional questions

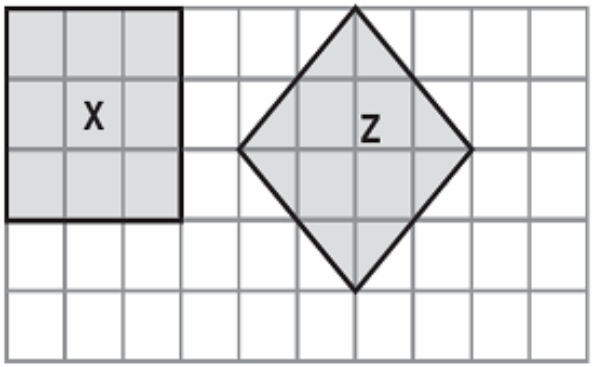
1. Why is Maria's arrangement a true measure of area?
2. Would Karen's arrangement over-estimate or under-estimate the area of the pin board? How do you know?
3. Helen covered the same pin board with pieces of paper that overlap. Would she over-estimate or under-estimate the area? How do you know?
4. Can you work out how many of Maria's paper rectangles match the area of the pin board without counting every piece? Discuss the link between arrays and the measure of area of rectangles.

Question 2

Here is a plan for 2 garden beds, X and Z.

Which statement is true about the area of the garden beds?

- ○ X is larger than Z.
- ○ Z is larger than X.
- ○ X and Z are the same.

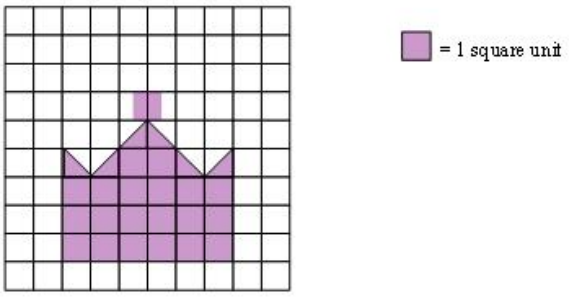


Skill: Students compare area on grids using whole and half units.
Answer key: A
Notes: Make sure all students know that letters are often used to label objects and refer to those objects in the questions and answers.

Additional questions

1. The **Z** square is drawn diagonally. How would you count its area?
2. How can the part squares be combined?
3. Use grid paper to draw a shape that has an area less than **X** and more than **Z**. How can check that your shape is correct?
4. Draw four different shapes with the same area as **Z**. How do you know they all have exactly the same area?

Question 3



The shaded areas in this grid, in square units is closest to

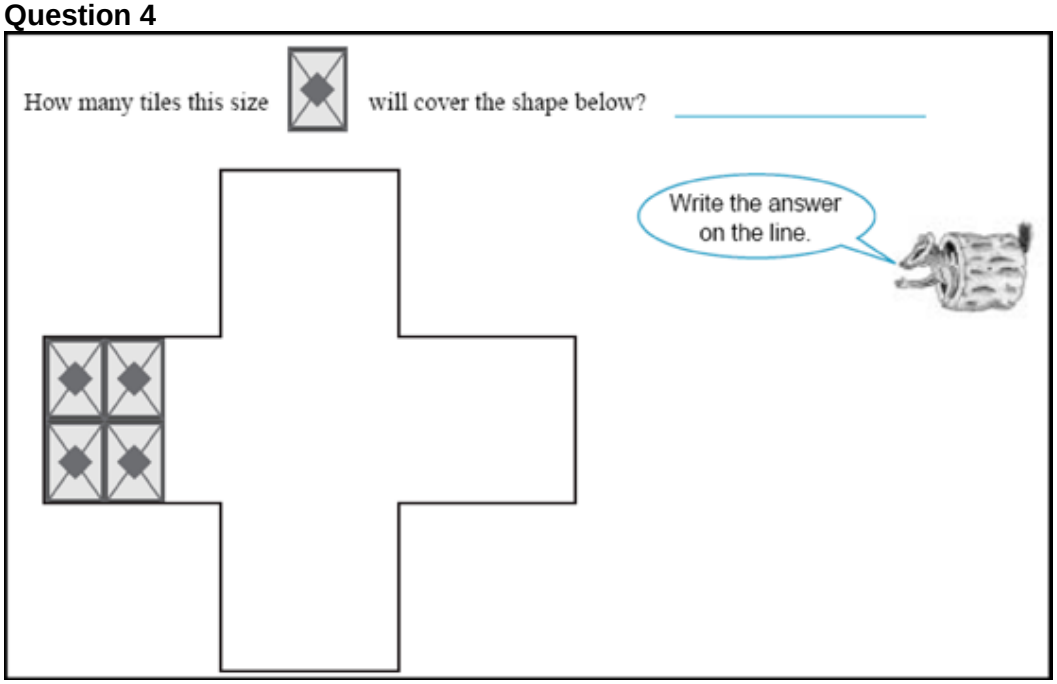
16 ○ 24 ○ 28 ○ 34 ○

Skill: Students count whole and half square units to measure area.
Answer key: 24

Additional questions

1. How did you work out the total area covered by the half squares?
2. Use grid paper to draw different figures that have the **same area** as the shading.

Question 4

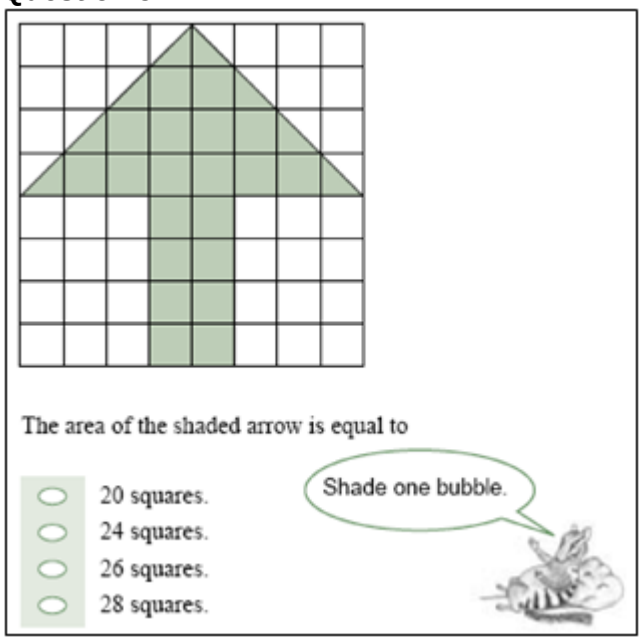


Skill: Students count whole and half square units to measure area.
Answer key: 30

Additional questions

1. How did you work it out? Is there a way you can check your answer?
2. Give students one or more of the tiles that they can cut out and physically lay them out to check the area. Use the same tile to check the area of other shapes or objects.

Question 5



Skill: Students work out the area of a shape using a non-standard unit
Answer key: 24

Additional questions

1. How do you know that you have counted all whole and all half squares?
2. How did you work out the total area covered by the half squares?
3. Use grid paper to draw different figures that have the **same area** as the shading.

Curriculum reference
Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Measurement* (book one):

- Chapter 3: Understand units
  - Key understanding 3: To measure something means to say how much of a particular attribute it has. We measure by choosing a unit and working out how many of the unit it takes to match the thing to be measured. p.28

Student worksheet

Focus

Measuring area on grids using whole and half units

Question 1

Karen, Joel and Maria tried to find the area of a pin board using pieces of paper.

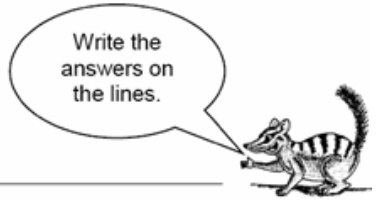
Karen Joel Maria

Their results were different.

Who was correct?_____

Explain why.

_____



Question 2

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Which statement is true about the area of the garden beds?

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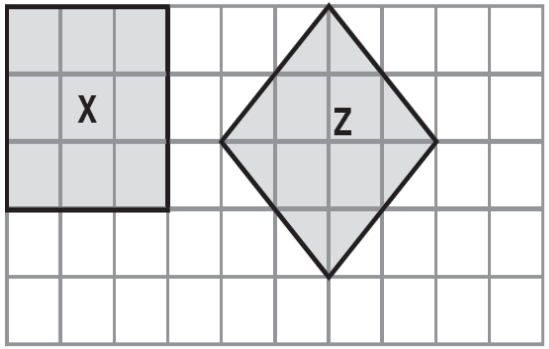
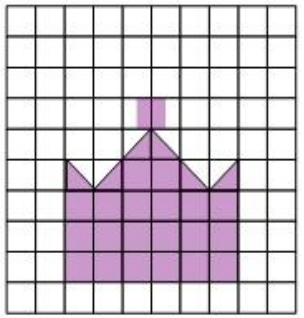
- ○ Z is larger than X.
- ○ X and Z are the same.



Question 3



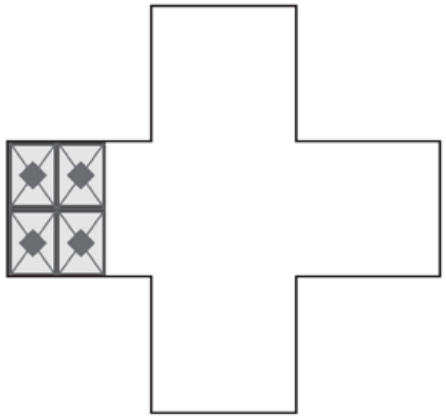
= 1 square unit

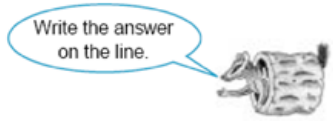
The shaded areas in this grid, in square units is closest to

16 ○ 24 ○ 28 ○ 34 ○

Question 4

How many tiles this size  will cover the shape below? _____



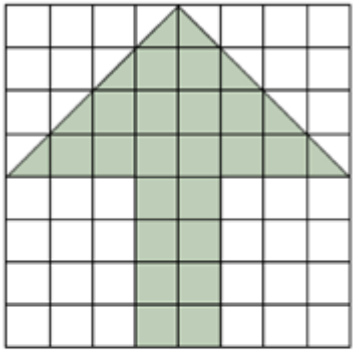


Student worksheet

Focus

Measuring area on grids using whole and half units

Question 5



The area of the shaded arrow is equal to

- ○ 20 squares.
- ○ 24 squares.
- ○ 26 squares.
- ○ 28 squares.

Calculating volume and area in whole units

Background information/teaching focus

For certain types of 2D figures (eg rectangle, triangle, and circle) we know the relationships between specified lengths and the perimeter. We also know the relationship between specified lengths and the area. For certain types of 3D objects (eg rectangular prism and cylinder) we know the relationships between specified lengths and the surface area and volume. Formulae are a shorthand way of describing these relationships. They are useful because they help us work out perimeter, area and volume more easily than measuring them directly.

Memorising formulae is less important than understanding the relationships involved. Students need experiences over an extended period of time in order to understand these relationships. Building the understanding of the structure, the use of arrays and how they link to multiplication is important.

For further related information see *First Steps in Mathematics: Measurement* (book two):

- Chapter 3: Indirect measure
  - Key understanding 1: Calibrated scales can be used as a substitute for repeating units when measuring length, capacity, mass, angle and time. p.12
  - Background notes: Structuring rectangular arrays p.68
- Chapter 4: Direct measure
  - Background notes: Measuring area and volume p.161

Rigby Harcourt Education, Australia

Western Australian Curriculum

- Year 4 – Compare objects using familiar metric units of area and volume (ACMMG290).
- Year 5 – Calculate the perimeter and area of rectangles using familiar metric units (ACMMG109).

For more information visit the Western Australian Curriculum.

Learning experiences

For ideas for activities see *First Steps in Mathematics: Measurement* (book two) and *First Steps in Mathematics: Number* (book two):

- Area problems p. 16
- Covering a rectangle p. 16
- Fencing for a paddock p. 16
- Incomplete grids p. 17
- Picnic blankets p. 17
- Which paddock is bigger? p. 18
- Buildings p. 19
- Twenty–four cubes p. 19
- Multiplication grids p. 149

Question 1

This jelly is cut into cubes of equal size.

What is the volume of the jelly in cubes?

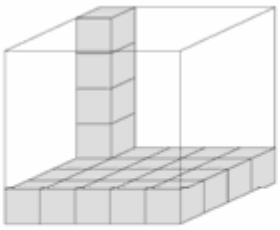
- ○ 12
- ○ 14
- ○ 18
- ○ 21
- ○ 42

Skill: Students visualise the number of cubes in a 2D drawing of a cube.
Answer key: 18

Additional questions

1. You cannot see all of the cubes. How did you know how many cubes the jelly had been cut into?
2. What is the best way for working out the total number of cubes in the jelly?
3. Imagine another layer of cubes on top of the jelly.
   How many extra cubes of jelly would there be?
4. Can you think of any shortcuts that would make it easier to work out the number of cubes?

Question 2



What is the total number of cubes that will fit in the box? _____

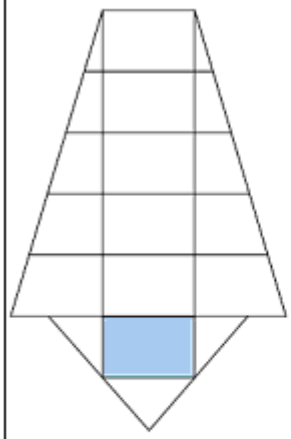
Skill: Students calculate volume of a rectangular prism.
Answer key: 100

Additional questions

1. How many cubes does each layer have?
2. How would counting the layers of cubes help?
3. How did you work out how many cubes would fit?
4. What could you enter into your calculator to solve the problem?
5. Kath said, 'It's just how many wide, times how many long, times how many high'. She is correct. Why? Can you write a number sentence for this?

Question 3

The area of the shaded rectangle is 100 square centimetres.



The approximate total area of the whole shape in square centimetres will be

- 600
- 1100
- 1200
- 1900

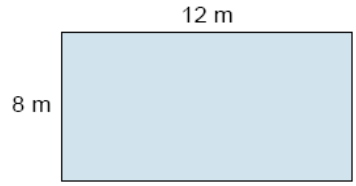
Skill: Students calculate area in square centimetres, given a unit of 100 square centimetres.
Answer key: 1200
Comment: The most common mistake was B, based on not counting the shaded rectangle.

Additional question

1. How did you go about working out how many shaded units were equal in area to the whole shape?
2. How did you decide to measure the part units that are larger or smaller than a half a rectangle?
3. Once you have counted the number of shaded rectangles, how did you convert this measurement to square centimetres?

Question 4

Ms Tran drew a plan of her garden.
She wants to fence it as shown.



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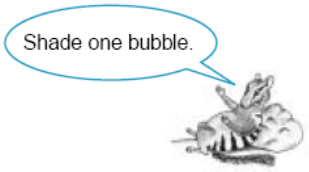


Which of the following would help her to work out how much fencing she would need?

- multiply length by width
- add length and width together
- add length and width together and double
- multiply length by width then double

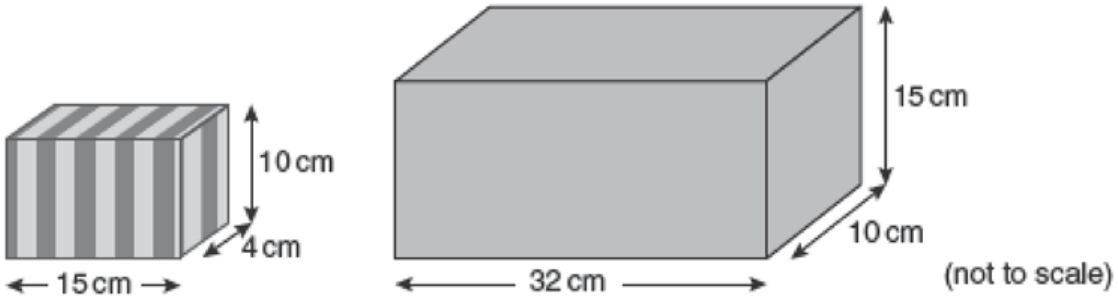
Skill: Students identify a rule to give the perimeter of a rectangle.
Answer key: C

Additional questions

1. Why do you need to double the combined total of the length and width?
2. Is there another way you could work it out?
3. What is the perimeter of this garden?
4. Will this rule work for all rectangles? Why? What about other shapes?

Question 5

Jo packs small boxes into a larger box.



What is the greatest number of the small boxes that will fit into the large box?

Skill: Students finds the relationship between volumes of boxes using their dimensions.
Answer key: 8

Additional questions

1. What did you have to visualise to solve the problem?
2. How many boxes would fit if the bigger box was 40cm long?
3. How many boxes would fit if the smaller box was 7.5 cm high?

Curriculum reference

Department of Education and Training Western Australia 2005, *First Steps in Mathematics Measurement* (book two):

- Chapter 3: Indirect measure
  - Key understanding 1: For certain types of shapes we can describe the relationship between the lengths of its edges and its perimeter, its area and its volume. p.12

Student worksheet

Focus

Calculating volume and area in whole units

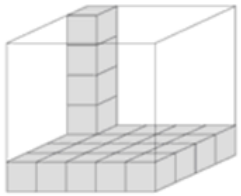
Question 1

This jelly is cut into cubes of equal size.

What is the volume of the jelly in cubes?

- ○ 12
- ○ 14
- ○ 18
- ○ 21
- ○ 42

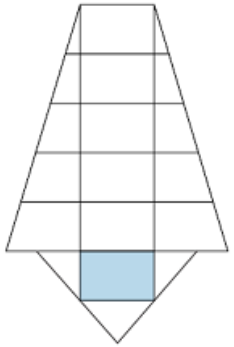
Question 2



What is the total number of cubes that will fit in the box? _____

Question 3

The area of the shaded rectangle is 100 square centimetres.



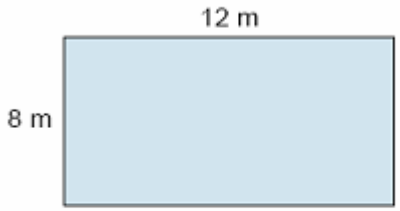
The approximate total area of the whole shape in square centimetres will be

- ○ 600
- ○ 1100
- ○ 1200
- ○ 1900

Question 4

Ms Tran drew a plan of her garden.

She wants to fence it as shown.



(not to scale)

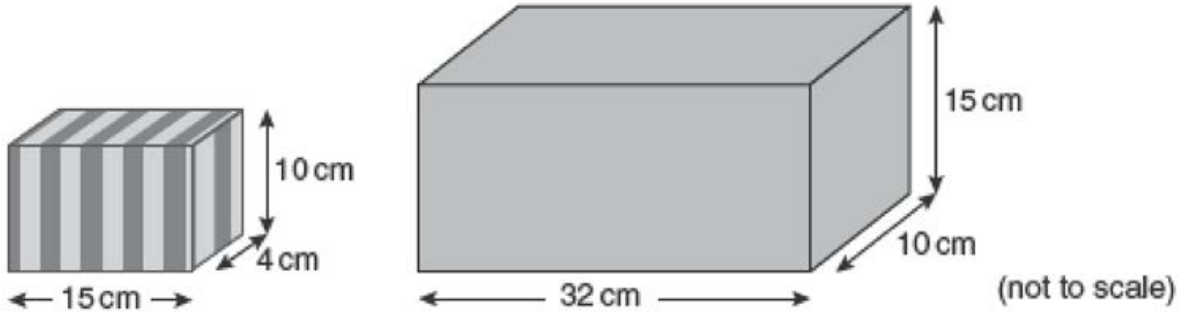
Which of the following would help her to work out how much fencing she would need?

- ○ multiply length by width
- ○ add length and width together
- ○ add length and width together and double
- ○ multiply length by width then double

Revised October 2016

Question 5

Jo packs small boxes into a larger box.



What is the **greatest** number of the small boxes that will fit into the large box?

Reading measures from a range of scales

Background information/teaching focus

Calibrated scales can be used as a substitute for repeating units when measuring length, capacity, mass, angle and time. Students should learn to read a range of graduated scales which progress in complexity from:

- every mark labelled eg 1, 2, 3,…
- some of the marks not labelled, but each mark is one unit; eg every fifth mark is labelled 5, 10, 15, 20 …
- scales involving some decimals; eg ten marks are placed between each whole but are not labelled; to
- the number of marks being fewer or greater than the number of units; eg every fifth mark is labelled 10, 20, 30, …, or every fifth mark is labelled 1, 2, 3,…

For further related information see *First Steps in Mathematics*: *Measurement* (book one):

- Chapter 4: Direct measure
  - Key understanding 4: Calibrated scales can be used as a substitute for repeating units when measuring length, capacity, mass, angle and time. p.124

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Western Australian Curriculum

- Year 4 – Use scaled instruments to measure and compare lengths, masses, capacities and temperatures (ACMMG084).
- Year 6 – Convert between common metric units of length, mass and capacity (ACMMG136).
- Year 6 – Solve problems involving the comparison of lengths and areas using appropriate units (ACMMG137).

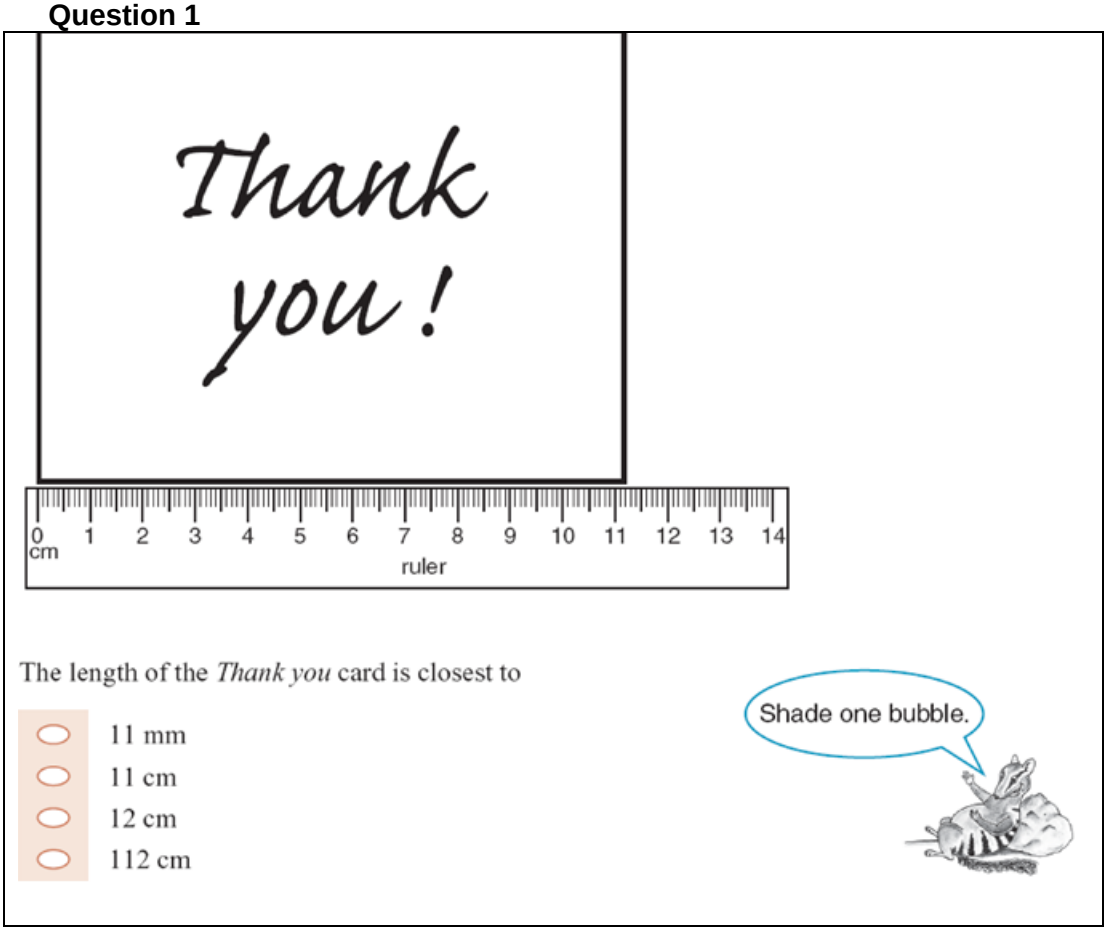
For more information visit the Western Australian Curriculum.

Learning experiences and activities

For related activities see *First Steps in Mathematics: Measurement* (book one):

- Make a measuring jug p. 127
- Calibrated containers in litres p. 127
- Matchstick tapes p.128
- Varying measurements p. 129
- Nails and elastic p. 129
- Marks not numbered p. 132

Question 1

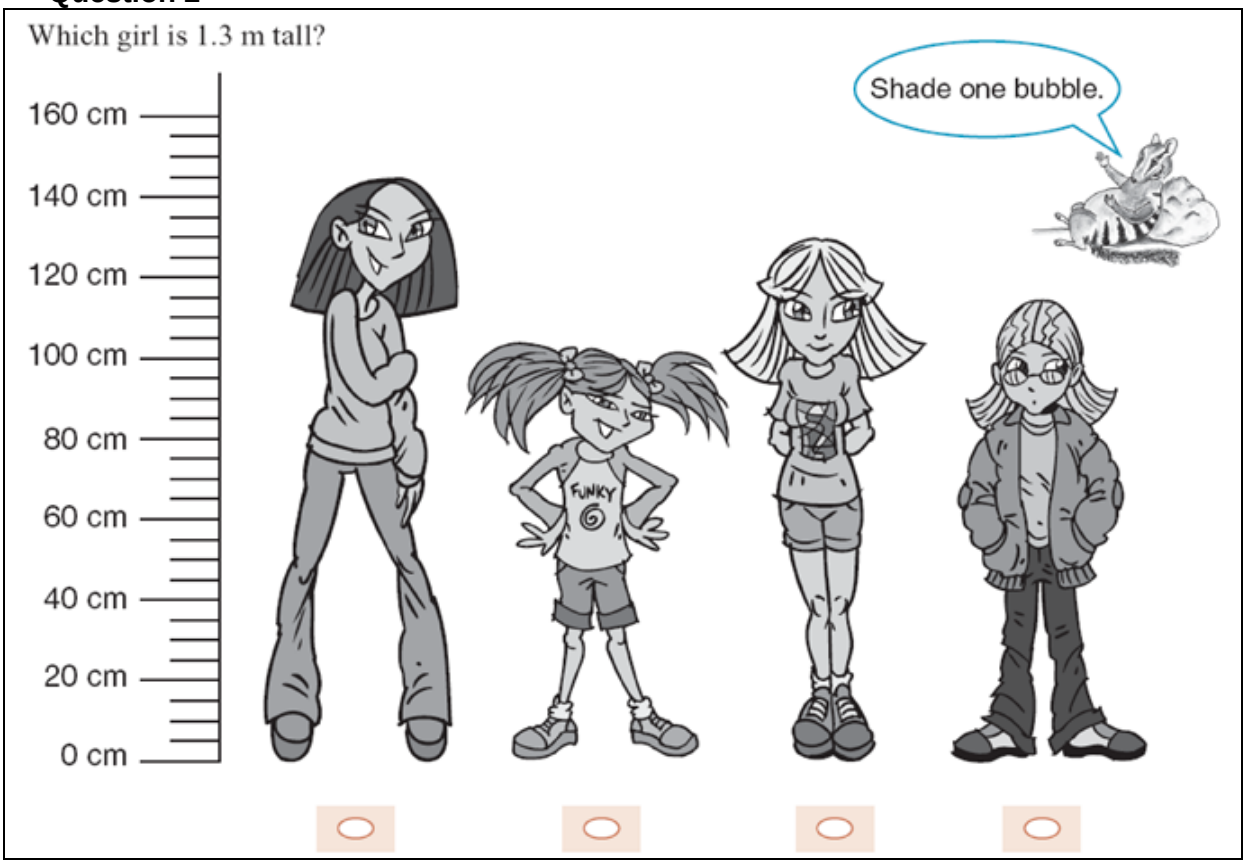


Skill: Students read a ruler.
Answer key: 11cm

Additional questions

1. Which unit is a more precise measure of the length of the card – a centimetre or a millimetre?
2. What would the length of the card be in millimetres?
3. Why is the edge of the card lined up with the zero mark and not the edge of the ruler?

Question 2



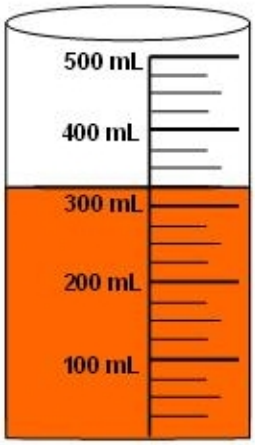
Skill: Students use a scale marked in centimetres to estimate height in metres.
Answer key: C

Additional questions

1. How many metres is 100cm?
2. Write 10 cm in metres.
3. How many centimetres are there in 1.1 m?
4. On the scale above, mark the position of 0.9 m

Question 3

This picture shows how much juice Benny poured into an empty jug from a full 1 litre carton.



The amount of juice **left** in the carton is closest to

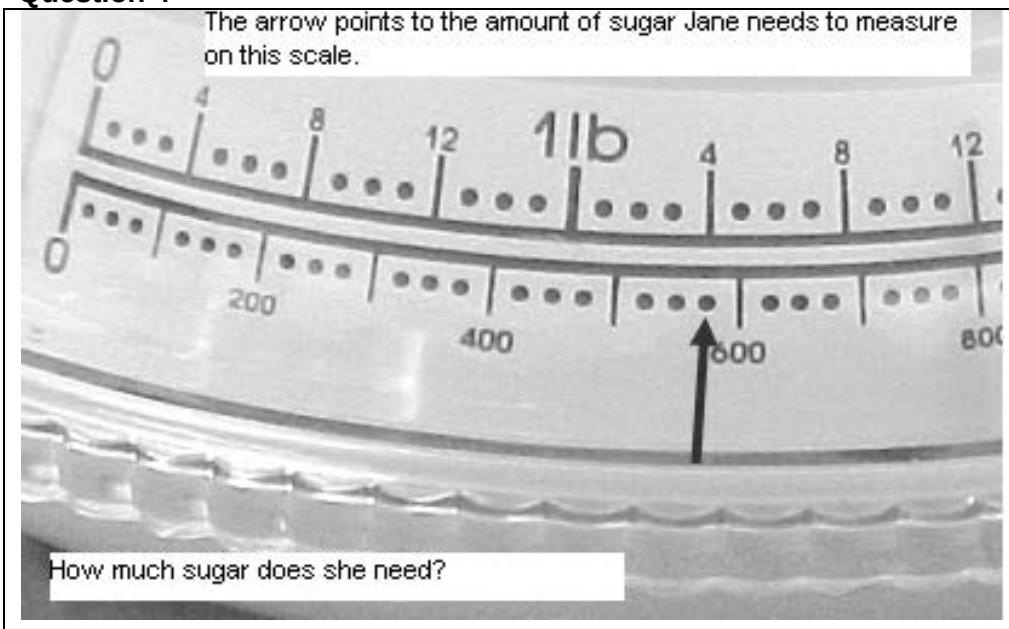
175 mL ○ 325 mL ○ 675 mL ○ 975 mL ○

Skill: Students read millilitres on a scale with not all calibrations shown.
Answer key: 675mL
Note: Draw students' attention to the bolded word (**left**). Talk about why words are bolded in questions.

Additional questions

1. How many millilitres of juice does a full carton hold?
2. How much juice is in the jug?
3. What is the largest amount of juice you could measure with this jug in just one filling?
4. How could you use this jug to measure 850 ml of orange juice for a recipe?

Question 4



Skill: Students read a scale in grams.
Answer key: 575 g (or 1 lb 4 oz.)

Additional questions

1. How would you know which row of markings relate to grams?
2. What does the line between the 400 and the 600 marks mean? How do you know?
3. What do the round dots mean? How do you know?
4. Where would the pointer be if Jane wants a half a kilogram?

Curriculum reference

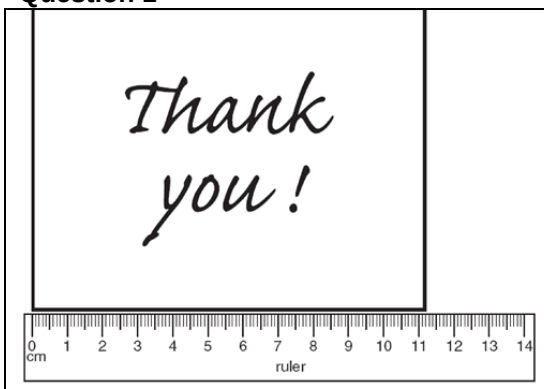
Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Measurement* (book one):

- Chapter 2: Direct Measure
  - Key understanding 4: Calibrated scales can be used as a substitute for repeating units when measuring length, capacity, mass, angle and time. p.124

Student worksheet

Focus
Reading scales

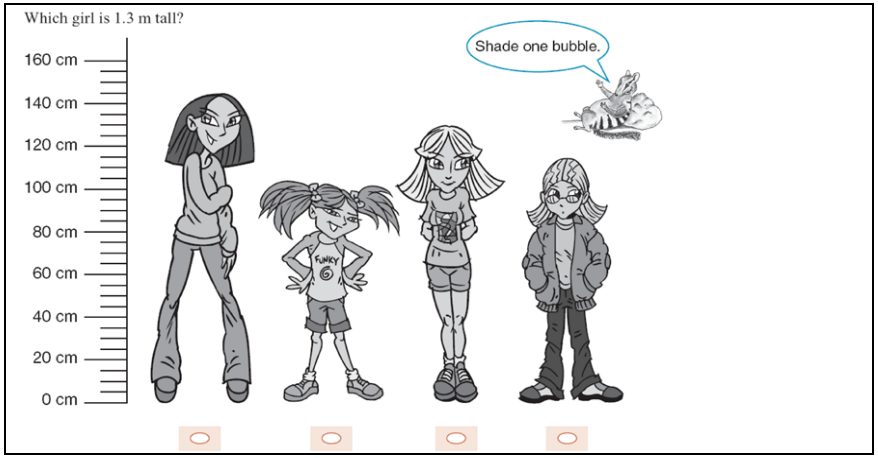
Question 1



The length of the *Thank you* card is closest to

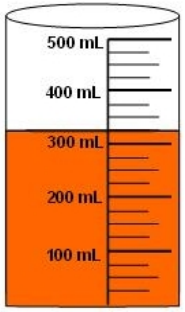
- ○ 11 mm
- ○ 11 cm
- ○ 12 cm
- ○ 112 cm

Question 2



Question 3

This picture shows how much juice Benny poured into an empty jug from a full 1 litre carton.



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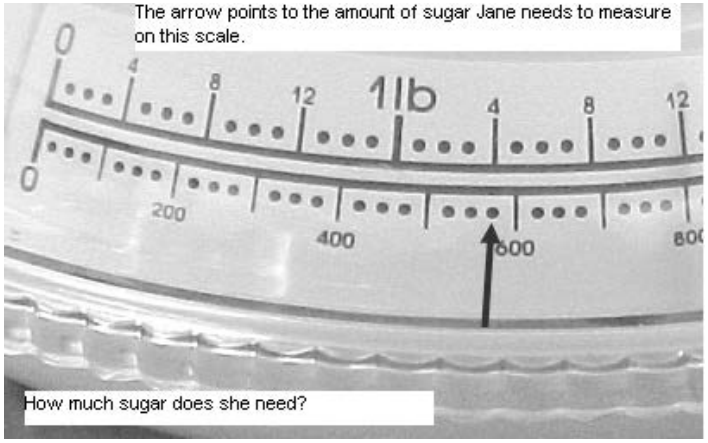
Question 4



Estimating length and capacity

Background information/teaching focus

We can improve our estimates by getting to know the size of common units and by practising judging the size of things. Practice helps improve our skill in estimating quantities enabling us to be more confident in our judgements and therefore more willing to trust them.

Helpful practice involves:

- making an estimate
- getting feedback on how close the estimate was (often by measuring immediately)
- consciously using the feedback to improve the next estimate, and repeating the cycle.

Students should be clear that the reason we often measure after estimating is to improve our estimation skills so we don't have to do both in the future. We estimate instead of direct measuring and confidence in estimation negates the need to measure accurately in common everyday situations. Model and encourage the use of language like 'reasonable', 'close' or 'a long way off' rather than talking about estimates as being correct or incorrect.

Students in the middle years will make reasonable estimates in length, mass, area, volume or angle, especially if they have the personal benchmarks such as a litre carton of milk, tub of margarine, length of the school oval etc, to draw upon.

We can use information we know to make and improve estimates. This also helps us to judge whether measurements and results are reasonable. There are a variety of ways in which known information might be built into an estimate.

- Students could make a direct perceptual comparison.
- Students could use something they know the size of as a measuring instrument by 'marking off'.
- Students could use ratios or fractions to estimate the size of small things.
- Students could pool a combination of known information and 'good guesses' to estimate quantities without collecting data.
- Students could average a number of estimates.
- Students could use common events to estimate amount of time and day.

For further related information see *First Steps in Mathematics: Measurement* (book two):

- Chapter 4: Estimate
  - Key understanding 1: We can make judgements about order and size without actually measuring. We should think about how confident we can be of our estimates. p.72
  - Key understanding 3: We can use information we know to make and improve estimates. This also helps us to judge whether measurements and results are reasonable. p.94

Western Australian Curriculum

- Year 5 – Choose appropriate units of measurement for length, area, volume, capacity and mass (ACMMG108).
- Year 6 – Convert between common metric units of length, mass and capacity (ACMMG136).
- Year 6 – Connect volume and capacity and their units of measurement (ACMMG138).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

For ideas for activities see *First Steps in Mathematics: Measurement* (book two):

- Thumb and forefinger p. 85
- How long is a metre p. 85
- A litre p. 86
- A square metre p. 86
- Cans of food p. 86
- Egg timer estimates p. 87
- Fish sizes p. 98
- The length of the oval p. 98
- Capacities p. 98
- Water used in the school p. 99

Question 1

This bucket is full, it holds about

Shade one bubble.

- 10 mL
- 100 mL
- 1 L
- 10 L

Skill: Students interpret unit notations and estimate capacity.
Answer key: D

Additional questions

1. How did you know which answer was correct?
2. What are some containers that would hold the other quantities of liquid?
3. About how many litre milk cartons would fill the bucket?
4. How many millilitres are there in one litre?
5. How many millilitres are there in 10 litres?

Question 2

Which of the following would be the best estimate of the height of a classroom door?

Shade one bubble.

- ⬭ 205 cm
- ⬭ 2.05 cm
- ⬭ 205 m
- ⬭ 20.5 m

Skill: Students make a sensible estimate of length of familiar objects and distinguish between metres and centimetres.
Answer key: A

Additional questions

1. Why is 205cm the only sensible estimate? Explain your reasoning.
2. How would 205cm be written in metres?
3. Which object in the school is about 20.5m long?

Question 3

What is the approximate mass of 2.5 L of milk?

Shade one bubble.

- ⬭ 25 kg
- ⬭ 2.5 kg
- ⬭ 25 g
- ⬭ 2.5 g

Skill: Students link units for capacity and volume.
Answer key: B
Note: Demonstrate that 1L of water has a mass of 1kg.

Additional questions

1. What do you need to know to be able to answer this question correctly?
2. How much water weighs about 500g? How could you find out if you don't know?
3. Peter has balance scales. He weighs 1L of water.
   How many grams will balance the scales?
4. You are sitting on the end of a seesaw. There is an empty container on the other end of the seesaw. About how much water would you need to put in the container to balance your mass?

Question 4

Approximately how much water is in this bottle?

- ○ 800 mL
- ○ 750 mL
- ○ 650 mL
- ○ 500 mL

Skill: Students interpret a scale with not all calibrations shown.
Answer key: C

Additional questions

1. What do the marks on the side of the bottle mean? What does 1L mean?
2. How many millilitres in a litre?
3. There are three marks between the bottom of the bottle and the 1L mark.
4. What amount does each mark represent?
5. How could you check that your answer is correct?
6. What difference would tilting the bottle make to reading the scale on the bottle?

Curriculum references

Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Measurement* (book two):

- Chapter 4: Estimate
  - Key understanding 2: We can improve our estimates by getting to know the size of common units and by practising judging the size of things. p.80
  - Key understanding 3: We can use information we know to make and improve estimates. This also helps us to judge whether measurements and results are reasonable. p.94

Student worksheet

Focus

Estimating length and capacity

Question 1

This bucket is full, it holds about

Shade one bubble.

- ○ 10 mL
- ○ 100 mL
- ○ 1 L
- ○ 10 L

Question 2

Which of the following would be the best estimate of the height of a classroom door?

Shade one bubble.

- ○ 205 cm
- ○ 2.05 cm
- ○ 205 m
- ○ 20.5 m

Question 3

What is the approximate mass of 2.5 L of milk?

Shade one bubble.

- ○ 25 kg
- ○ 2.5 kg
- ○ 25 g
- ○ 2.5 g

Question 4

Approximately how much water is in this bottle?

- ○ 800 mL
- ○ 750 mL
- ○ 650 mL
- ○ 500 mL

Revised October 2016

Moving between different units of measure

Background information/teaching focus

Often students learn the relationship between particular units of measure, (eg that 10 millimetres is equal to one centimetre, and that 100 centimetres is equal to one metre) as though they were unrelated 'facts'. The benefit of the metric system is that the same set of multiplicative relationships is built into all metric measures through the prefixes: having learned the relationships for one attribute, you know them for all attributes and the same decimal structure can be used for all measures.

In the context of helping students understand metric units, it is also important that they recognise which of our units do not use decimals; for example time and angle (degrees).

For further related information see *First Steps in Mathematics*: *Measurement* (book one):

- Chapter 1: Understand units
  - Key understanding 8: The relationships between standard units in the metric system help us to judge size, move between units and do calculations.

Rigby Harcourt Education, Australia

Western Australian Curriculum

- Year 4 – Convert between units of time (ACMMG085).
- Year 5 – Choose appropriate units of measurement for length, area, volume, capacity and mass (ACMMG108).
- Year 6 – Connect decimal representations to the metric system (ACMMG135).
- Year 6 – Convert between common metric units of length, mass and capacity (ACMMG136).
- Year 6 – Connect volume and capacity and their units of measurement (ACMMG138).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

For related activities see *First Steps in Mathematics: Measurement* (book two):

- Thumb and forefinger p. 85
- How long is a metre p. 85
- A litre p. 86
- A square metre p. 86
- Cans of food p. 86
- Egg timer estimates p. 87
- Fish sizes p. 98
- The length of the oval p. 98
- Capacities p. 98
- Water used in the school p. 99

Question 1

Liam heats his pie in the microwave for a minute and a half.

How many **seconds** is this? _____

Skill: Students use the links between units for time.
Answer key: 90 seconds

Additional questions

1. How many seconds in a minute?
2. How many seconds in half a minute?
3. Liam heats another meal for two and half minutes. How many seconds is that?
4. How many seconds in a quarter of a minute?

Question 2

Which is true?

750 g is

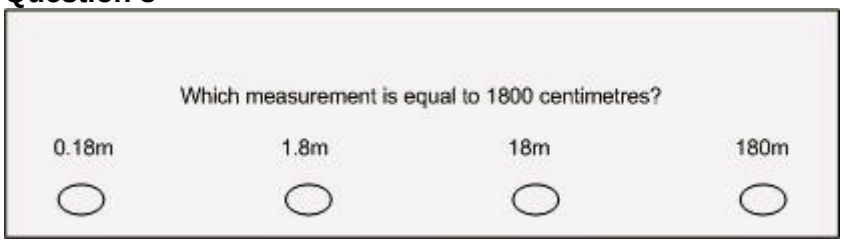
- ⬭ less than half a kilogram.
- ⬭ 7.5 kilograms.
- ⬭ between half a kilogram and a kilogram.
- ⬭ more than 70 kilograms.

Skill: Students move between grams and kilograms.
Answer key: C

Additional questions

1. How did you decide which one is correct?
2. What does *g* stand for? How many grams in a kilogram?
3. How many grams in half a kilogram? How did you work that out?
4. Is 750 g more than half a kilogram? How do you know?
5. Is 7.5 kilograms the same as 750 g? Is 75 g equal to 750 g?
6. How is 0.750 kilograms the same or different from 0.75 kilograms?
7. Is 750 g between half a kilogram and a kilogram? How do you know?
8. Is 750 g more or less than 70 kilograms? How many grams would 70 kilograms be?
9. On a number line, draw a scale and show the positions of four measures smaller than a kilogram. Work out the number of grams for each option.

Question 3

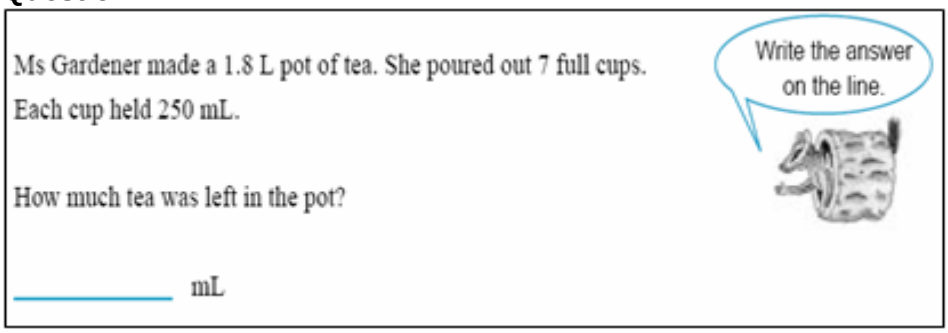


Skill: Students move between centimetres and metres.
Answer key: C

Additional questions

1. How did you work it out?
2. How many centimetres are there in a metre?
3. How many metres is 1880 cm?
4. How many cm is 1.8 m? Which is longer 1080 cm or 11 m? How do you know?

Question 4



Skill: Students move between units for capacity.
Answer key: 50 mL
Note: Tell students that the mL symbol, written next to the answer line, is the unit required in the answer.

Additional questions

1. How many 250 mL cups would be needed for one litre of tea? How do you know?
2. How many 250 mL cups would 1.5 L fill?
3. How much tea would be left after 1.5 L of tea was used?
4. How many litres (at least) would the pot have to hold if you wanted to be able to pour 10 cups of tea, 250 mL each, from the one pot?

Curriculum references

Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Measurement:* (book one):

- Chapter 3: Understand units
  - Key understanding 8: The relationships between standard units in the metric system help us to judge size, move between units and do calculations. p.78

Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Measurement* (book two):

- Chapter 3: Indirect measure
  - Key understanding 4: We can calculate one measurement from others using relationships between quantities. p.54

Student worksheet

Focus

Moving between different units of measure

Question 1

Liam heats his pie in the microwave for a minute and a half.

How many **seconds** is this? _____

Question 2

Which is true?

Shade one bubble.

750 g is

- ○ less than half a kilogram
- ○ 7.5 kilograms.
- ○ between half a kilogram and a kilogram.
- ○ more than 70 kilograms.

Question 3

Which measurement is equal to 1800 centimetres?

0.18m	1.8m	18m	180m
○	○	○	○

Question 4

Ms Gardener made a 1.8 L pot of tea. She poured out 7 full cups.
Each cup held 250 mL.

How much tea was left in the pot?

_____ mL

Write the answer on the line.

Measuring time on analogue and digital clocks to the nearest five minutes

Background information/teaching focus

We can judge and measure time using both natural cyclical changes and special techniques and tools which people have developed. Students should develop the skills associated with measuring time, (eg what time it is) and elapsed time, (eg how long it took). In order to specify time uniquely, we choose an arbitrary starting point and units that are used to mark off time from that starting point. The units we use for describing what time it is, was or will be, are related to the recurring cyclical nature of physical phenomena that produce day and night, the waxing and waning of the moon and the seasons.

Students should be able to read the time on analogue and digital clocks, read calendars, timetables and schedules and compare 12 and 24 hour time systems and convert between them.

For further related information see *First Steps in Mathematics*: *Measurement* (book one):

- Chapter 4: Direct measure
  - Key understanding 6: We can judge and measure time using both natural cyclical changes and special techniques and tools which people have developed. p.150

Rigby Harcourt Education, Australia

Western Australian Curriculum

- Year 3 – Tell time to the minute and investigate the relationship between units of time (ACMMG062).
- Year 4 – Use ‘am’ and ‘pm’ notation and solve simple time problems (ACMMG086).
- Year 5 – Compare 12- and 24-hour time systems and convert between them (ACMMG110).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

For ideas for activities see *First Steps in Mathematics*: *Measurement* (book one):

- Walking clock face p. 155
- Analogue and digital clocks p. 156
- Clocks and stopwatches p. 156
- Calendars p. 156
- Phases of the moon p. 157
- Timetables p. 160

Question 1

What time is shown on the clock?

- ○ quarter past 10
- ○ quarter to 10
- ○ quarter past 11
- ○ 9 minutes to 3
- ○ 10 minutes to 3

Skill: Students read time to the quarter hour on an analogue clock.
Answer key: A

Additional questions

1. Which hand tells the hours?
2. Why isn't the hour hand pointing exactly at the 10?
3. Where would the hour hand be when it is quarter to 10?
4. Where would the hands be in half an hour? Show the hands on the clock's face.

Question 2

The time on the clock is

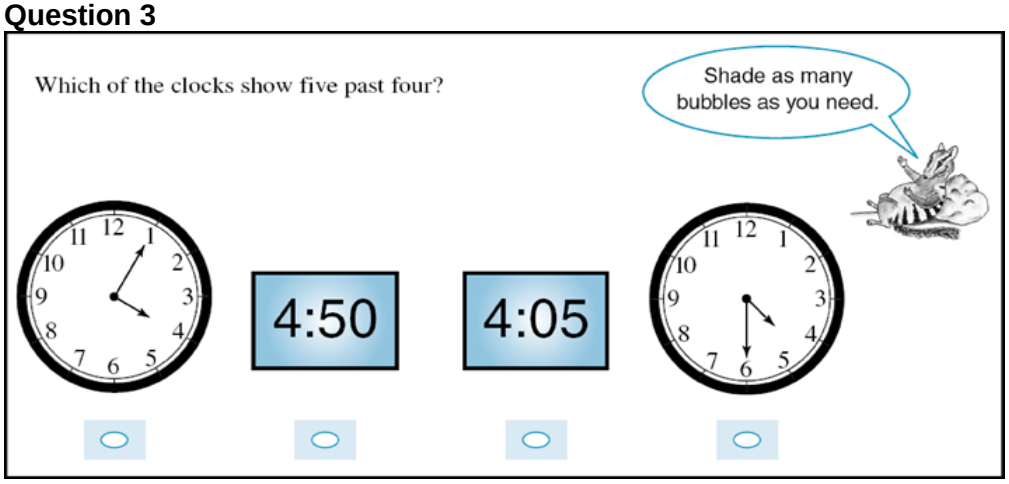
- ○ 15 minutes to 12.
- ○ 12 minutes to 15.
- ○ 12 minutes past 15.
- ○ 15 minutes past 12.

Skill: Students read time on a digital clock to the quarter hour.
Answer key: D

Additional questions

1. Which numbers show the hours and which show the minutes?
2. What was the time 15 minutes earlier?
3. Which of the answers don't make any sense? Why?
4. What would the clock show if the time was 15 minutes to 12?
5. How long will it be before the clock shows the time as 1 o'clock? What numbers will you see?

Question 3

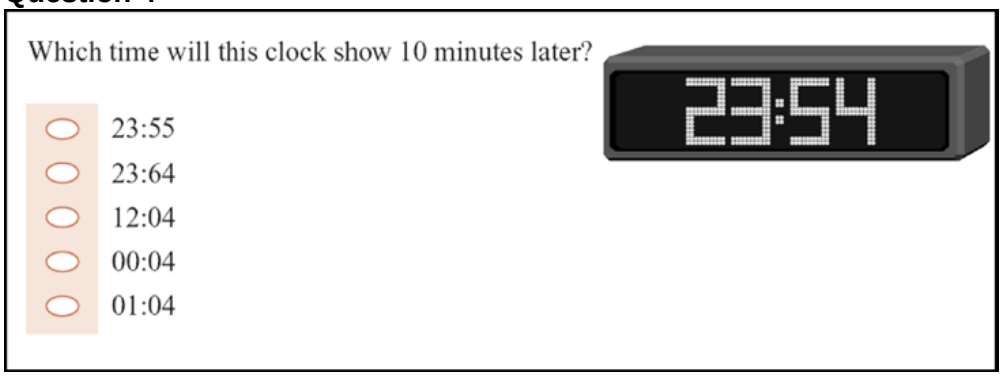


Skill: Students read analogue and digital times to 5 minutes.
Answer key: A and C
Note: More than one response is required.

Additional questions

1. How did you decide which clocks show 5 minutes past 4?
2. What would look different if the time was 4 minutes past 5?
3. What would the second analogue time be on a digital clock?
4. Show 4:50 on an analogue clock face.
5. If the time was 4:55, where would the hour hand be pointing?

Question 4



Skill: Students interpret 24-hour time.
Answer key: D

Additional questions

1. How did you know which time was correct?
2. What time would be showing on a 12-hour clock at 23:54, and 10 minutes later?
3. What would the time be 12 hours earlier than 23:54?
4. Use an analogue clock face to show the times given as alternative answers.

Curriculum references

Department of Education and Training Western Australia 2004, *First Steps in Measurement:* (book one):

- Chapter 4: Direct measure
  - Key understanding 4: Calibrating scales can be used as a substitute for repeating units when measuring length, capacity, mass, angle and time. p.124
  - Key understanding 6: We can judge and measure time using both natural cyclical changes and special techniques and tools which people have developed. p.150

Student worksheet

Focus

Measuring time on analogue and digital clocks to the nearest five minutes

Question 1

What time is shown on the clock?

- ○ quarter past 10
- ○ quarter to 10
- ○ quarter past 11
- ○ 9 minutes to 3
- ○ 10 minutes to 3

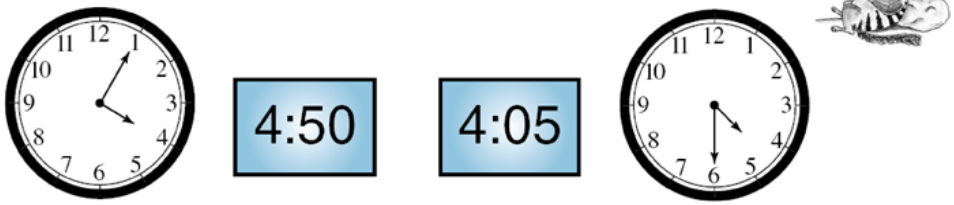
Question 2

The time on the clock is

- ○ 15 minutes to 12.
- ○ 12 minutes to 15.
- ○ 12 minutes past 15.
- ○ 15 minutes past 12.

Question 3

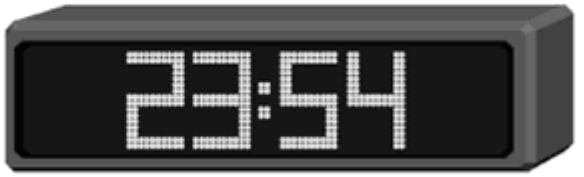
Which of the clocks show five past four?



○ ○ ○ ○

Question 4

Which time will this clock show 10 minutes later?



- ○ 23:55
- ○ 23:64
- ○ 12:04
- ○ 00:04
- ○ 01:04

Elapsed time and durations in minutes and hours

Background information/teaching focus

Students need many opportunities to explore situations involving measurement of elapsed time. It is a concept that many students find difficult to understand and some may believe that the person who arrives latest is also the one that took the longest time to get there. They read the time on clocks (digital and analogue), calendars, schedules and timetables to measure elapsed time. Relating elapsed time to the students' experience of using TV guides and timetables can assist students to develop their understanding of this concept.

For further related information see *First Steps in Mathematics: Measurement* (book two):

- Chapter 4: Direct measure
  - Key understanding 6: We can judge and measure time using both natural cyclical changes and special techniques and tools which people have developed. p.150

Rigby Harcourt Education, Australia

Western Australian Curriculum

- Year 3 – Tell time to the minute and investigate the relationship between units of time (ACMMG062).
- Year 4 – Use 'am' and 'pm' notation and solve simple time problems (ACMMG086).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

For further ideas for activities see *First Steps in Mathematics: Measurement* (book two):

- Analogue and digital clocks p. 156
- Comparing elapsed time p. 159

Question 1

A concert started at 7:45 pm and went for 2 hours and 40 minutes.

At what time did it finish?

- ○ 10:25 pm
- ○ 10:05 pm
- ○ 10:15 pm
- ○ 9:40 pm

Skill: Students recognise the finishing time given the starting and elapsed times.
Answer key: A

Additional questions

1. What would the finishing time be if the concert took two hours?
2. How did you decide what is the correct answer?
3. It is 9:40am. How many more minutes to 10:00am?
4. A concert lasts for 2 hours and 30 minutes. If the concert finishes at 10:05pm, at what time did it start?

Question 2

Weekly Computer Timetable

Computer Time	Monday	Tuesday	Wednesday	Thursday	Friday
8:50 – 9:10		Benny			
11:00 – 11:25		Yanni	Tom	Lizzie	Yanni
12:30 – 1:00	Lizzie		Sarah		
1:00 – 1:30				Benny	Kate

Who has the most computer time this week?

- ○ Benny
- ○ Lizzie
- ○ Tom
- ○ Kate
- ○ Yanni

Skill: Students use a timetable to calculate and compare elapsed times.
Answer key: Lizzie

Additional questions

1. How much time did each child have on the computer?
2. On which day, or days, was the computer used for the longest time? How do you know?
3. What is the maximum time the computers could be used in a day?
4. Plan a weekly timetable so that every child has the same amount of computer time.

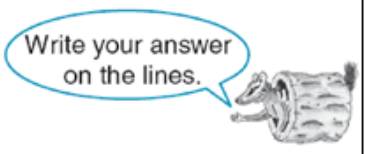
Question 3

Alan arrived in Albany at 4:30 pm.
Ron arrived in Albany at 4:35 pm.
Jodie arrived in Albany at 4:20 pm.

Who took the longest to get to Albany?

- ⬭ Alan
- ⬭ Ron
- ⬭ Jodie
- ⬭ You can't tell.

Explain how you know.



Skill: Students recognise that to calculate elapsed time, the start and the finish times are needed.
Answer key: D. An explanation indicating the importance of knowing the time they left home.

Additional questions

1. Why can't you say who took the longest time?
2. Who would have taken the longest time if they all started travelling at the same time?
3. How long was the longest time taken if they all started travelling at 1:30pm?
4. Explain how you would find the time taken by the person who got to Albany first? What do you need to know to work this out?
5. How long did Ron's trip take if he left at 10:45am?

Question 4

The table below shows the times four people arrived at work and when they left work.

Time / Name	Arrived at work	Left work
Jasmine	7:00 am	3:30 pm
Mia	8:30 am	3:30 pm
Quang	8:30 am	4:10 pm
Luke	8:20 am	3:20 pm

Which person was at work for the longest time?

- ⬭ Jasmine
- ⬭ Mia
- ⬭ Quang
- ⬭ Luke

Skill: Students compare elapsed time that extends beyond 12:00 noon
Answer key: A

Additional questions

1. How long did each of them work in the morning?
2. How long did each of them work in the afternoon?
3. How did you know which person worked the longest?
4. For how long were all four of them at work at the same time? How did you work it out?
5. What is the total amount of work time provided by the four people?

Curriculum references
Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Measurement* (book 2):

- Chapter 3: Indirect measure
  - Key understanding 4: We can calculate one measurement from others using relationships between quantities.p.54
- Chapter 4: Direct measure
  - Key understanding 6: We can judge and measure time using both natural cyclical changes and special techniques and tools which people have developed. p.150

Student worksheet

Focus

Elapsed time and durations in minutes and hours

Question 1

A concert started at 7:45 pm and went for 2 hours and 40 minutes.

At what time did it finish?

- ○ 10:25 pm
- ○ 10:05 pm
- ○ 10:15 pm
- ○ 9:40 pm

Question 2

Weekly Computer Timetable

Computer Time	Monday	Tuesday	Wednesday	Thursday	Friday
8:50 – 9:10		Benny			
11:00 – 11:25		Yanni	Tom	Lizzie	Yanni
12:30 – 1:00	Lizzie		Sarah		
1:00 – 1:30				Benny	Kate

Who has the most computer time this week?

- ○ Benny
- ○ Lizzie
- ○ Tom
- ○ Kate
- ○ Yanni

Question 3

Alan arrived in Albany at 4:30 pm.
Ron arrived in Albany at 4:35 pm.
Jodie arrived in Albany at 4:20 pm.

Who took the longest to get to Albany?

- ○ Alan
- ○ Ron
- ○ Jodie
- ○ You can't tell.

Explain how you know.

Question 4

The table below shows the times four people arrived at work and when they left work.

Name \ Time	Arrived at work	Left work
Jasmine	7:00 am	3:30 pm
Mia	8:30 am	3:30 pm
Quang	8:30 am	4:10 pm
Luke	8:20 am	3:20 pm

Which person was at work for the longest time?

- ○ Jasmine
- ○ Mia
- ○ Quang
- ○ Luke

Revised October 2016

Locating information using calendars, timelines and timetables

Background information/teaching focus

Students need opportunities to explore a variety of calendars, timelines and timetable formats. Recording of time, particularly seasons, is cultural. Students can investigate the different ways cultural groups record and designate periods of time to seasons of the year. For example:

- Australian Aboriginal seasons vary between different groups.
- Early Egyptian calendars had New Year in July.
- Some Asian countries use the Gregorian calendar for daily activities however use the ancient Chinese calendar for significant celebrations (Chinese New Year).

Students need to recall the months of the year automatically but need to be given the opportunity to see how the months fit in a calendar year. The link must be made explicit how the days of the week continue the same sequence even when the month has changed.

For further related information see *First Steps in Mathematics: Measurement* (book one):

- Chapter 4: Direct measure
  - Key understanding 6: We can judge and measure time using both natural cyclical changes and special techniques and tools which people have developed. p.150

Rigby Harcourt Education, Australia

Western Australian Curriculum

- Year 3 – Tell time to the minute and investigate the relationship between units of time (ACMMG062).
- Year 4 – Use ‘am’ and ‘pm’ notation and solve simple time problems (ACMMG086).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

For related activities see *First Steps in Mathematics*: *Measurement* (book one):

- Analogue and digital clocks p. 156
- Comparing elapsed time p. 159

Question 1

Monday's Computer Times

Student	Time
Ann	1:45 pm
Ben	10:35 am
Chloe	11:25 am
Dave	9:10 am

Which list shows the order, from earliest to latest, that Ann, Ben, Chloe and Dave are to use the computer?

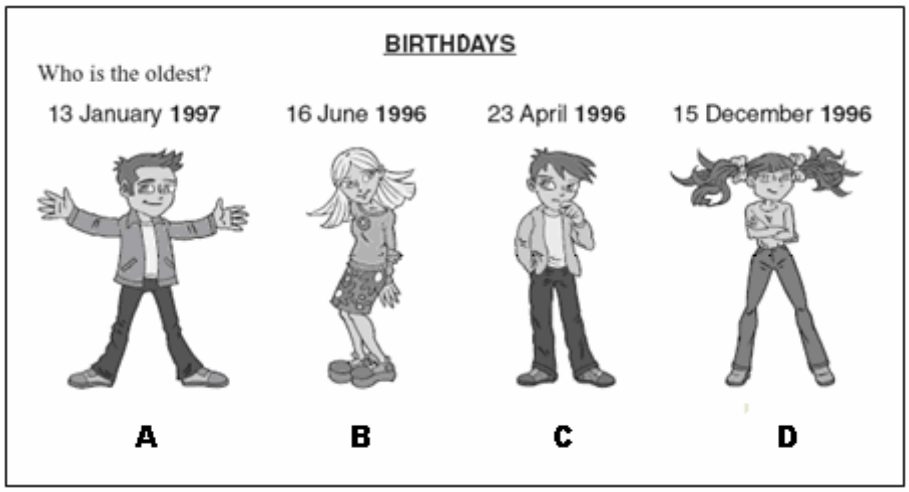
- ○ Ann, Ben, Chloe, Dave
- ○ Ann, Dave, Ben, Chloe
- ○ Dave, Chloe, Ben, Ann
- ○ Dave, Ben, Chloe, Ann
- ○ Dave, Ann, Ben, Chloe

Skill: Students read a table to compare digital time to 5 minutes.
Answer key: D

Additional questions

1. How do you know that 11:25 was before 1:45?
2. How long did Chloe have to wait after Dave began his turn?
3. How much earlier than Ann did Dave begin his turn?

Question 2



Skill: Students compare birth dates to determine who is the oldest.
Answer key: C

Additional questions

1. How do you know who is the oldest?
2. Which child is the youngest? How do you know?
3. Use the letters A, B, C and D to order the children from youngest to oldest.
4. How old was the oldest child when the youngest child was born?

Question 3

Aidan borrows a book on 28 June.
He returns it two weeks later.

When does he return the book?

- ○ 30 June
- ○ 11 July
- ○ 12 July
- ○ 13 July
- ○ 14 July

Skill: Students use a calendar to calculate dates beyond the month shown.
Answer key: 12 July

Additional questions

1. How did you decide on the date?
2. What day of the week would that day be?
3. If Aidan returned the book on the 14 July, for how long did he keep the book?
4. What if he borrowed the book on 28 July and returned it two weeks later? What date would that be? How did you work it out?

Question 4

Below is a train timetable.

DEPATURE TIMES				
Central	6.15am	9.51am	2.53pm	7.05pm
Parks	6.26am	10.02am	3.04pm	7.16pm
Lawley	6.38am	10.14am	3.16pm	7.28pm
Roseworthy	6.48am	10.24am	3.26pm	7.38pm

What time does the last morning train depart from Roseworthy? ☐

Skill: Students read and extract information from a time table
Answer key: 10.24am

Additional questions

1. What time does the last train arrive in Central?
2. How long does it take for the train to get from Central to Roseworthy
3. If you were in Parks and needed to be in Lawley by 7am, what time would you need to catch the train?

Curriculum reference

Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Measurement* (book one):

- Chapter 4: Direct measure
  - Key understanding 6: We can judge and measure time using both natural cyclical changes and special techniques and tools which people have developed. p.150

Student worksheet

Focus

Locating information using calendars, timelines and timetables.

Question 1

Monday's Computer Times

Student	Time
Ann	1:45 pm
Ben	10:35 am
Chloe	11:25 am
Dave	9:10 am

Which list shows the order, from earliest to latest, that Ann, Ben, Chloe and Dave are to use the computer?

- ○ Ann, Ben, Chloe, Dave
- ○ Ann, Dave, Ben, Chloe
- ○ Dave, Chloe, Ben, Ann
- ○ Dave, Ben, Chloe, Ann
- ○ Dave, Ann, Ben, Chloe

Question 2

BIRTHDAYS

Who is the oldest?

13 January **1997** | 16 June **1996** | 23 April **1996** | 15 December **1996**

A **B** **C** **D**

Question 3

Aidan borrows a book on 28 June.
He returns it two weeks later.

When does he return the book?

- ○ 30 June
- ○ 11 July
- ○ 12 July
- ○ 13 July
- ○ 14 July

Question 4

Below is a train timetable.

DEPATURE TIMES				
Central	6.15am	9.51am	2.53pm	7.05pm
Parks	6.26am	10.02am	3.04pm	7.16pm
Lawley	6.38am	10.14am	3.16pm	7.28pm
Roseworthy	6.48am	10.24am	3.26pm	7.38pm

What time does the last morning train depart from Roseworthy? _____

Recognising and describing triangles and quadrilaterals

Background information/teaching focus

Shape is a property or attribute of things and there are infinitely variable shapes possible. Standard classification of shapes has therefore been developed and shapes have been given classes and names of their own. This naming helps students to distinguish shapes and remember them. The classes themselves become concepts with properties of their own. Thus a triangle is the bearer of sets of properties.

Students should understand that figures that they recognise as being, for example, rectangles all have certain properties in common. They should then move on to realise that it is the properties that define the class of the figure. Students will benefit from activities focusing on relationships between properties. Only when students understand that properties are related to each other do they understand that knowing just a few properties of a figure or object enables them to work out other properties. This is the most useful aspect of geometry.

For further related information see *First Steps in Mathematics: Space:*

- Chapter 6: Reason geometrically
  - Key understanding 4: People have developed useful ways to classify shapes. Knowing that a shape is one of the standard types can tell us a lot about it. p.196

Rigby Harcourt Education, Australia

Western Australian Curriculum

- Year 2 – Describe and draw two-dimensional shapes, with and without digital technologies (ACMMG042).

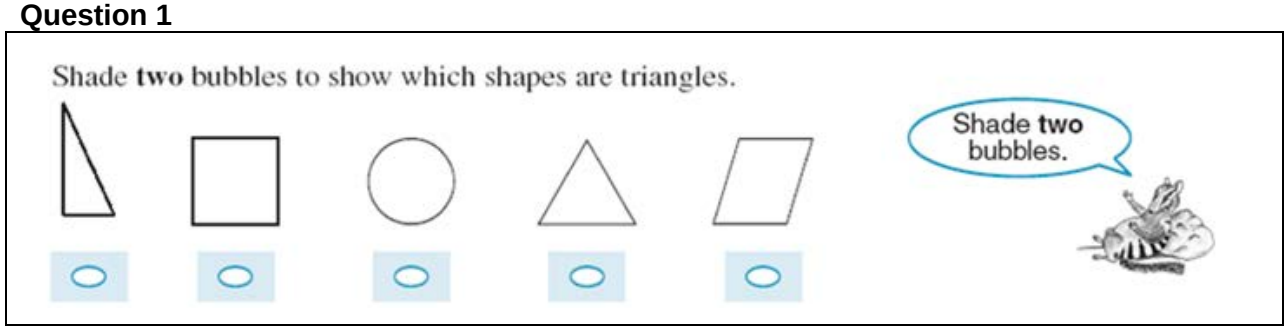
For more information visit the Western Australian Curriculum.

Learning activities

For ideas for activities see *First Steps in Mathematics*: Space:

- Quadrilaterals p. 203
- Geoboard p. 203
- Shape clues p. 204
- Every square a rectangle p. 205
- Quadrilaterals p. 205
- Relationships p. 205

Question 1

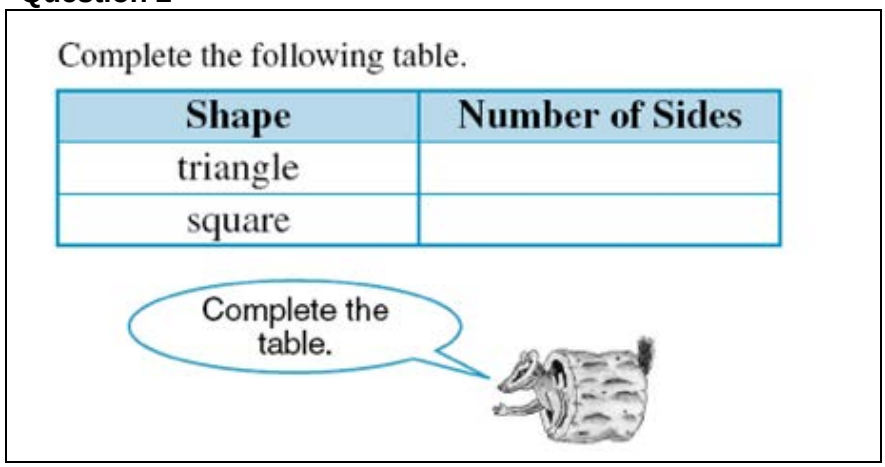


Skill: Students distinguish triangles from quadrilaterals.
Answer key: A & D
Note: Students should be reminded to check the instructions.

Additional questions

1. What features do you look for to decide if a shape is a triangle?
2. What if the shape was on its point like this? 
3. Would it still be a triangle? How do you know?
4. Draw as many different shaped triangles as you can.
5. Is it possible to draw a straight-sided shape with exactly three sides that is not a triangle? Explain your thinking.

Question 2

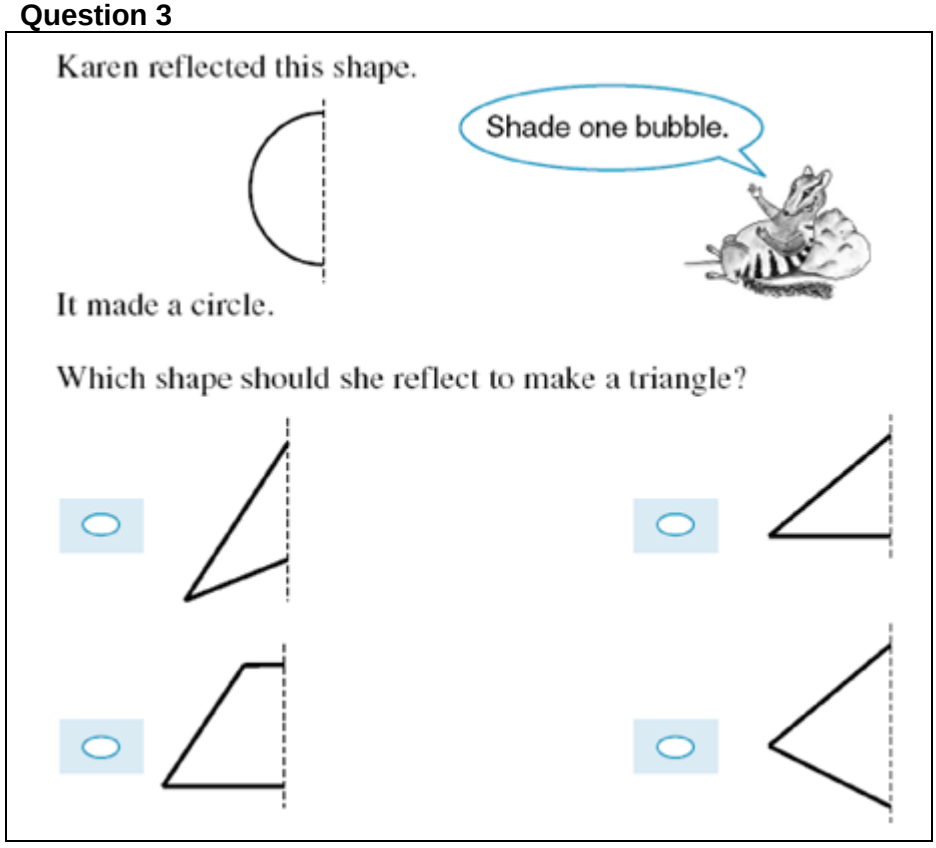


Skill: Students describe a triangle and a square by the number of sides.
Answer key: 3 and 4
Note: Make sure students know that something should be written in all of the blank cells.

Additional questions

1. What if instead of ‘square’, the table said ‘rectangle’? Does the number of sides change?
2. What is special about the sides of a square?
3. Draw and compare some different squares and triangles. What is the same and what is different about the squares? What is the same and what is different about the triangles?
4. Have students make squares and triangles using straws and pipe cleaners. Talk about the effect of different length sides and different shaped corners on the shapes. How does a triangle change when the sides and angles are varied? Is it still a triangle? Why? How does a square change when the sides and angles are varied? Is it still a square? Why not?
5. Have students investigate a range of quadrilaterals (4 sided polygons) including a rectangle, a square, a rhombus, a trapezium, and other irregular quadrilaterals with every side a different length.)

Question 3



Skill: Students visualise the resulting shape after a reflection.
Answer key: B
Note: Students need to understand the meaning of the line of symmetry as well as recognise a triangular shape to be able to answer the question.

Additional questions

1. What happens to the lines of the shapes when they pass through the 'mirror line'? Which of the lines above will **not** change direction?
2. Draw half of a straight-sided shape and a line of symmetry (as in the question) and say what shape it should make when reflected.
   Fold, hold up to the light, and then trace the shape. Did you see the shape you expected when you opened it?
3. Use a mirror and some triangles and quadrilaterals to explore the different shapes they make when the line of symmetry is moved around. Can you find a place where the reflected shape matches exactly the hidden part of the shape? Why? Why not?

Question 4

Bret has to make a rectangle by joining the ends of a complete set of straws.

Set 1 Set 2 Set 3 Set 4

Which set of straws should Bret use?

- ○ Set 1
- ○ Set 2
- ○ Set 3
- ○ Set 4

Skill: Students recognise the features of a rectangle.
Answer key: A
Note: Help students see the importance of the words 'complete set of straws' and be sure they understand what it means.

Additional questions

1. Does it matter in which order you join the set of straws? Why?
2. If you joined the straws with pipe-cleaners, or threaded elastic, would a rectangle be the only shape it would make? Why?
3. Draw the straws you would need to make a triangle, a square, and a four-sided shape that is not a rectangle (an irregular quadrilateral).
4. What shapes would Set 3 and Set 4 make? How do you know?
5. Can you say what shape Set 2 would make? How do you know?
6. How many straight-sided shapes can you name? List them.

Curriculum reference

Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Space:*

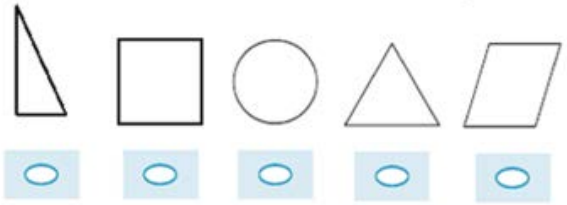
- Chapter 6: Reason geometrically
  - Key understanding 4: People have developed useful ways to classify shapes. Knowing that a shape is one of the standard types can tell us a lot about it. p.196

Student worksheet

Focus: Recognising and describing triangles and quadrilaterals

Question 1

Shade **two** bubbles to show which shapes are triangles.



Question 2

Complete the following table.

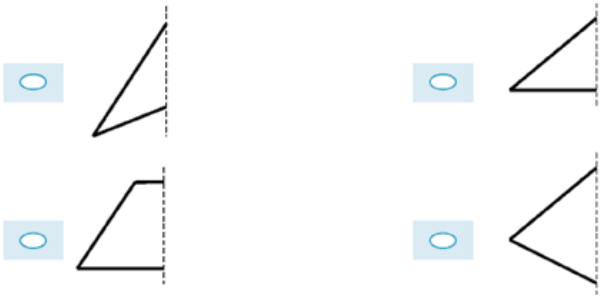
Shape	Number of Sides
triangle	
square	

Question 3

Karen reflected this shape.

It made a circle.

Which shape should she reflect to make a triangle?



Question 4

Bret has to make a rectangle by joining the ends of a complete set of straws.

Set 1 Set 2 Set 3 Set 4

Which set of straws should Bret use?

- Set 1
- Set 2
- Set 3
- Set 4

Naming and describing polygons

Background information/teaching focus

Shape is a property or attribute of things and there are infinitely variable shapes possible. Standard classification of shapes has therefore been developed and shapes have been given classes and names of their own. This naming helps students to distinguish shapes and remember them. The classes themselves become concepts with properties of their own. Thus a triangle is the bearer of sets of properties.

Students should understand that figures that they recognise as being, for example, rectangles all have certain properties in common. They should then move on to realise that it is the properties that define the class of the figure. Students will benefit from activities focusing on relationships between properties. Only when students understand that properties are related to each other do they understand that knowing just a few properties of a figure or object enables them to work out other properties. This is the most useful aspect of geometry.

For further related information see *First Steps in Mathematics: Space:*

- Chapter 6: Reason geometrically
  - Key understanding 4: People have developed useful ways to classify shapes. Knowing that a shape is one of the standard types can tell us a lot about it.

Rigby Harcourt Education, Australia

Western Australian Curriculum

- Year 2 – Describe and draw two-dimensional shapes, with and without digital technologies (ACMMG042).
- Year 4 – Compare and describe two dimensional shapes that result from combining and splitting common shapes, with and without the use of digital technologies (ACMMG088).

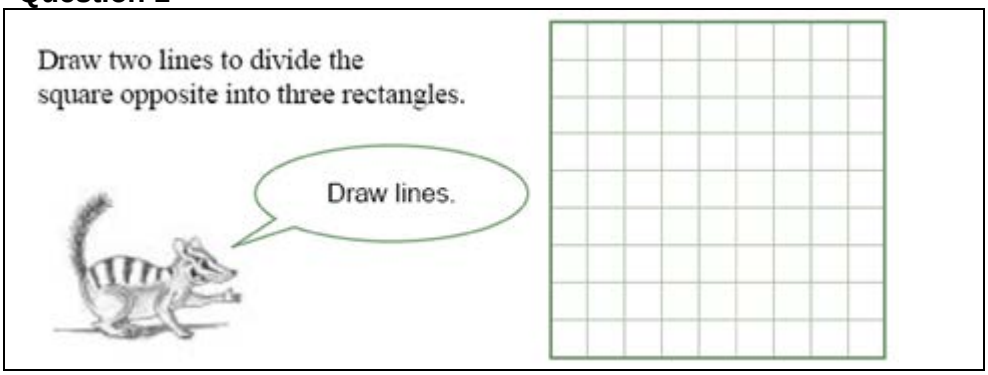
For more information visit the Western Australian Curriculum.

Learning activities

For ideas for activities see *First Steps in Mathematics: Space*:

- Shape clues p. 204
- True or false? p. 204
- Sorting triangles p. 205

Question 1

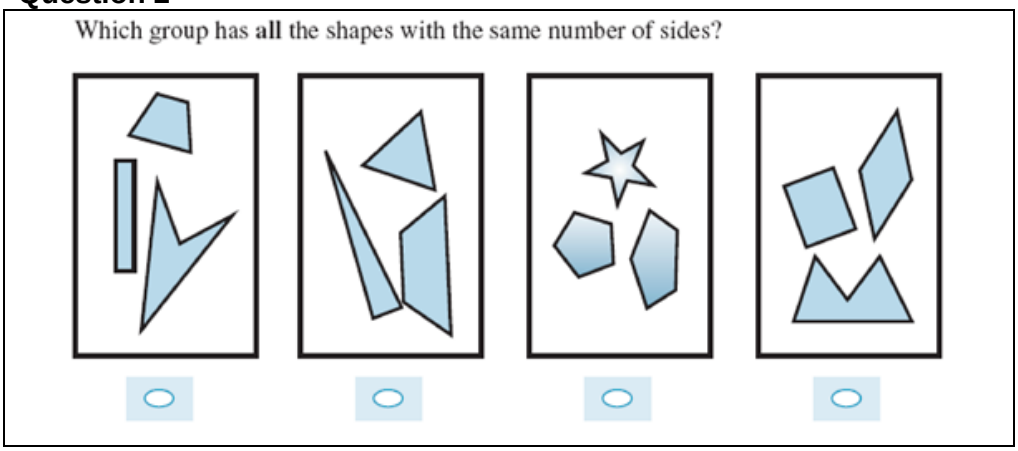


Skill: Students recognise and draw rectangles.
Answer key: Any correct response.
Note: Draw students' attention to the specific instructions that need to be followed.

Additional questions

1. How do you know that you have three rectangles?
2. Would it be a rectangle if I drew one of my lines along the first grid row? How do you know?
3. Walter drew a line half a row long. Could he still make three rectangles?
4. What other groups of three rectangles can you make?

Question 2

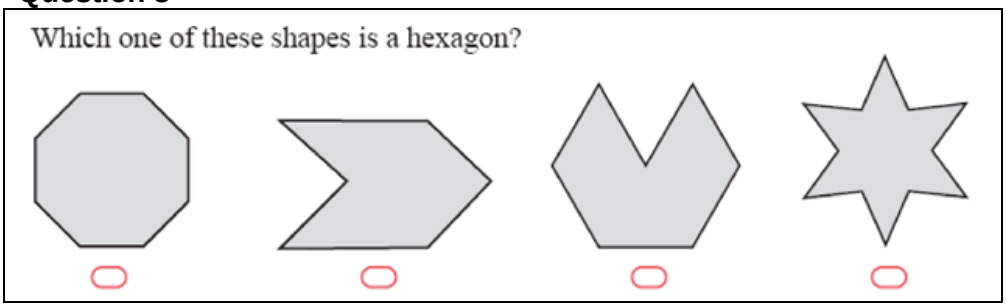


Skill: Students recognise polygons with equal numbers of sides.
Answer key: A
Note: Students need to take particular notice of words that have been bolded. In this case, **all** shapes in the group must have the same number of sides.

Additional questions

1. How did you select the group with **all** shapes with the same number of sides?
2. Name some polygons with exactly four straight sides.
3. Have students investigate polygons with different numbers of sides, and draw up a table naming the shapes. Students should be exposed to regular polygons as well as irregular ones.

Question 3

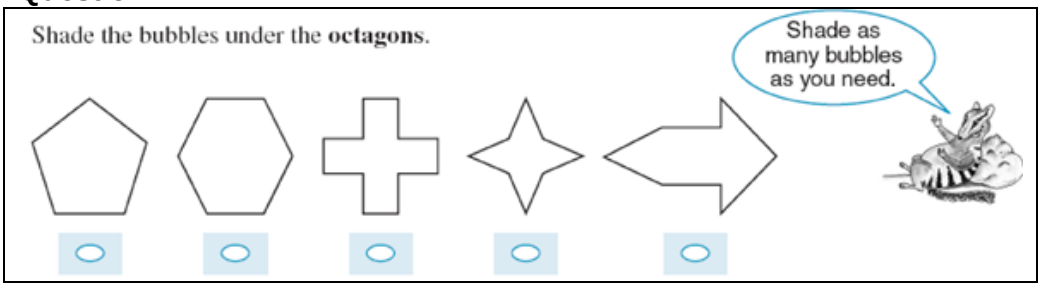


Skill: Students recognise an irregular hexagon.
Answer key: B
Note: Students should be made aware that all closed shapes with six straight sides are called hexagons.

Additional questions

1. What shape did you expect to see when you saw the word 'hexagon'?
2. Use your ruler to draw as many different hexagons as you can.
3. What is the same about all hexagons?

Question 4



Skill: Students recognise a range of differently shaped octagons.
Answer key: D and E

Additional questions

1. How did you know which were octagons? Were they regular or irregular?
2. How would you draw a regular octagon?
3. What, other than sides with the same size, would you need to think about when constructing a *regular* octagon?
4. How many different irregular shaped octagons can you draw?
5. How many different regular octagons could you draw?

Curriculum references

Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Space:*

- Chapter 6: Reason geometrically
  - Key understanding 1: Things can be the same in some ways and different in other ways. When we classify, we sort things into groups that are the same in specified ways. p.158
  - Key understanding 3: There are special words, phrases and symbols that help us to think about and describe the shape and structure of things. p.182
  - Key understanding 4: People have developed useful ways to classify shapes. Knowing that a shape is one of the standard types can tell us a lot about it. p.196

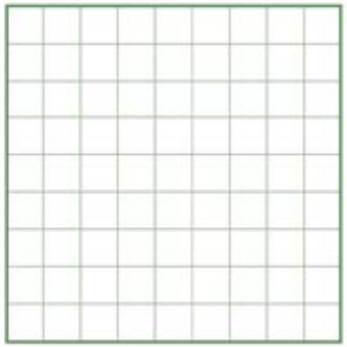
Student worksheet

Focus

Naming and describing polygons

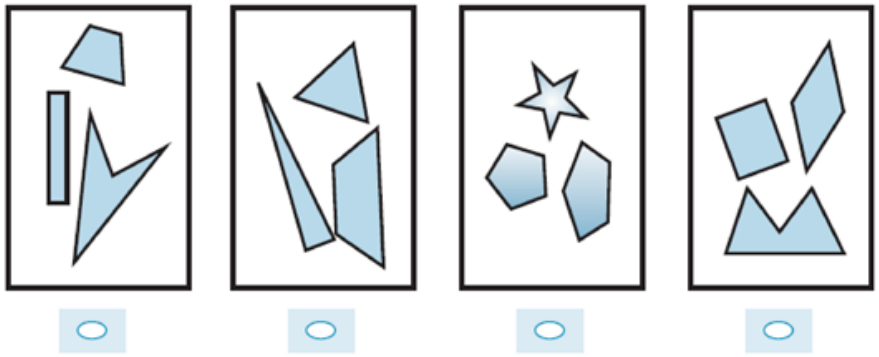
Question 1

Draw two lines to divide the square opposite into three rectangles.



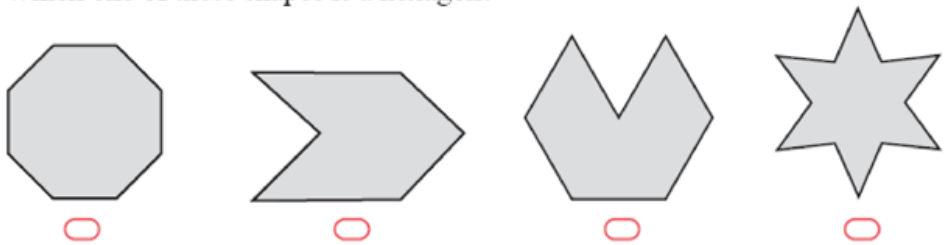
Question 2

Which group has **all** the shapes with the same number of sides?



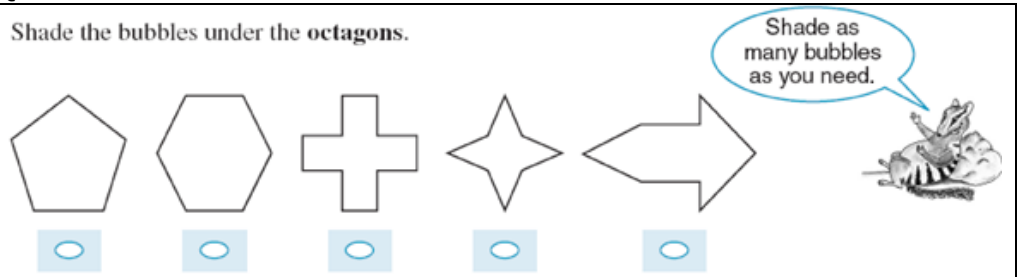
Question 3

Which one of these shapes is a hexagon?



Question 4

Shade the bubbles under the **octagons**.



Understanding geometric language (vertex, face, edge)

Background information/teaching focus

Students should learn to use a wide range of spatial words in their own descriptions and explanations—intersection, perpendicular, triangular, side, edge, face, vertices. The shift to conventional terms should occur as they hear them used in context by others. If students do not have a name for a particular shape or property, then it may be that they do not think of that shape or property as an important feature of the things they observe. It would then be helpful for teachers to draw students' attention to these features by using appropriate language in context.

Without being unduly technical, teachers should model the use of correct spatial language in contexts that make the meaning of this language clear. Students should then be assisted and increasingly expected to use the language for themselves, practising describing the spatial features of objects and surroundings in situations where there is some purpose in doing so.

For further related information see *First Steps in Mathematics: Space:*

- Chapter 6: Reason geometrically
  - Key understanding 3: There are special words, phrases and symbols that help us to think about and describe the shape and structure of things.

Rigby Harcourt Education, Australia

Western Australian Curriculum

- Year 2 – Describe the features of three-dimensional objects (ACMMG043).
- Year 3 – Make models of three-dimensional objects and describe key features (ACMMG063).
- Year 5 – Connect three-dimensional objects with their nets and other two-dimensional representations (ACMMG111).
- Year 6 – Construct simple prisms and pyramids (ACMMG140).

For more information visit the Western Australian Curriculum.

Learning activities

For ideas for activities see *First Steps in Mathematics: Space:*

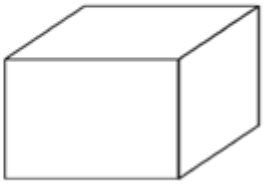
- Barrier game p. 187
- Back to back p. 187
- Mathematical language p. 192

Question 1

Alex painted **all** the faces of a cube.

How many faces did Alex paint?

- ⬭ 12
- ⬭ 8
- ⬭ 7
- ⬭ 6
- ⬭ 3

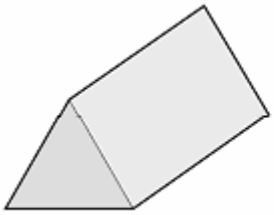


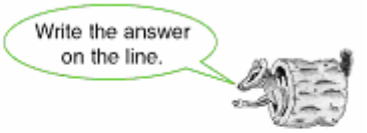
Skill: Students interpret the meaning of *face*.
Answer key: D
Comment: The most common mistake is E (3).

Additional questions

1. How many faces of the cube cannot be seen?
2. Name an object that has the same number of faces as the cube?
3. Ask students to make a question using the word face.
4. If you cut a thin slice off each face, how many faces would the object that is left have?

Question 2





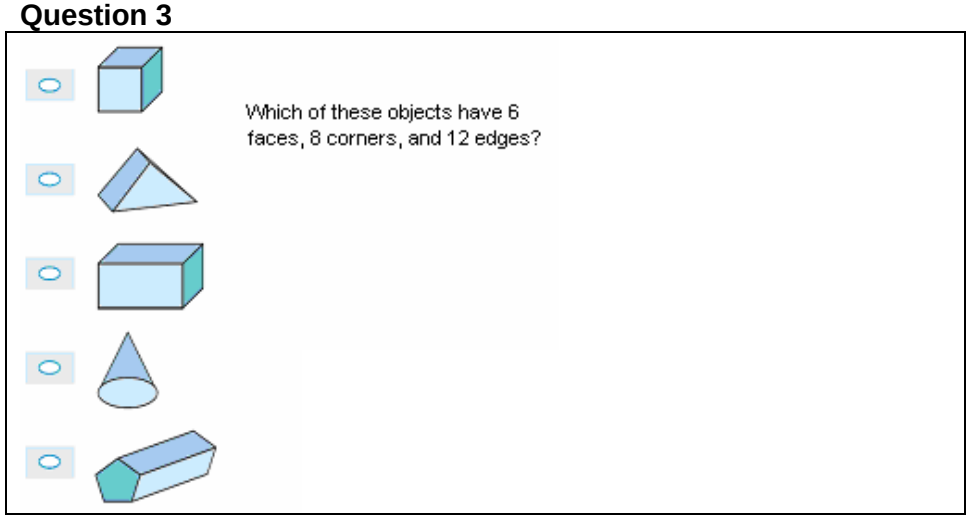
A triangular prism has _____ edges and _____ faces.

Skill: Students visualise the number of edges and faces of a triangular prism.
Answer key: 9 edges and 5 faces

Additional questions

1. How did you work out the number of faces?
2. How did you work out the number of edges?
3. What would the name of the prism be if the *ends* were squares? What about if the *ends* were hexagons?
4. How many faces and how many edges does a hexagonal prism have?

Question 3

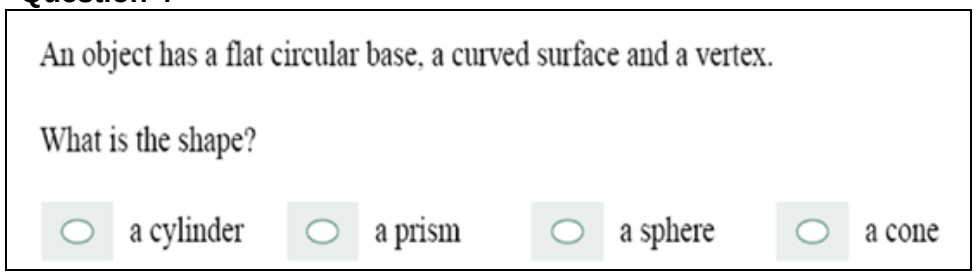


Skill: Students identify drawings of 3D objects from the number of faces, vertices and edges.
Answer key: A and C
Note: Remind students to read the instructions carefully.

Additional questions

1. How many faces, corners (vertices) and edges do the other objects have?
2. Draw an object that has six faces, but does not have eight corners or 12 edges. How many corners (vertices) and edges does your object have?
3. Make or draw some different objects and describe them using the words edges, faces and vertices.

Question 4



Skill: Without reference to a diagram, students visualise and identify the name of a geometric object from its properties.
Answer key: D
Note: Students who cannot do this item might benefit from working with physical models and drawings before they can be expected to use visualisation alone.

Additional questions

1. What objects around the room have a flat circular base?
2. Name an object that has a curved surface?
3. What does the word vertex mean?
4. Use any of the words circular, flat or vertex to describe a familiar object. Name your object.

Curriculum reference

Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Space:*

- Chapter 6: Reason geometrically
  - Key understanding 3: There are special words, phrases and symbols that help us to think about and describe the shape and structure of things. p.182

Student worksheet

Focus

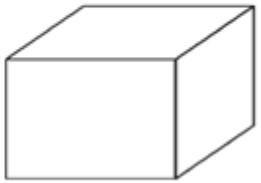
Understanding geometric language (vertex, face, edge)

Question 1

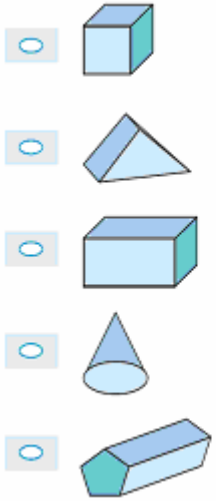
Alex painted **all** the faces of a cube.

How many faces did Alex paint?

- ⬭ 12
- ⬭ 8
- ⬭ 7
- ⬭ 6
- ⬭ 3

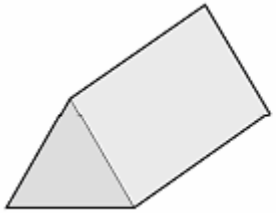


Question 3



Which of these objects have 6 faces, 8 corners, and 12 edges?

Question 2



Write the answer on the line.

A triangular prism has _____ edges and _____ faces.

Question 4

An object has a flat circular base, a curved surface and a vertex.

What is the shape?

⬭ a cylinder ⬭ a prism ⬭ a sphere ⬭ a cone

Visualising 3D objects

Background information/teaching focus
Students need opportunities to analyse the component parts that form a 3D object (shapes, size, and placement) and consider how the components fit and hold together.

Mathematics provides a number of standard ways of representing space that are in widespread use internationally and students need to learn the conventions for interpreting and producing them. Students should understand that we often interpret diagrams by reading beyond them to what is not in the diagram but must have been there and begin to see 2D diagrams look like 3D things.

Students need activities that focus their attention on the individual faces so as to make the distinction between a 3D object and its 2D surfaces. This assists students to explore how 3D objects can be represented in a 2D way. Students need to learn to see the 2D shapes that make up the 3D object and be involved in activities that have the students investigating which 2D shapes go together to make a particular prism or pyramid. How these shapes are connected to each other will then help them to begin to see the parts that make up the whole object.

For further related information see *First Steps in Mathematics: Space*:

- Chapter 4: Represent shape
  - Key understanding 1: When we copy and make figures and objects, we need to think about how the parts relate to each other and to the whole. p.58
  - Key understanding 3: To understand drawings of objects we need to combine what we can actually see with what we think is there. Special drawing techniques emphasise different aspects of an object. p.84

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Western Australian Curriculum

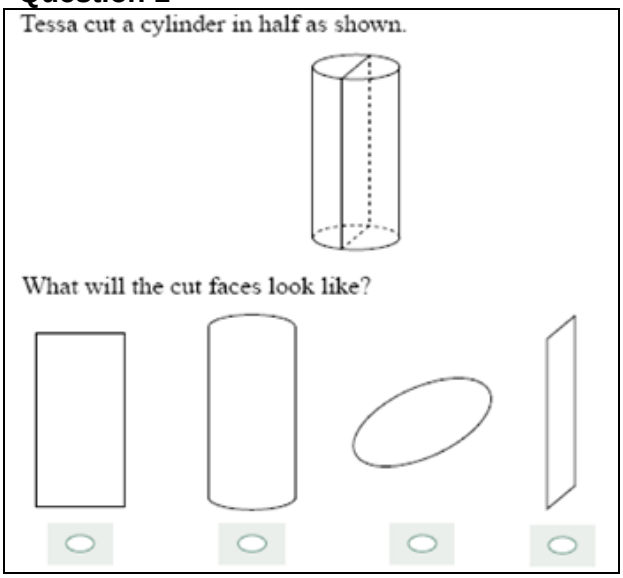
- Year 5 - Connect three–dimensional objects with their nets and other two-dimensional representations (ACMMG111).

For more information visit the Western Australian Curriculum.

Learning activities
For ideas for activities see *First Steps in Mathematics: Space:*

- Baskets p. 64
- Hollow models p. 64
- Skeleton diagram p. 89
- Cross sections p. 90

Question 1

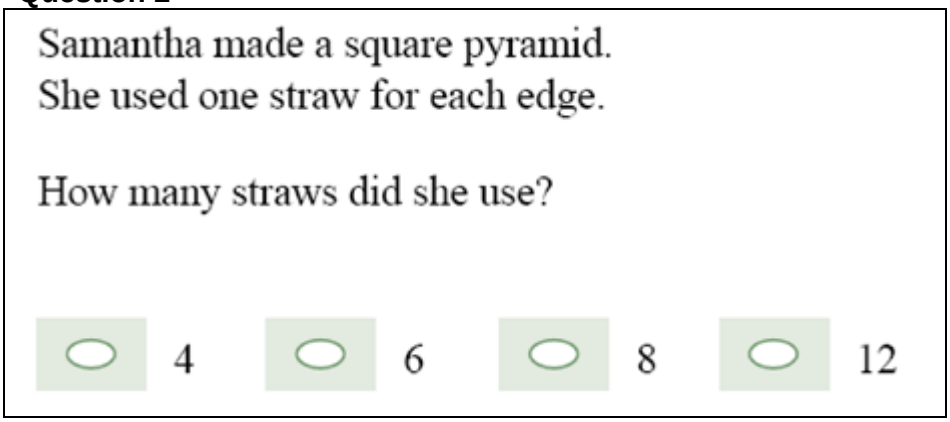


Skill: Students visualise the face formed by dissecting a 3D object
Answer key: A

Additional questions

1. Will there be any curved sides on the new face? How do you know?
2. What shape would be formed if you cut this shape horizontally through the middle?
3. What if you cut a diagonal line? What shape would the new face be?
4. Give the students plasticine or Play doh to explore creating and cutting shapes for themselves.

Question 2



Skill: Students recognise properties of a 3D object
Answer key: C
Note: Point out to the students that they could count the number of edges

Additional questions

1. How did you decide how many straws were needed?
2. Would it make a difference if it was a rectangular pyramid? Why?
3. How would it make a difference if it was a triangular or a pentagonal pyramid?
4. Write a rule that lets you work out the number of edges of any shaped pyramid.

Question 3

Which of these shapes could together make a prism?

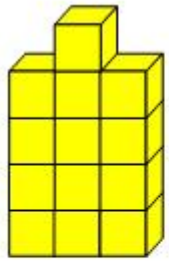
a. Rectangles and triangles
b. Pentagons and triangles
c. Pentagons and squares
d. Triangles and octagons

Skill: Students visualise the 2D shapes needed to make prisms
Answer key: A and C

Additional questions

1. What does a prism look like?
2. Why can't pentagons and triangles together make a prism?
3. What shapes could make the faces of a prism?
4. How can you tell if an object is or is not a prism?

Question 4



Mark builds this 3D object using 13 cubes.
He then paints the outside faces including the base.

How many cubes have only 2 faces painted?

Skill: Students identify hidden faces in a 2D drawing of a 3D object
Answer key: 3

Additional questions

1. How did you work out the answer?
2. How many of the cubes have 3 faces painted? How many have more than 3 faces painted?
3. What do you notice about the position of the cube within the shape and the number of painted faces?
4. Make your own shape using cubes that would have only three cubes with two painted faces.

Curriculum references

Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Space*:

- Chapter 4: Represent shape
  - Key understanding 1: When we copy and make figures and objects, we need to think about how the parts relate to each other and to the whole. p.58
  - Key understanding 3: To understand drawings of objects we need to combine what we can actually see with what we think is there. Special drawing techniques emphasise different aspects of an object. p.84

Student worksheet

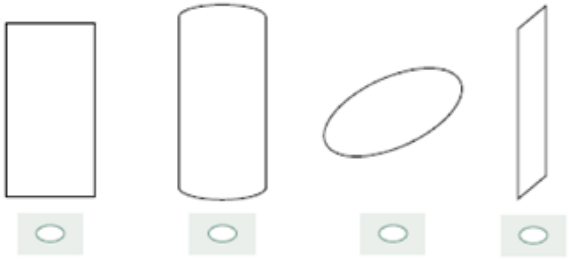
Focus

Visualising 3D objects

Question 1

Tessa cut a cylinder in half as shown.

What will the cut faces look like?



Question 3

Which of these shapes could together make a prism?

e. Rectangles and triangles

f. Pentagons and triangles

g. Pentagons and squares

h. Triangles and octagons

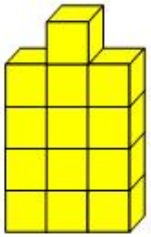
Question 2

Samantha made a square pyramid.
She used one straw for each edge.

How many straws did she use?

4 6 8 12

Question 4



Mark builds this 3D object using 13 cubes.
He then paints the outside faces including the base.

How many cubes have only 2 faces painted?

Nets of 3D objects

Background information/teaching focus

A net is a special technique used for producing objects. It is composed of figures arranged in a particular flat configuration. The arrangement of these figures does not exactly match the arrangement on the object to be made, as some sides may be some distance from each other. This arrangement is such that when it is folded all the parts will come together in the right relationship. Through experience that focuses upon the component parts of a figure and how they fit together, students learn that the net of any given object will need:

- figures of the right shape and size;
- in the right number; and
- in the right position relative to each other.

Students should be able to match provided nets to actual objects and to make their own nets for 3D objects. To achieve this, activities that involve the students in investigating which 2D shapes go together to make a particular prism or pyramid and how these shapes are connected to each other will help them to see the parts that make up the whole object.

For further related information see *First Steps in Mathematics: Space:*

- Chapter 4: Represent shape
  - Key understanding 2: The net of an object has to have the same component parts as the object and the parts have to be in the right relationship to each other.

Western Australian Curriculum

- Year 5 – Connect three-dimensional objects with their nets and other two-dimensional representations (ACMMG111).

For more information visit the Western Australian Curriculum.

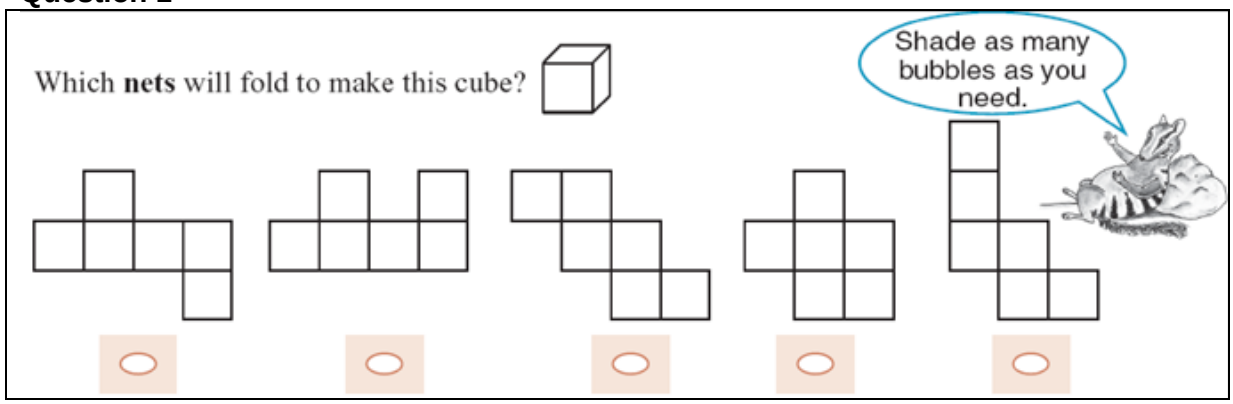
Learning activities

For ideas for activities see *First Steps in Mathematics: Space:*

- Flattened boxes p. 76
- Pass the nets p. 77
- Pyramid p. 77
- Dice p. 78
- Different dice p. 78
- Coloured cube p. 79

Revised October 2016

Question 1

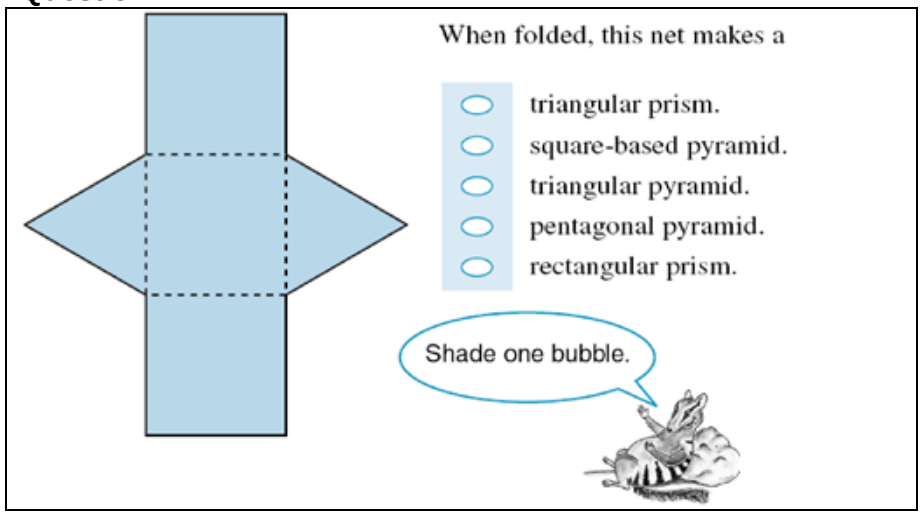


Skill: Students recognise nets of a cube.
Answer key: A and C

Additional questions

1. How many faces does the cube have? What shape are the faces of a cube?
2. Explain why the two nets you chose will form a cube.
3. Use squared grid paper to draw the nets. Cut them out to find whether your predictions were correct.
4. Draw other nets that will fold into a cube. How can you tell when it will **not** make a cube?

Question 2

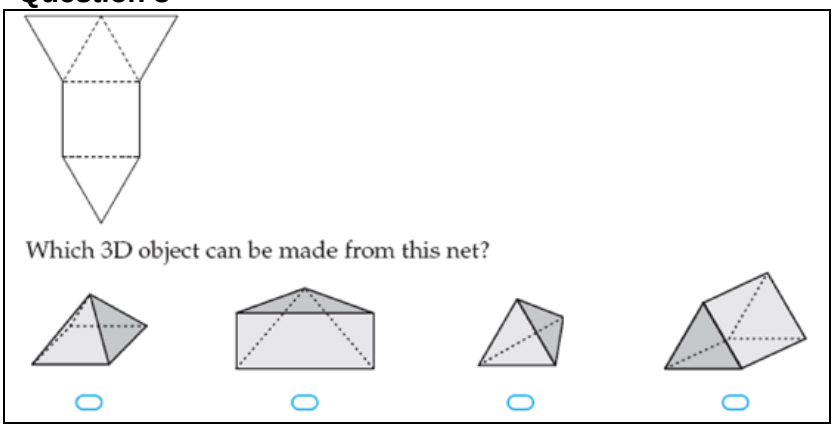


Skill: Students visualise folding a net.
Answer key: A

Additional questions

1. How is a prism different to a pyramid?
2. How do we name prisms and pyramids?
3. In groups, draw nets for each of the other objects in the list above. Explain why the net will fold to make that object and what the features are which identify it as that object.
4. Draw nets for two other pyramids. Name the pyramids.

Question 3

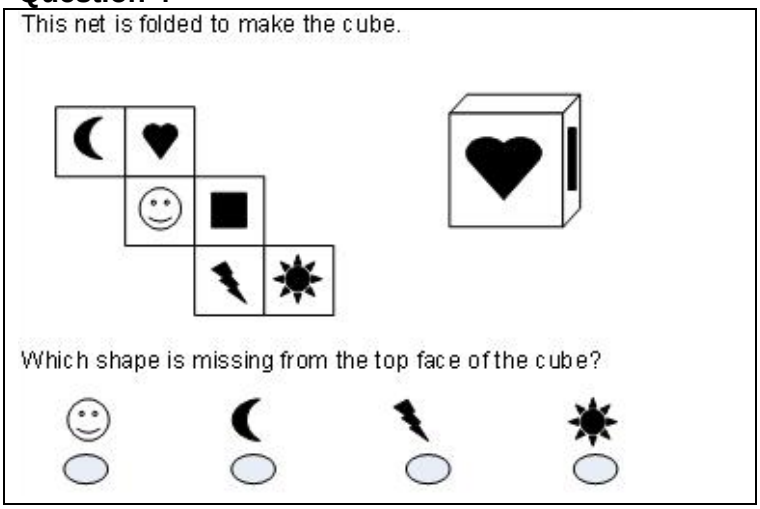


Skill: Students identify a 3D object from a given net
Answer key: A

Additional questions

1. How do you know which is the correct 3D object?
2. Why is there only one square in this net?
3. What shape would you see in the net of any pyramid?
4. What shape would you see in the net of any prism?
5. How many triangles and how many rectangles would be in the net of the triangular prism? What about the triangular based pyramid?

Question 4



Skill: Students identify the 3D object formed by the folding of a net
Answer key: D

Additional questions

1. How did you know which shape would be on the top face?
2. Which shape would be on the bottom face? How do you know?
3. Which shape would not have an edge joining the heart face (is opposite the heart face)? How can you tell this by looking at the net?
4. Let students cut out the net and test their predictions.
5. Make a net for a cube and then fill in the dots so that when it is folded it will match the dots on a six – sided dice.

Curriculum reference

Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Space:*

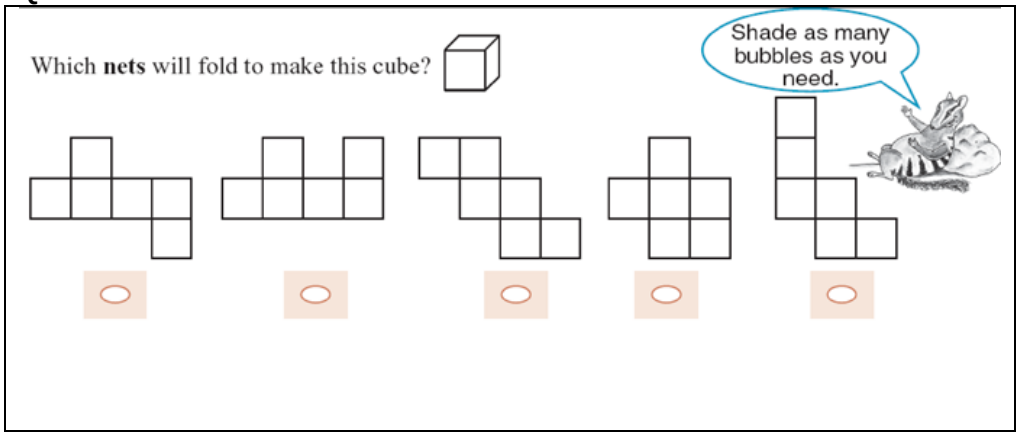
- Chapter 4: Represent shape
  - Key understanding 2: The net of an object has to have the same component parts as the object and the parts have to be in the right relationship to each other. p.72

Student worksheet

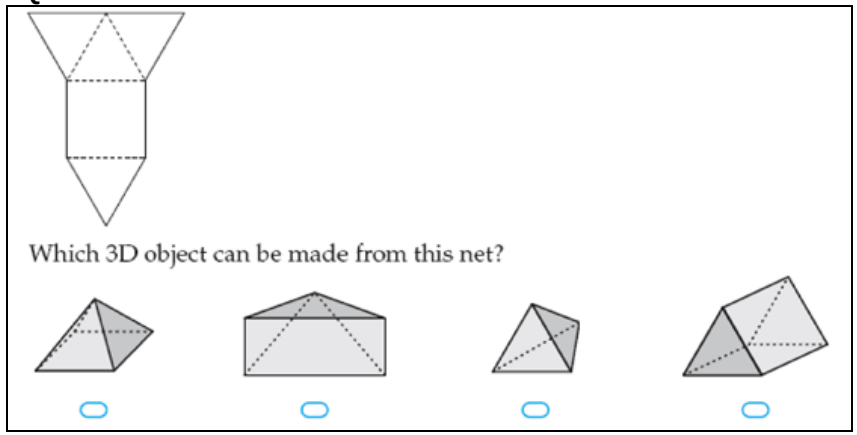
Focus

Nets of 3D objects

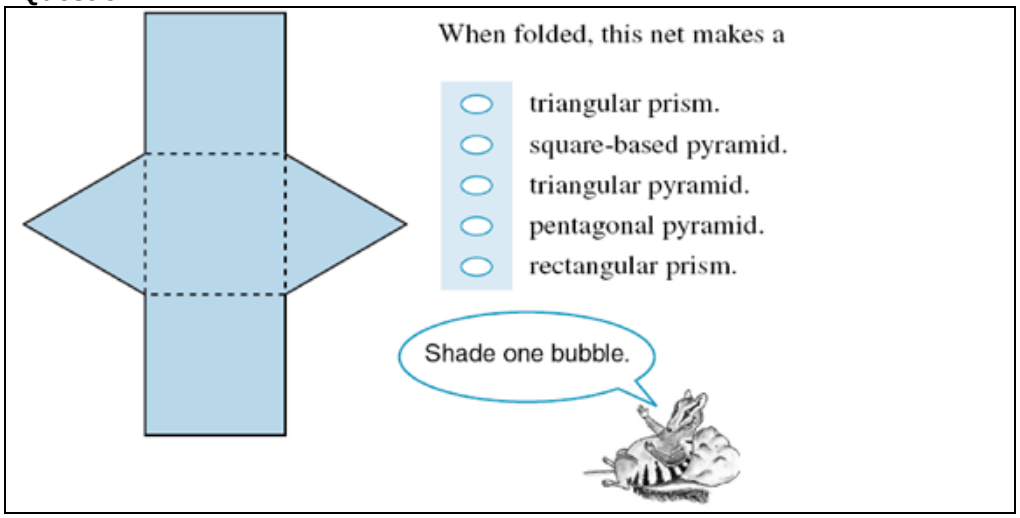
Question 1



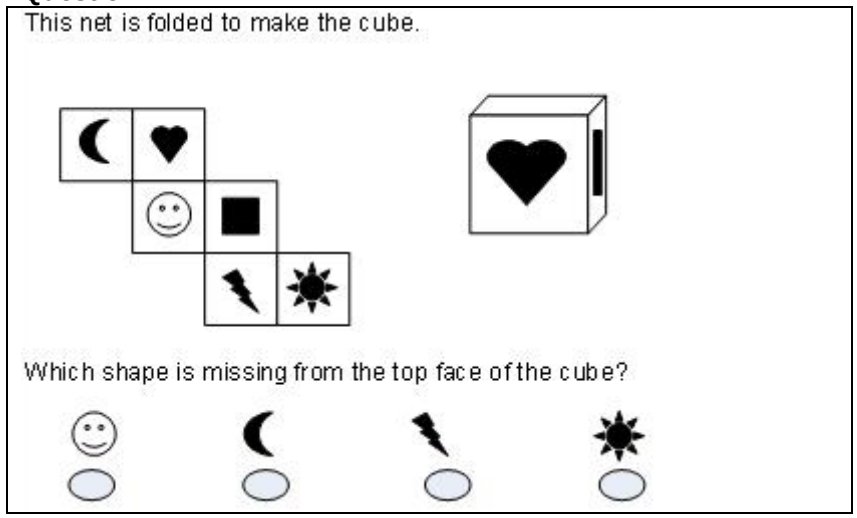
Question 3



Question 2



Question 4



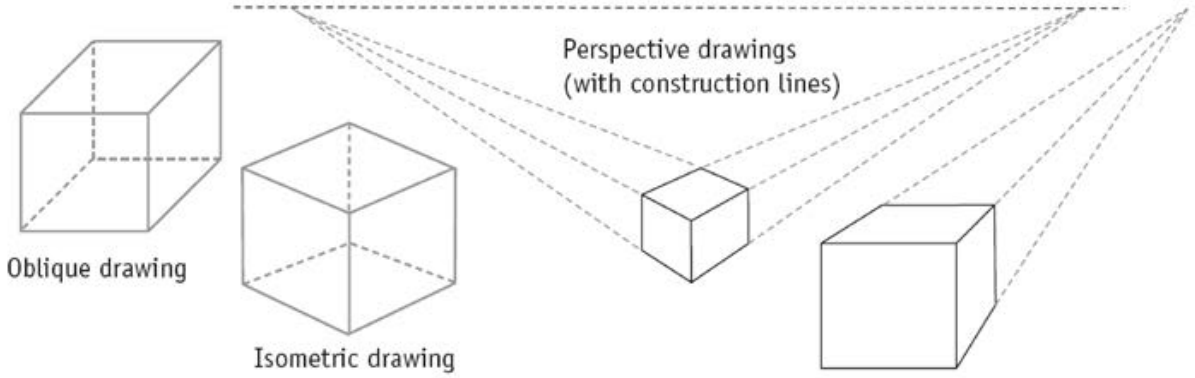
Visualising 3D objects using oblique and isometric drawings

Background information/teaching focus

When we draw any object we have the choice of drawing it flat (2D) or as a solid (3D) and our choice is determined by the purpose. Perspective, oblique and isometric drawings are three common forms of representation which, to varying degrees, look like 3D objects to us. We use oblique and isometric drawings to draw 3D pictures of objects when the scale of the sides matters.

Oblique drawings have one face of the object positioned at the front so that the shape and angles of this face are the same as the object and the lengths of the edges of this face are to scale. Two other faces are drawn at a 45º angle to this front face, with each maintaining parallelism where it exists in the object being drawn.

Isometric drawings have an edge positioned towards the front of the drawing. The three faces are drawn with the length of all edges to scale and parallelism maintained. However, the shapes of these faces and the angles are not the same as on the object. For example, parallelograms are used to represent square and rectangle faces.



For further related information see *First Steps in Mathematics: Space*:

- Chapter 4: Represent Shape
  - o Background notes p.97

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Western Australian Curriculum

- Year 3 – Make models of three-dimensional objects and describe key features (ACMMG063).
- Year 5 – Connect three-dimensional objects with their nets and other two-dimensional representations (ACMMG111).

For more information visit the Western Australian Curriculum.

Learning activities
For ideas for activities see *First Steps in Mathematics: Space:*

- Isometric drawings p. 90
- Soma cube p. 91
- Building complex structures p. 93
- Elevation plans p. 96

Question 1

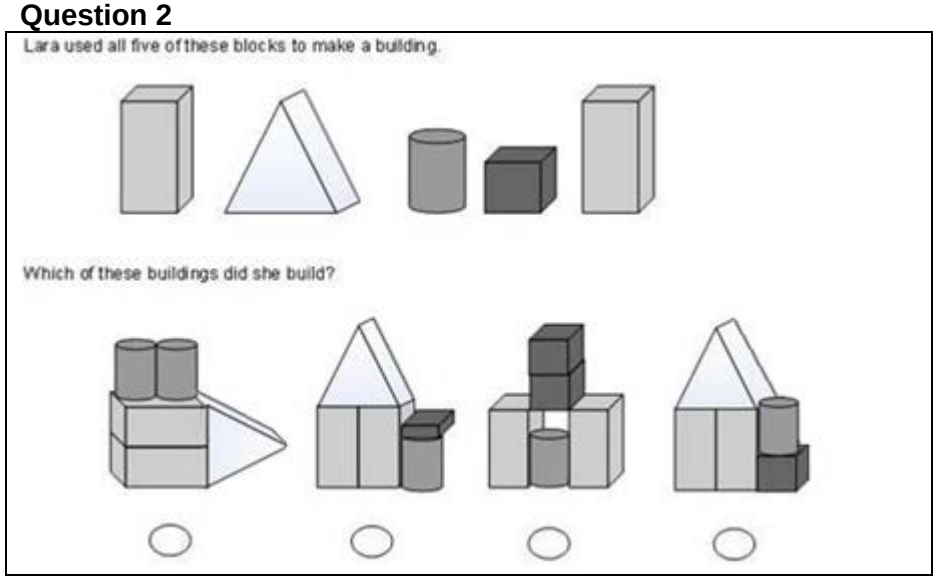
How many edges of this cube **cannot** be seen? _____

Skill: Students visualise hidden edges from a drawing of a cube.
Answer key: 3

Additional questions

1. How did you work out how many edges were hidden?
2. How many edges does a cube have?
3. Tom can see only the top and front faces of a cube. How many edges of the cube **can** be seen? How many edges of the cube **cannot** be seen?
4. Look at a real cube from different directions. Is there any position of the cube where you see exactly 4 edges only? How many edges are hidden?

Question 2

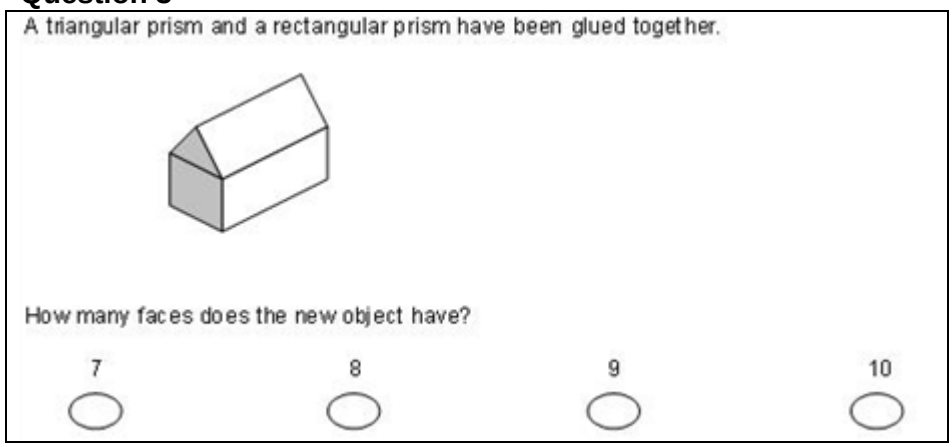


Skill: Students recognise familiar 3D objects in different arrangements.
Answer key: D

Additional questions

1. How did you decide which drawing is correct?
2. Which drawing shows two cylinders?
3. Which block is missing in the first drawing?
4. Which drawing shows a block that is not one of the five blocks shown?

Question 3



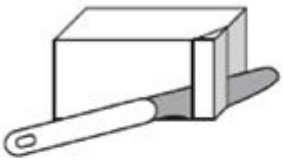
Skill: Students visualise the faces of a familiar 3D object.
Answer key: A (because the triangle and rectangle together make one face)

Additional questions

1. How many faces altogether did the two objects have before they were joined?
2. How many faces of the object in Question 3 cannot be seen?
3. Another rectangular prism was glued to the bottom. How many faces does the new object have?

Question 4

Freya cut a rectangular block of butter into 2 pieces.



How many faces does the larger piece have?

- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 10

Skill: Students visualise faces on a drawing of a rectangular prism.
Answer key: C

Additional questions

1. How many faces were on the block to begin with?
2. What is the shape of the new face created by the cut?
3. What is the shape of the piece cut off? How do you know?
4. How many faces and edges are on the piece that is cut off?
5. Altogether, how many faces are there on the two objects?

Curriculum reference

Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Space*:

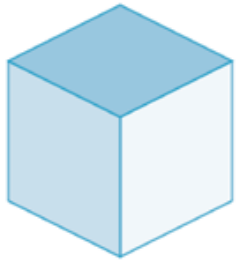
- Chapter 4: Represent shape
  - Key understanding 3: To understand drawings of objects we need to combine what we can actually see with what we think is there. Special drawing techniques emphasise different aspects of an object. p.84

Student worksheet

Focus

Visualising 3D objects using oblique and orthogonal drawings

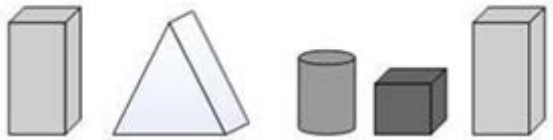
Question 1



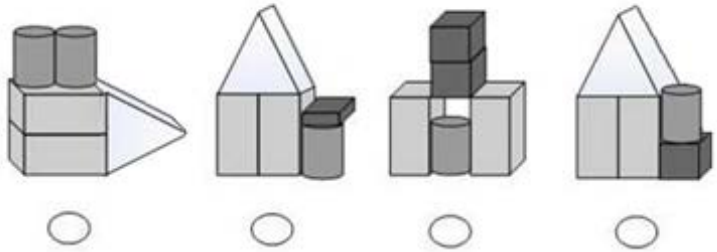
How many edges of this cube **cannot** be seen? _____

Question 2

Lara used all five of these blocks to make a building.



Which of these buildings did she build?



Question 3

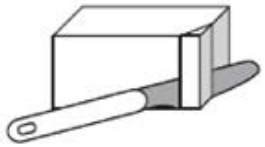
A triangular prism and a rectangular prism have been glued together.

How many faces does the new object have?

7 ○ 8 ○ 9 ○ 10 ○

Question 4

Freya cut a rectangular block of butter into 2 pieces.



How many faces does the larger piece have?

○ 5
○ 6
○ 7
○ 8
○ 10

Applying a single transformation to a shape

Background information/teaching focus
We can move things around in space by reflecting, translating and rotating. When a transformation is applied, some properties of the whole figure or object will be changed, other properties will remain unchanged. These three translations are grouped together because they each leave the shape and size of the object unchanged so that the original object and the transformed object are congruent.

Translation: When a figure or object is translated the whole thing **slides** a specified distance in a specified direction.
Rotation: When a figure is rotated the whole thing **turns** around a specified point by a specified amount. When an object is rotated the whole thing turns around a specified line by a specified amount.
Reflection: When a figure is reflected the whole thing **flips** over a line, so that every point of the image is as far from the line as was the matching point of the original figure. When an object is reflected, however, the idea of flipping does not really work. The object looks different in a mirror to what would happen if it was flipped over a line.

Students should learn to recognise and describe translations, rotations and reflections of shapes embedded in designs and arrangements. This might involve reproducing a design or picture by identifying and matching component shapes and turning or reorientating them to fit. Students should be encouraged to notice the balances, repetitions and movements in figures, objects and arrangements and talk about what they see. They should use the correct language in context, helping them to refine their descriptions of what they see.

The study of tessellations helps students learn about the properties of shapes and transformations.

For further related information see *First Steps in Mathematics: Space:*

- Chapter 5: Represent transformation
  - Key understanding 2: We can move things around in space by reflecting, translating and rotating. These do not change size or shape. p.114

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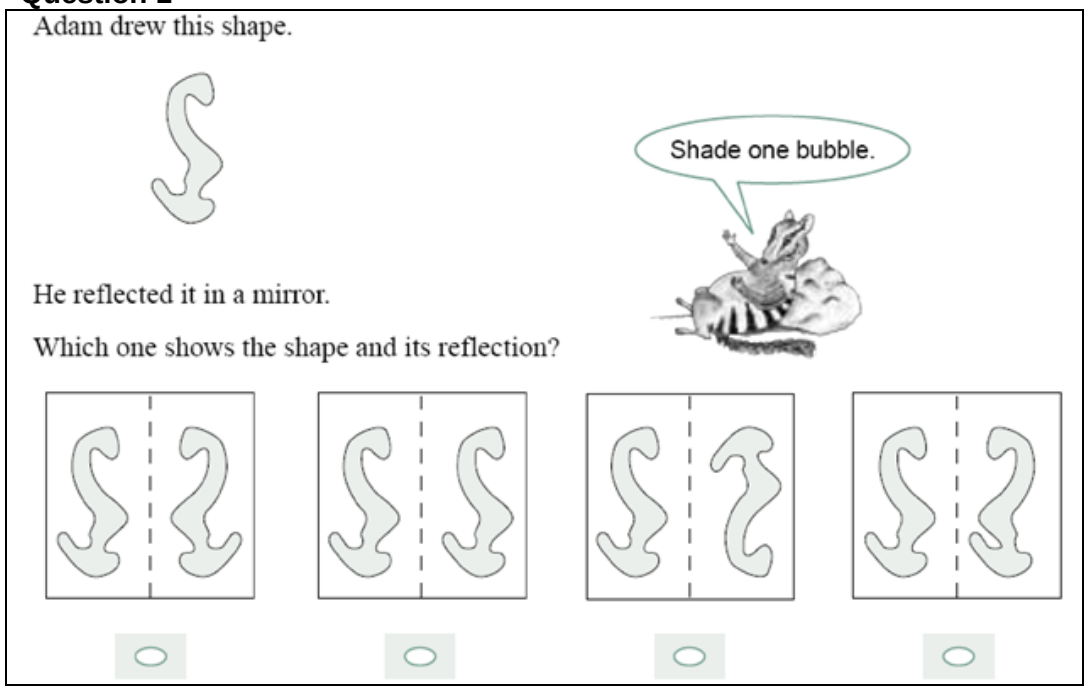
- Year 5 – Describe translations, reflections and rotations of two-dimensional shapes. Identify line and rotational symmetries (ACMMG114).
- Year 6 – Investigate combinations of translations, reflections and rotations, with and without the use of digital technologies (ACMMG142).
- Year 7 – Describe translations, reflections in an axis, and rotations of multiples of 90° on the Cartesian plane using coordinates. Identify line and rotational symmetries (ACMMG181).

For more information visit the Western Australian Curriculum.

Learning activities
For ideas for activities see *First Steps in Mathematics: Space:*

- Border pattern p.119
- Rotation p.119
- Transformation puzzle p. 120
- Tessellation p. 121

Question 1

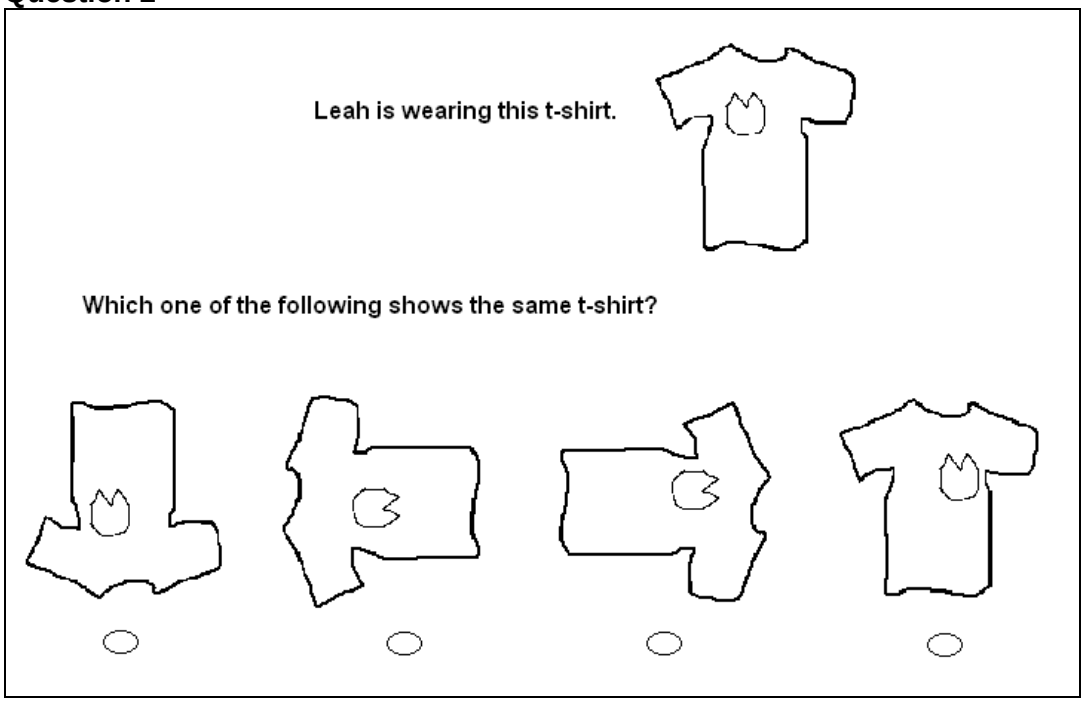


Skill: Students recognise a reflection of a shape.
Answer key: A

Additional questions

1. How do you know which shape was reflected?
2. Which option shows a translation, not a reflection?
3. Fold a piece of paper in half. Draw a shape on one side of the paper. Hold the paper against a window. Trace the shape's reflection. How do you know it is a true reflection?
4. Measure the distance of matching parts from the fold line. What do you notice?
5. Look at the third option. What transformation is shown there?

Question 2

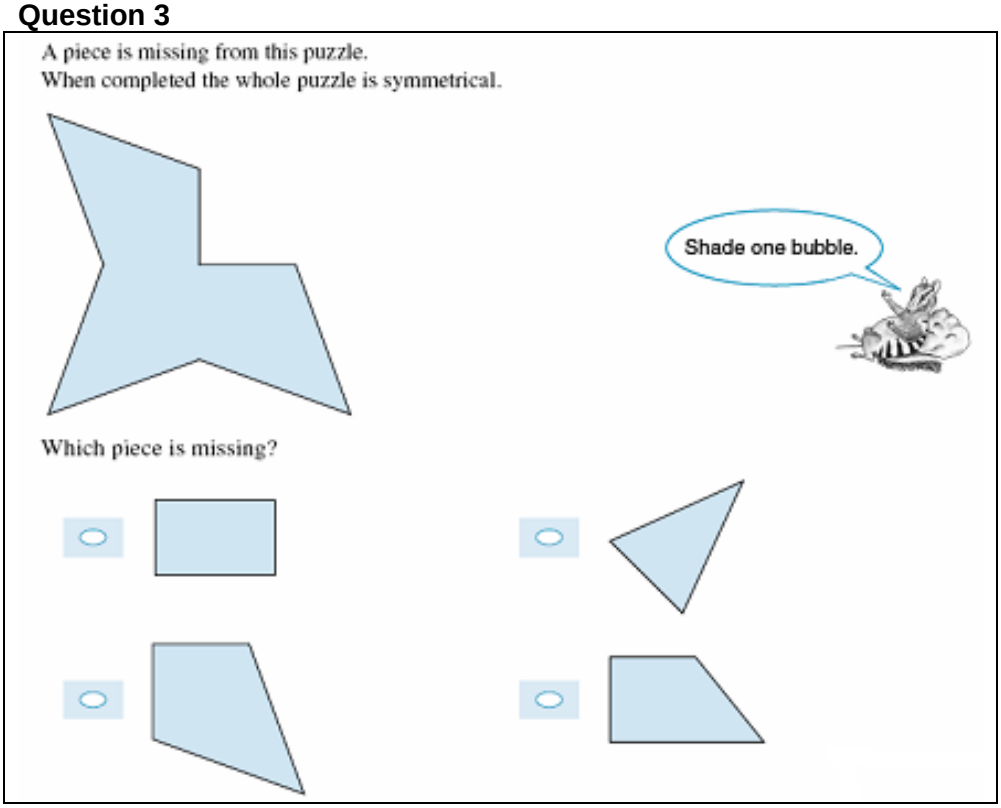


Skill: Students recognise a rotated image.
Answer key: C

Additional questions

1. What did you look at to work out which T-shirt logo matched?
2. Draw how the logo in the second option looks when the child is standing up.
3. Draw four pictures showing the position of the logo on Leah's shirt after four, quarter turn rotations.

Question 3



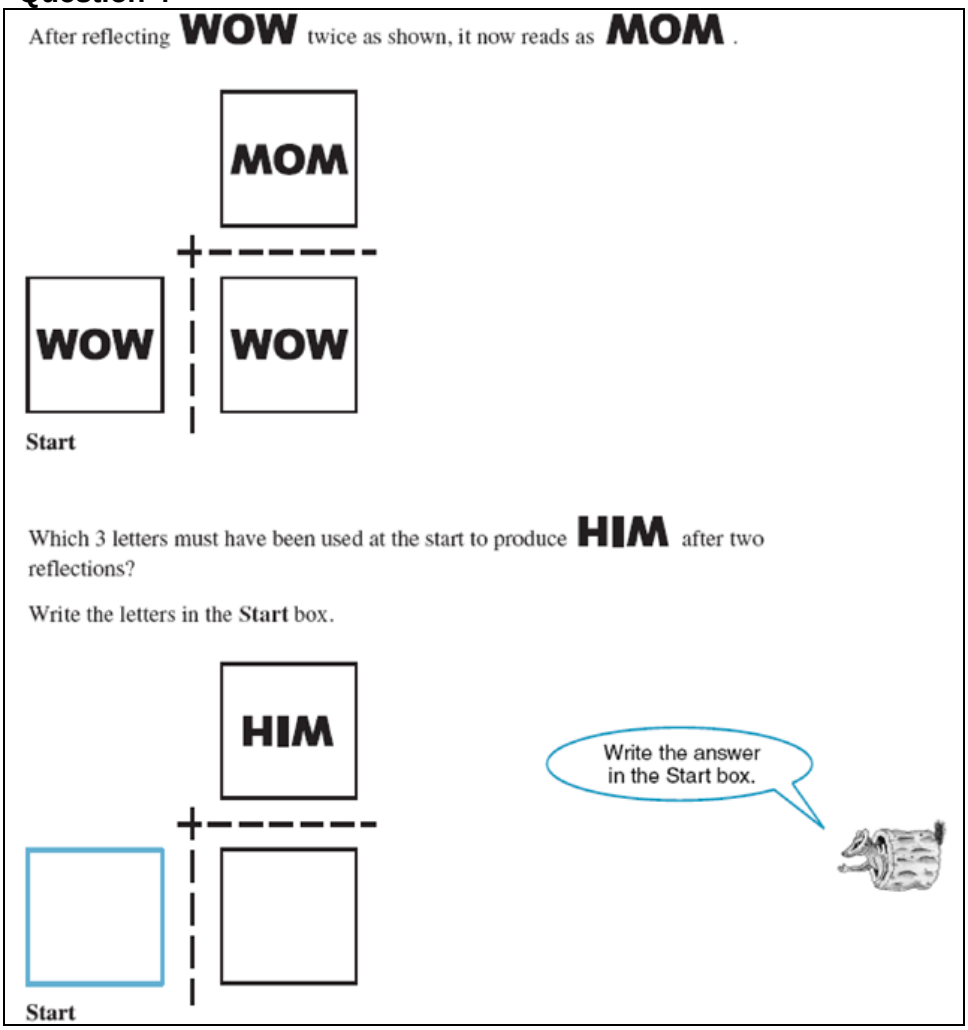
Skill: Students visualise transformations.

Answer key: 

Additional questions

1. How did you choose which piece was missing?
2. What movement did you visualise to imagine the shape in the correct place?
3. How do you know the shape is symmetrical?
4. How many different lines of symmetry are there in the final shape? How do you know?
5. Have students trace and cut out the shapes to physically move them around and try it out.

Question 4



Skill: Students perform consecutive reflections.

Answer: WIH

Additional questions

1. How did you work out what was in the Start box?
2. What are all the possible reflections of each letter?
3. What changes in a top to bottom, or bottom to top reflection?
4. What changes in a right to left, or left to right reflection?
5. What other letters could be reflected top to bottom **and** right to left and still make recognisable letters?

Curriculum references

Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Space:*

- Chapter 5: Represent transformations
  - Key understanding 1: We can imagine how a thing will look after we move all or part of it or change our view of it. p.102
  - Key understanding 2: We can move things around in space by reflecting, translating and rotating. These do not change size or shape. p.114
  - Key understanding 4: Symmetrical things have component parts which can be matched by rotating, reflecting or translating. p.140

Student worksheet

Focus

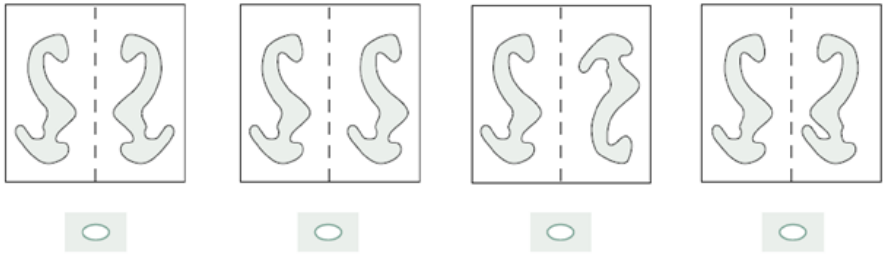
Applying a single transformation to a shape

Question 1

Adam drew this shape.

He reflected it in a mirror.

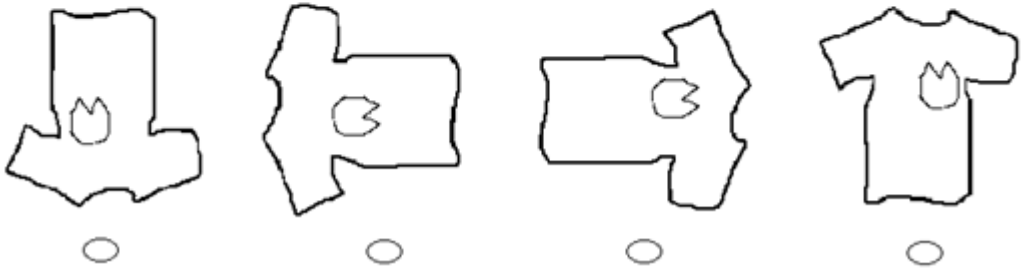
Which one shows the shape and its reflection?



Question 2

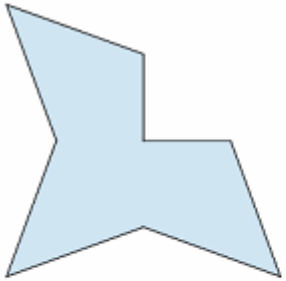
Leah is wearing this t-shirt.

Which one of the following shows the same t-shirt?

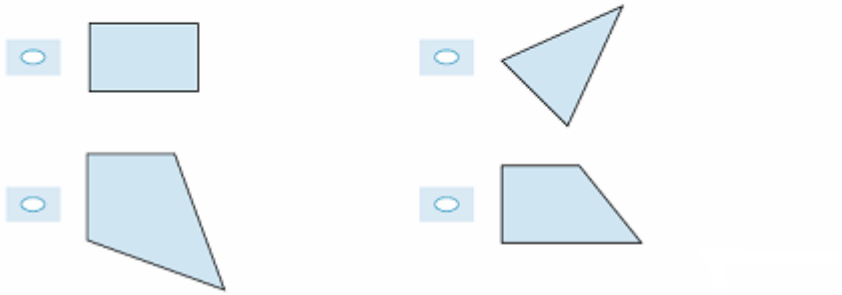


Question 3

A piece is missing from this puzzle.
When completed the whole puzzle is symmetrical.

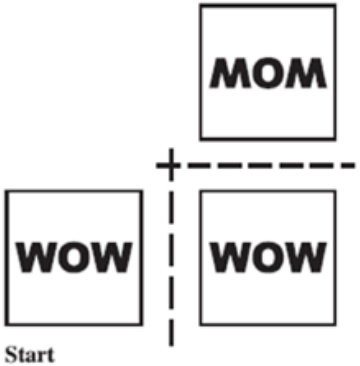


Which piece is missing?



Question 4

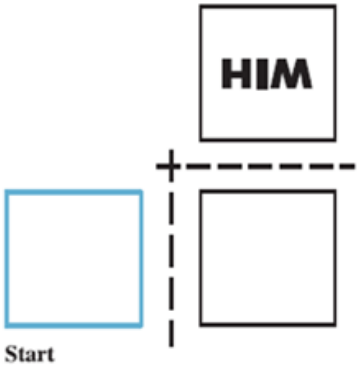
After reflecting **WOW** twice as shown, it now reads as **MOM** .



Start

Which 3 letters must have been used at the start to produce **HIM** after two reflections?

Write the letters in the **Start** box.



Start

Enlargement and reduction of 2D shapes and 3D objects

Background information/teaching focus

Some transformations, such as enlargement and reduction, change size but leave the shape unchanged. This type of transformation produces a scaled version of the original figure or object. All the angle sizes remain the same but the length of the sides are scaled either up or down.

Other transformations may distort both shape and size. Drawing on a rubber sheet and the stretching it produces its own transformation, generally called 'topological'. Such transformations preserve betweenness and order, but not distance or direction.
Students can use projected images, shadow shapes, computer graphics and grids to investigate a variety of transformations, thinking about which features are maintained and which are distorted. They should understand that there are many ways we transform figures and objects, for a variety of purposes.

For further related information see *First Steps in Mathematics: Space:*

- Chapter 5: Represent transformation
  - Key Understanding 3: Some transformations, such as enlargement, change size but leave shape unchanged. Others change shape and size. p.130

Rigby Harcourt Education, Australia

Western Australian Curriculum

- Year 5 – Apply the enlargement transformation to familiar two dimensional shapes and explore the properties of the resulting image compared with the original (ACMMG115).

For more information visit the Western Australian Curriculum.

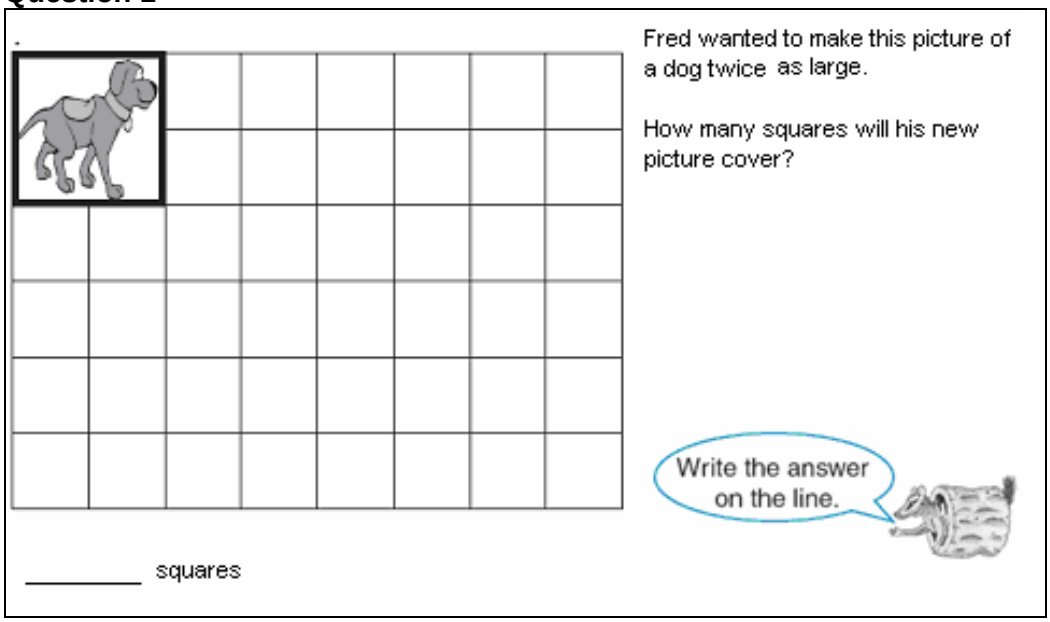
Learning activities

For ideas for activities see *First Steps in Mathematics: Space:*

- Photographs p. 134
- Enlarging a design p. 135
- Reductions p. 136
- Cartoon character p. 137

Revised October 2016

Question 1



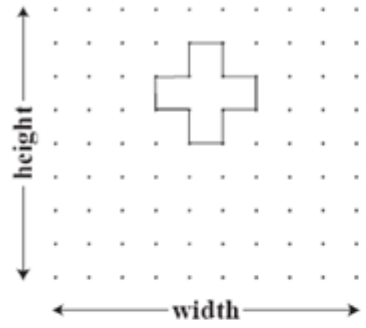
Skill: Students construct an enlargement of a simple shape.
Answer key: 16

Additional questions:

1. How did you work it out?
2. Can you enlarge the picture? Draw it onto the grid.
3. What stayed the same when the object was enlarged? What changed when the object was enlarged?
4. Draw a shape on grid paper. Reduce the height of the shape by half.
5. Investigate what happens to different objects when only **one** attribute (height or width) is made twice as big (or three times).

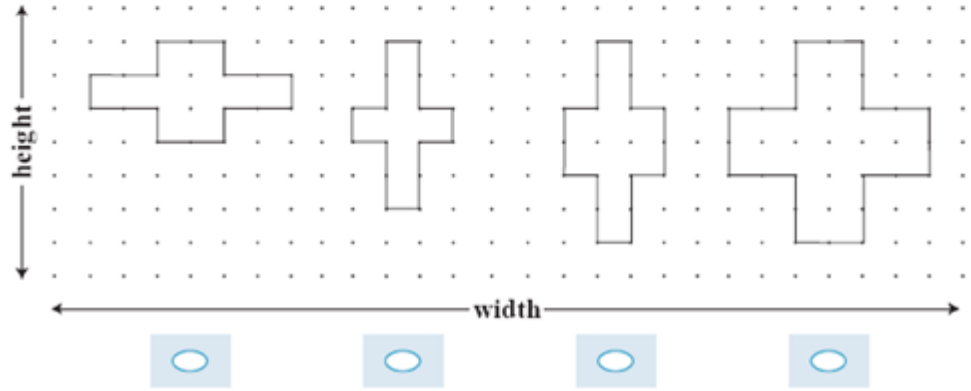
Question 2

Aaron drew this figure.



He then drew it again and doubled its height only.

Which figure shows this?

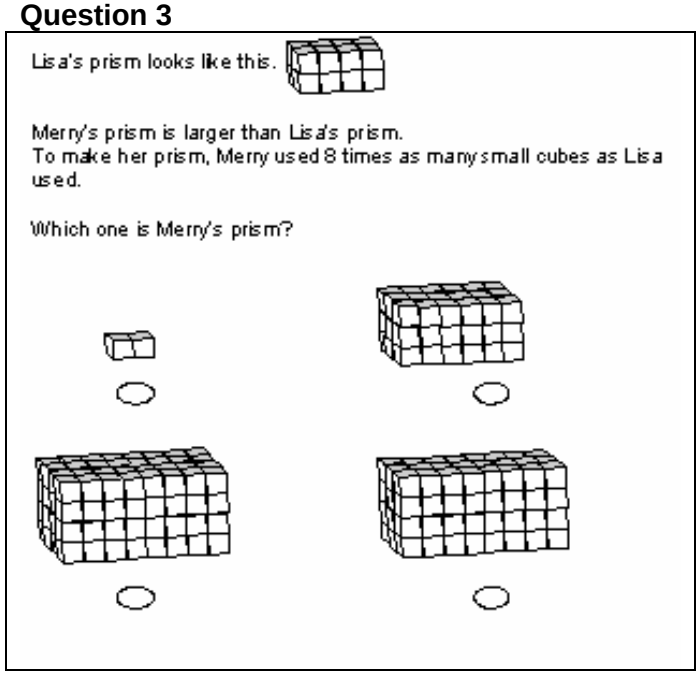


Skill: Students recognise enlargement on one dimension of a shape.
Answer key: C

Additional questions

1. How did you know which figure was double the height of the first?
2. Which figure is double the width of the first? How do you know?
3. Which figures are twice the area of the first figure?
4. Use square dot paper to draw figures that are twice the height and width of the other three figures.

Question 3

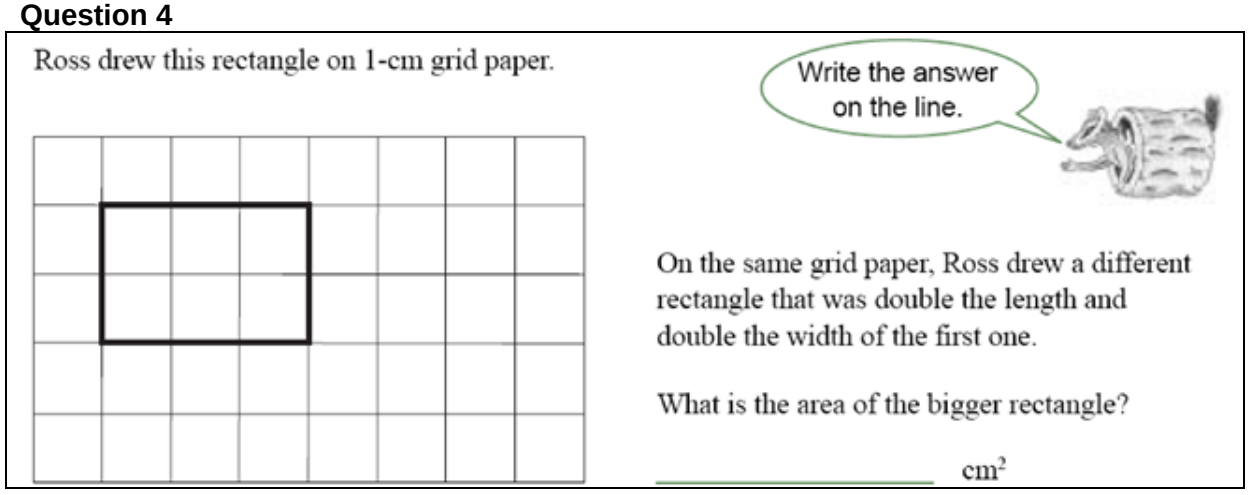


Skill: Students recognise the enlargement of a 3D object.
Answer key: C

Additional questions:

1. How did you choose the correct prism?
2. Lisa's prism is four cubes long. What will the length of Merry's prism be?
3. Lisa's prism is two cubes high. What is the height of Merry's prism?
4. How many small cubes did Merry use?

Question 4



Skill: Students solve an area problem involving enlargement of a 2D figure.
Answer key: 24 cm^2

Additional question:

1. What would be the area if the dimensions of the rectangle were tripled?
2. What would be the area if only the width was doubled?
3. If only the length was doubled, would the area be same or different than if only the width was doubled? How do you know?

Curriculum references
Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Measurement* (book two):

- Chapter 3: Indirect measure
  - Key understanding 3: Scale drawings and models have the same shape as the original object. This can be useful for comparing and calculating dimensions and for making judgements about position. p.44

Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Space*:

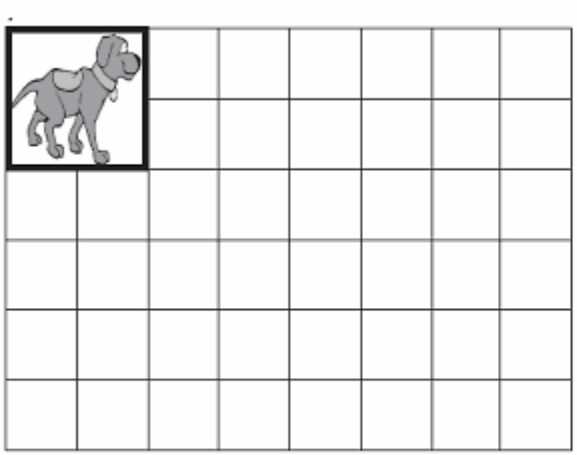
- Chapter 5: Represent transformation
  - Key understanding 3: Some transformations, such as enlargement, change size but leave shape unchanged. Others change shape and size. p.130

Student worksheet

Focus

Enlargement and reduction of 2D shapes and 3D objects

Question 1



Fred wanted to make this picture of a dog twice as large.

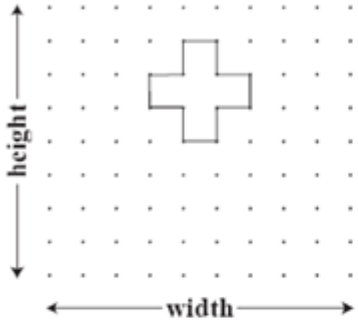
How many squares will his new picture cover?

Write the answer on the line.

_____ squares

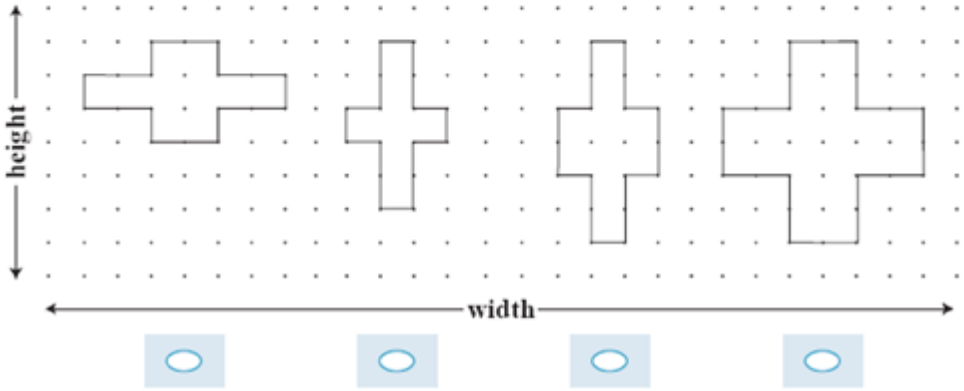
Question 2

Aaron drew this figure.



He then drew it again and doubled its height only.

Which figure shows this?

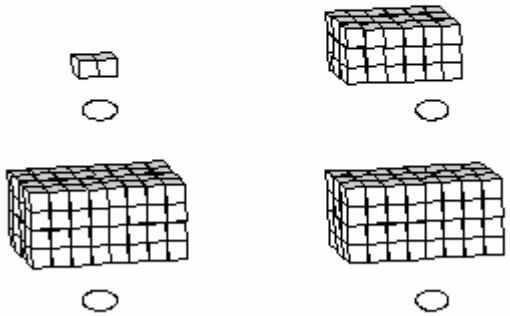


Question 3

Lisa's prism looks like this. 

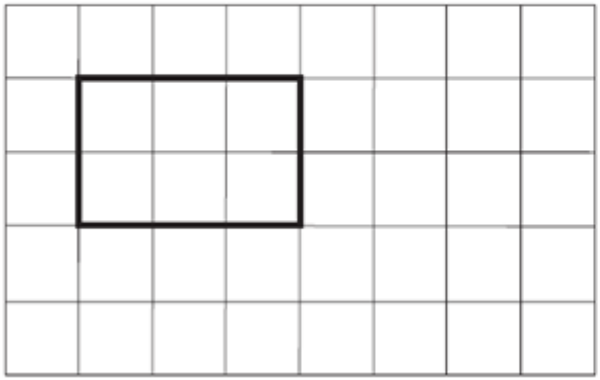
Merry's prism is larger than Lisa's prism.
To make her prism, Merry used 8 times as many small cubes as Lisa used.

Which one is Merry's prism?



Question 4

Ross drew this rectangle on 1-cm grid paper.



Write the answer on the line.

On the same grid paper, Ross drew a different rectangle that was double the length and double the width of the first one.

What is the area of the bigger rectangle?

_____ cm^2

Compass directions (north, north-east, east etc.)

Background information/teaching focus

Students should develop the basic concepts underlying the mathematical representation of arrangement and location by exploring and describing the layout and position of things in their environment and paths and movements within it. Their work with maps should begin with the layouts, paths and positions of things that are most familiar within their home communities and gradually expand to include those that are less familiar and more conventionally mathematical. They should use sketches of their locality or road maps to describe the position of local features, understand and use bearings to define direction and specify location by using simple coordinate grids and distances and directions. Students should learn to relate direction and angle of turning to compass directions and use a magnetic compass to determine simple directions.

For further related information see *First Steps in Mathematics: Space:*

- Chapter 3: Represent location
  - Key understanding 2: Some maps or diagrams show the order of things and what comes between what. Others also represent distances and directions between things. p.26

Western Australian Curriculum

- Year 4 – Use simple scales, legends and directions to interpret information contained in basic maps (ACMMG090).
- Year 5 – Use a grid reference system to describe locations. Describe routes using landmarks and directional language (ACMMG113).

For more information visit the Western Australian Curriculum.

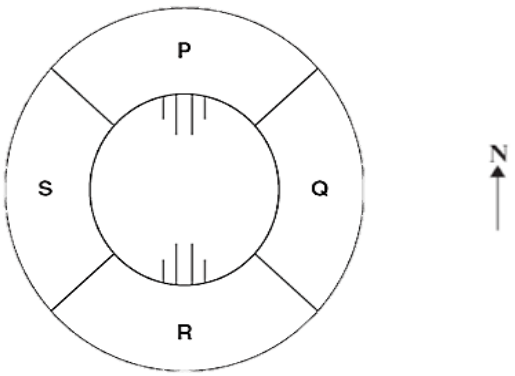
Learning activities

For ideas for activities see *First Steps in Mathematics: Space:*

- Scale map p. 31
- Local maps p. 32
- Fun run p. 33
- Orienteering p. 35

Question 1

Ben sits in the west section of the oval.



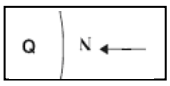
Ben is sitting in section

- P
- Q
- R
- S

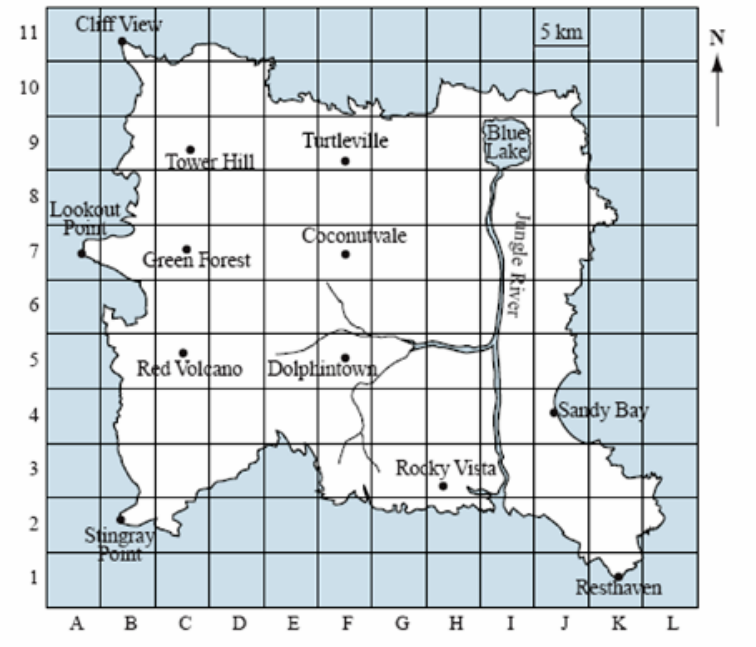
Skill: Students recognise west using a north compass direction
Answer key: S

Additional questions

1. How did you know which section was west?
2. Use compass directions to name the other three sections.
3. If the North arrow (N) was pointing towards the Q, which section would be south? Where would the other sections be?



Question 2



Mina is at Cliff View. What direction will she need to travel in to reach Coconutvale?

- south-east
- north-east
- south-west
- north-west

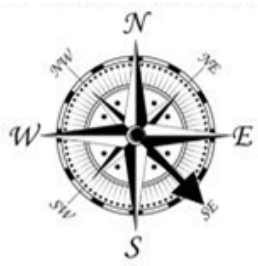
Skill: Students identify directions on a formal map.
Answer key: A

Additional questions

1. On the map only north is shown. How does this help you to find east, west and south?
2. How did you work out the direction needed to travel to Coconutvale?
3. What direction would she need to travel to reach Lookout point from Cliff View?
4. Provide a set of directions for a classmate to follow on the map?
5. If you travelled in a ship around the 'island', approximately how far would you travel if you did NOT travel into all the coves and beaches?

Question 3

The arrow is pointing south-east.



Jimmy turns the arrow a quarter turn clockwise.

Which direction is the arrow pointing after the turn?

south	south-east	south-west	north-east
⬭	⬭	⬭	⬭

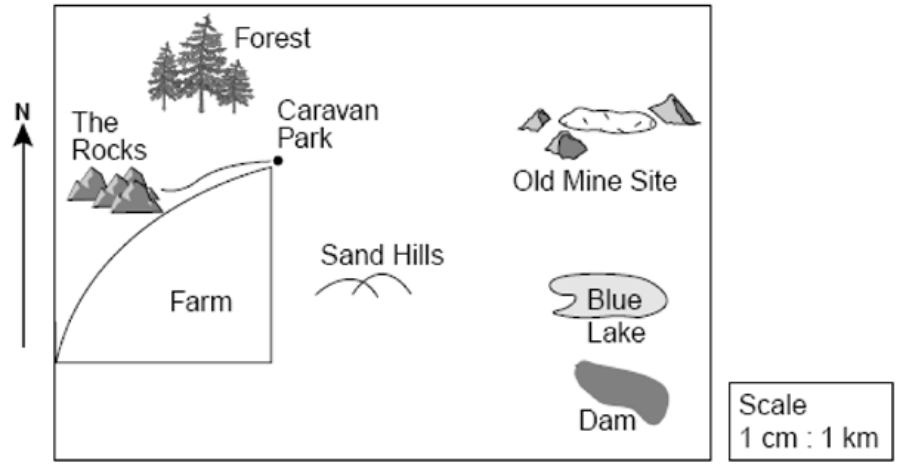
Skill: Students use compass directions and quarter turns to read directions.
Answer key: C

Additional questions

1. How did you know what was a quarter turn?
2. Where would it be pointing if you turned the arrow a half turn anticlockwise?
3. How far and in which direction would you move the arrow so that it points south?
4. Where will the arrow be pointing if you turned it clockwise by three–quarters of a turn, and then anticlockwise one–eighth of a turn?

Question 4

Holly used this map for bush walking.



Holly walked east from the caravan park for about 2 km.

She turned south and walked another 2 km.

She turned west and walked for another 3 km.

Where would Holly be now?

farm	Sand Hill	forest	Blue Lake
⬭	⬭	⬭	⬭

Skill: Students follow compass directions on a map using a simple scale.
Answer key: A

Additional questions

1. What did you look at to find out in which direction to travel?
2. What if Holly started at the Old Mine Site and followed the same directions? How do you know where she will end up? Why don't you have to try it out?
3. Provide instructions for travelling from the forest to the dam, passing through the farm.
4. Practice giving directions to a partner then check if they follow them correctly.

Curriculum references

Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Space:*

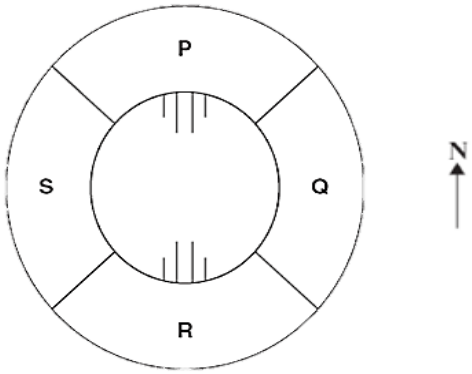
- Chapter 3: Represent location
  - Key understanding 1: We describe where things are in relation to other things. There are special words, phrases and symbols that help us with this. p.12
  - Key understanding 2: Some maps or diagrams show the order of things and what comes between what. Others also represent distances and directions between things. p.38

Student worksheet

Focus
Compass directions (north, north-east, east etc.)

Question 1

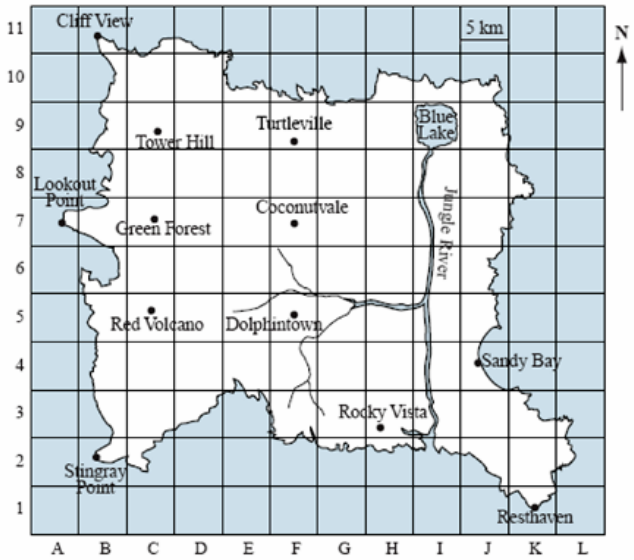
Ben sits in the west section of the oval.



Ben is sitting in section

- P
- Q
- R
- S

Question 2

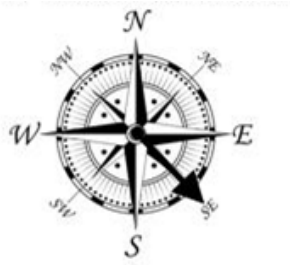


Mina is at Cliff View. What direction will she need to travel in to reach Coconutvale?

- south-east
- north-east
- south-west
- north-west

Question 3

The arrow is pointing south-east.



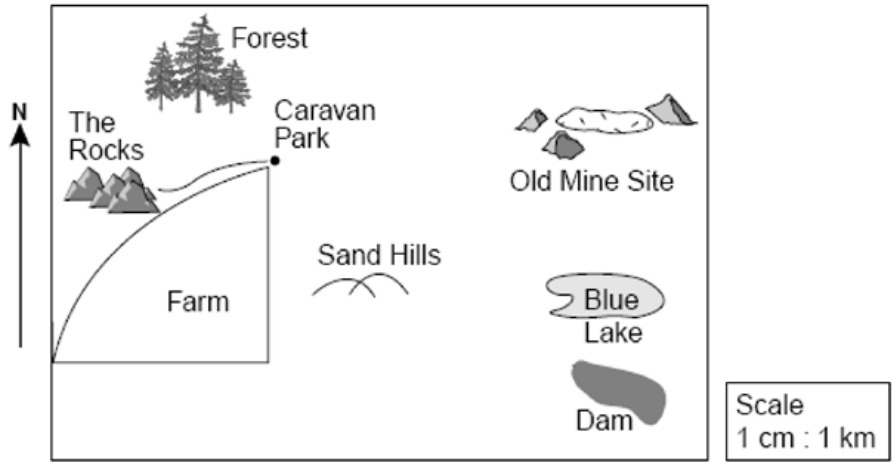
Jimmy turns the arrow a quarter turn clockwise.

Which direction is the arrow pointing after the turn?

south	south-east	south-west	north-east
⬭	⬭	⬭	⬭

Question 4

Holly used this map for bush walking.



Holly walked east from the caravan park for about 2 km.

She turned south and walked another 2 km.

She turned west and walked for another 3 km.

Where would Holly be now?

farm	Sand Hill	forest	Blue Lake
⬭	⬭	⬭	⬭

Interpreting simple scales on grids and maps

Background information/teaching focus

Scale maps use a scale to represent the distance and direction between objects. This scale may be measured precisely or estimated. The positions of objects on the map or plan replicate their position in real life. On plans, the objects themselves are also drawn to the same scale. Scale maps, however, are normally of much larger areas, so a smaller scale is needed to represent the distances between objects. For this reason, the objects themselves cannot be drawn to the same scale and may be represented using a different scale, (eg the roads in street directories) or by symbols.

Scale maps:

- Key features within certain boundaries are represented (mainly with symbols).
- Distances between objects are drawn to scale.
- Positions of objects are a bird's eye view.

Plans:

- Key features within certain boundaries are drawn to scale.
- Distances between objects are drawn to scale.
- Positions of objects are a bird's eye view, showing orientation.

For further related information see *First Steps in Mathematics: Space:*

- Chapter 3: Represent location
  - Background notes – maps and plans

Western Australian Curriculum

- Year 3 – Create and interpret simple grid maps to show position and pathways (ACMMG065).
- Year 4 – Use simple scales, legends and directions to interpret information contained in basic maps (ACMMG090).
- Year 5 – Use a grid reference system to describe locations. Describe routes using landmarks and directional language (ACMMG113).

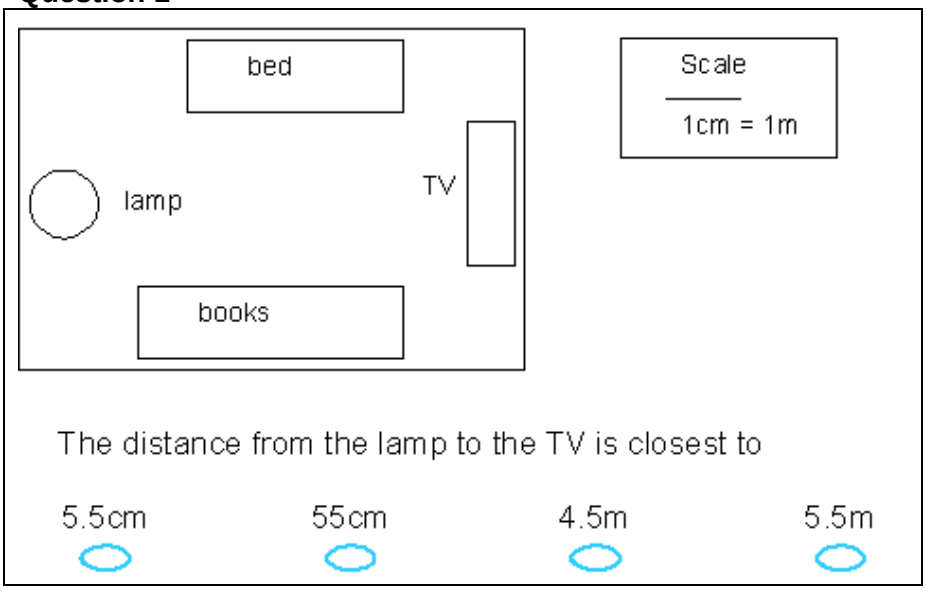
For more information visit the Western Australian Curriculum.

Learning experiences and activities

For ideas for activities see *First Steps in Mathematics: Space*:

- Classroom plans p. 43
- Aerial view p. 43
- Ideal playgrounds p. 45

Question 1

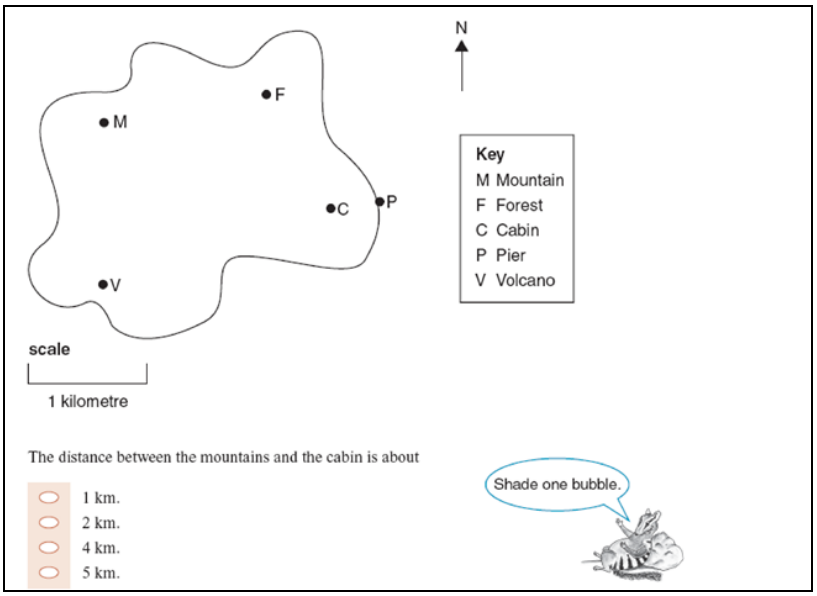


Skill: Students use a simple one-to-one unit scale to estimate distance on a plan.
Answer key: D

Additional questions

1. Explain how you used the scale.
2. What are the dimensions of the room?
3. Calculate the perimeter of the room.
4. If you were to purchase carpet by the square metre, how much would you need?

Question 2



Skill: Students estimate distance on a plan given a physical scale.
Answer key: B

Additional questions

1. How can you compare the kilometre distance given in the scale to the distance between the mountain and the cabin?
2. What is the approximate distance from the cabin to the forest?
3. What is the distance between the cabin and pier?
4. How did you work it out?

Question 3

If the two towns marked on the map are 3.5 cm apart, the real distance between them is

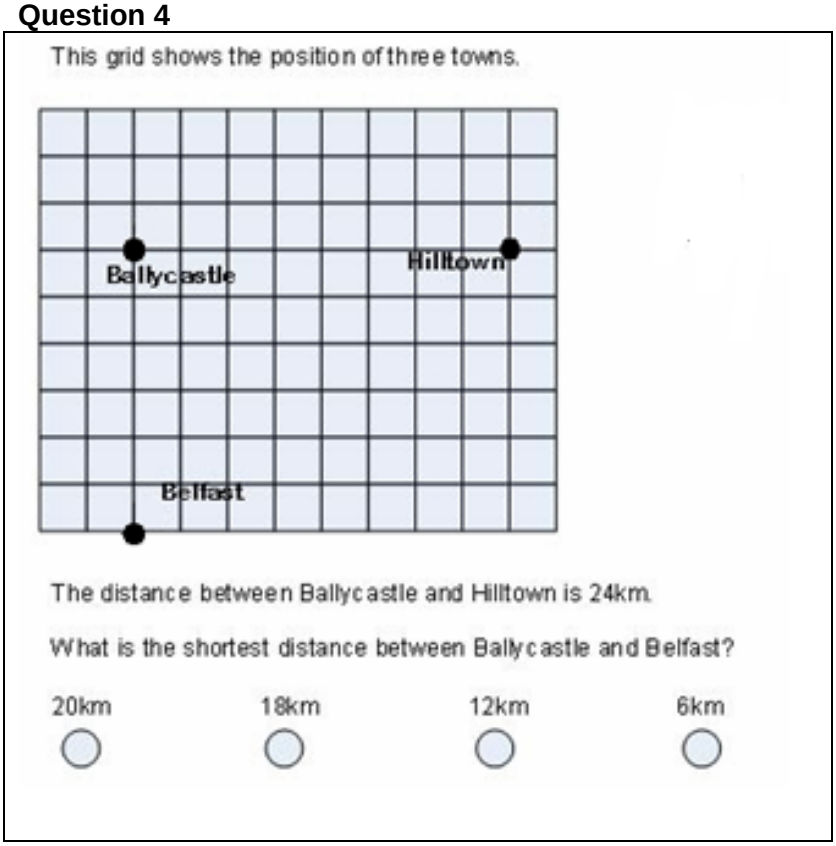
- ⬭ 35 km
- ⬭ 3.5 km
- ⬭ 0.35 km
- ⬭ 350 km

Skill: Students use a simple one-to-ten unit scale to estimate distance on a map.
Answer key: A

Additional questions

1. How did you calculate the real distance between the towns?
2. What would the distance on the map be, if the real distance was 100 km? How did you calculate that?
3. Draw a line on the map that would represent 5 km?
4. Approximately how many square kilometres does the map cover? How do you know?

Question 4



Skill: Students find the scale given a grid and the actual distance.
Answer key: B

Additional questions:

1. How many kilometres is one grid unit? How do you know?
2. How could you work out the distance from Belfast to Hilltown?
3. Why can't you use the diagonals as scale units?
4. What is the distance right around the outside of the grid?
5. How did you work it out?

Curriculum references

Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Space:*

- Chapter 3: Represent location
  - Key understanding 2: Some maps or diagrams show the order of things and what comes between what. Others also represent distances and directions between things. p.26
  - Key understanding 3: Plans show the placement and relative size of things from a top view. p.38

Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Measurement* (book two)*:*

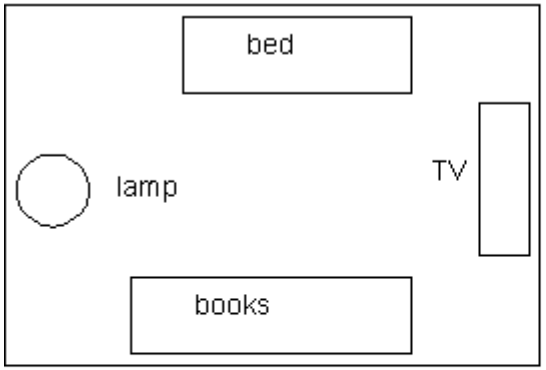
- Chapter 3: Indirect measure
  - Key understanding 3: Scale drawings and models have the same shape as the original object. This can be useful for comparing and calculating dimensions and for making judgements about position. p.44

Student worksheet

Focus

Interpreting simple scales on grids and maps

Question 1



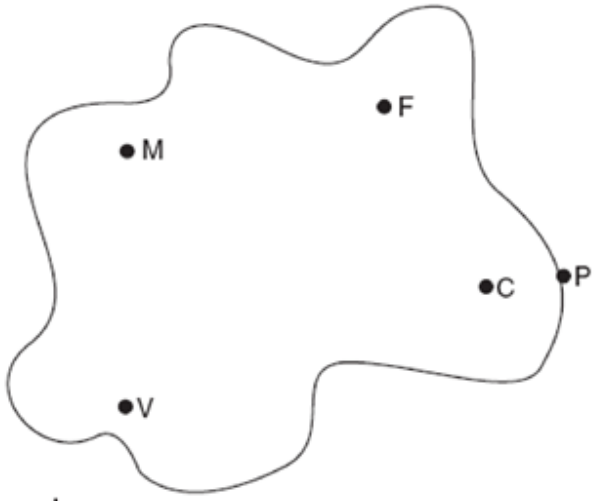
Scale

1cm = 1m

The distance from the lamp to the TV is closest to

5.5cm 55cm 4.5m 5.5m

Question 2



N

Key
M Mountain
F Forest
C Cabin
P Pier
V Volcano

scale

1 kilometre

The distance between the mountains and the cabin is about

- 1 km.
- 2 km.
- 4 km.
- 5 km.

Shade one bubble.

Revised October 2016

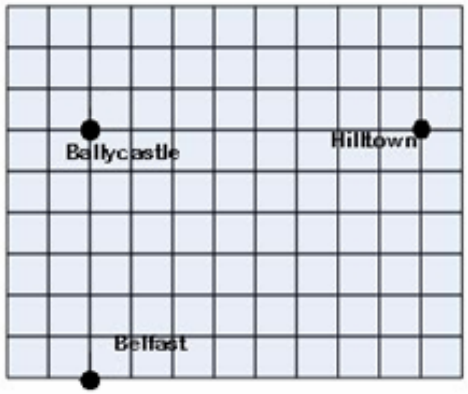
Question 3

If the two towns marked on the map are 3.5 cm apart, the real distance between them is

- ○ 35 km
- ○ 3.5 km
- ○ 0.35 km
- ○ 350 km

Question 4

This grid shows the position of three towns.



The distance between Ballycastle and Hilltown is 24km.

What is the shortest distance between Ballycastle and Belfast?

20km ○ 18km ○ 12km ○ 6km ○

Interpreting coordinates and directions

Background information/teaching focus

Grids and coordinates provide the major mathematical contribution to representing location and direction, the essential idea being that we can use numbers (usually pairs of numbers) to describe where something is. Often students' experience with locating things on grids involves focusing on the squares where rows and columns intersect. In order to take advantage of the numerical dimensions of a coordinate system (for distances to make sense), students need to be able to focus upon points as the intersection of two grid lines. The mathematical convention when referring to the coordinates is to go across (the x coordinate) first and then up (the Y coordinate). The reference relates to the crossing points of the gridlines or the corners of the squares on the grid.

For further related information see *First Steps in Mathematics: Space:*

- Chapter 3: Represent location
  - Key understanding 1: We describe where things are in relation to other things. There are special words, phrases and symbols that help us with this p. 12.
  - Did you know?: Grid references p. 22

Rigby Harcourt Education, Australia

Western Australian Curriculum

- Year 4 – Use simple scales, legends and directions to interpret information contained in basic maps (ACMMG090).
- Year 5 – Use a grid reference system to describe locations. Describe routes using landmarks and directional language (ACMMG113).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

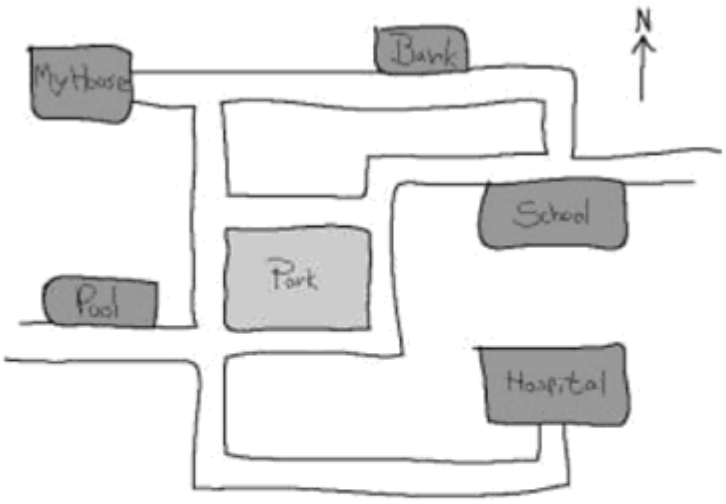
For ideas for activities see *First Steps in Mathematics: Space*:

- Mystery object p. 17
- Show time p. 17
- Battleships p. 18
- Grid picture p. 18

Revised October 2016

Question 1

Toby drew a map of the roads near his house and school.



From Toby's house, which direction is the Bank?

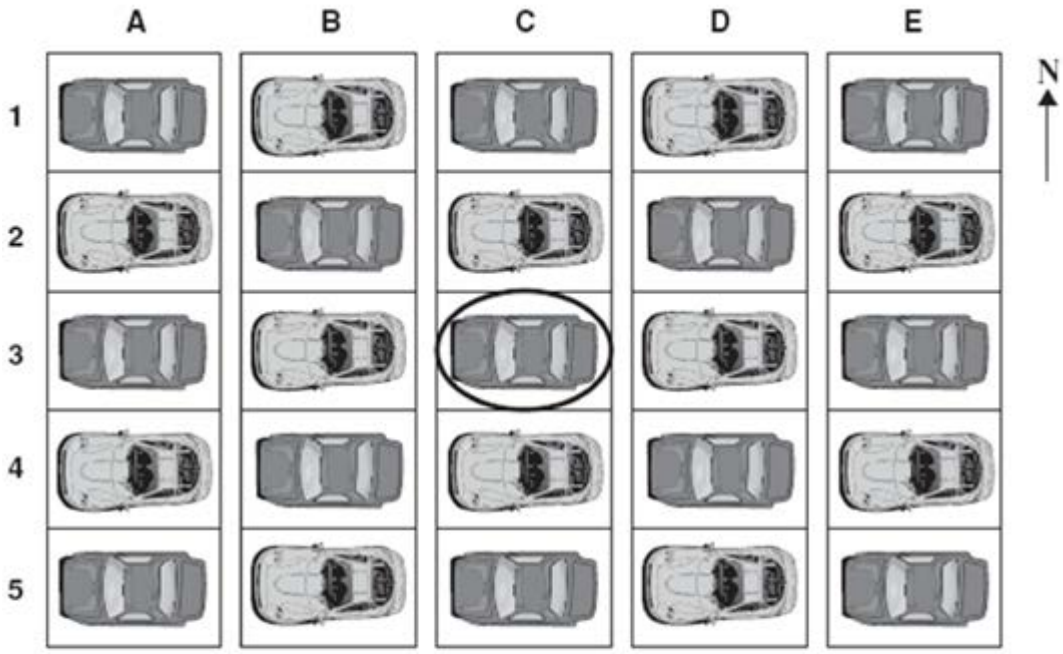
- ❍ North
- ❍ South
- ❍ East
- ❍ West

Skill: Students read an informal map.
Answer key: C

Additional questions

1. Toby walked east from his house to the first intersection. He then walked south to the first intersection. What is he next to?
2. Describe how Toby would travel to get from his house to school going past the park.
3. Describe how Toby would travel to get from school to the hospital by the shortest route.

Question 2



Emma's car is circled.

Jade's car is two cars south and one car west of Emma's car.

Jade's car is at

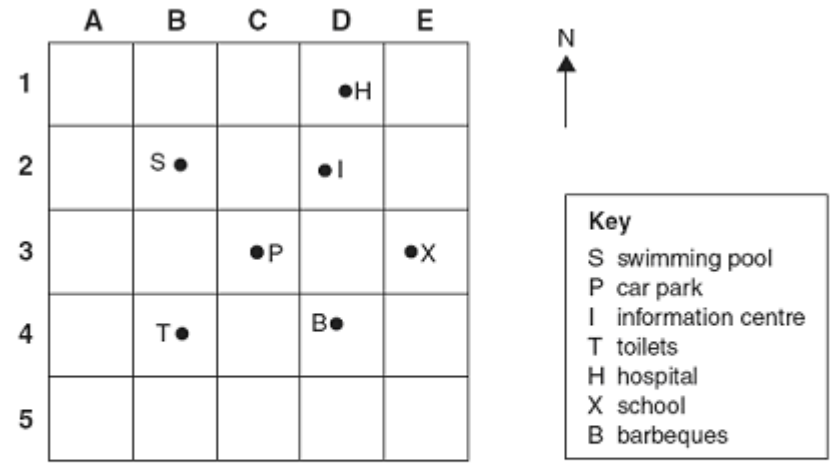
- ○ B1.
- ○ B5.
- ○ D1.
- ○ D5.

Skill: Students interpret and follow directional language.
Answer key: B

Additional questions

1. Bill's car is at A4. How would you get from Bill's car to Emma's car?
2. How would you get from Jade's car to Bill's car?
3. Craig's car is four cars east and two cars north of Bill's. Where is Craig's car?

Question 3



1. What is the grid reference for the toilets?_____
2. What is the grid reference for the hospital? _____
3. What is located at grid reference B2? _____
4. What is located at grid refernce E3_____

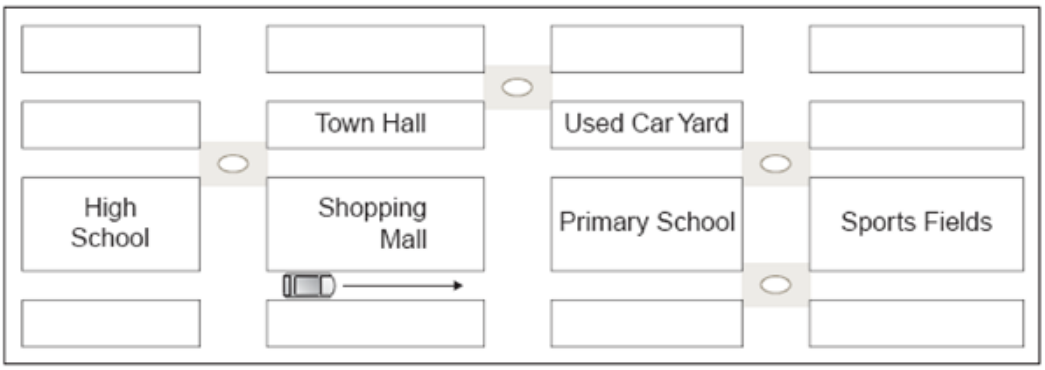
Skill: Students interpret a key and find a grid reference.
Answer key: B4; D1, swimming pool, school

Additional questions

1. What is the grid reference for the information centre?
2. Describe how to get from the hospital to the car park?
3. What is located two places east, then two places south of the swimming pool? What are it's coordinates?

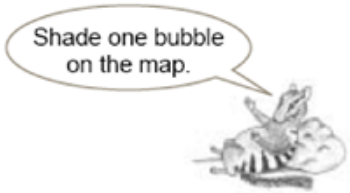
Question 4

This is a map of Westown.



Miss Tam is in the car near the Shopping Mall. She is travelling in the direction of the arrow.
At the next intersection she turns left. She continues for one block.
She then turns right and continues for another block, and then her car breaks down.

Shade the bubble on the map to show where Miss Tam's car broke down.



Skill: Students interpret and follow directions.
Answer key: She is at the intersection bounded by the used car yard, the primary school, the sports field and the unlabelled block.

Additional question

1. Describe another journey Miss Tam could take so that a friend can follow your directions and say where she finishes her journey. Remember to say where Miss Tam is starting from and use the north, south, east or west to indicate where she travels. When you have finished ask someone else to follow your directions and see if they end up at the intended location.

Curriculum references

Department of Education and Training Western Australia 2005, *First Steps in Mathematics: Space:*

- Chapter 3: Represent location
  - Key understanding 1: We describe where things are in relation to other things. There are special words, phrases and symbols that help us with this. p.12
  - Key understanding 2: Some maps or diagrams show the order of things and what comes between what. Others also represent distances and directions between things. p.26

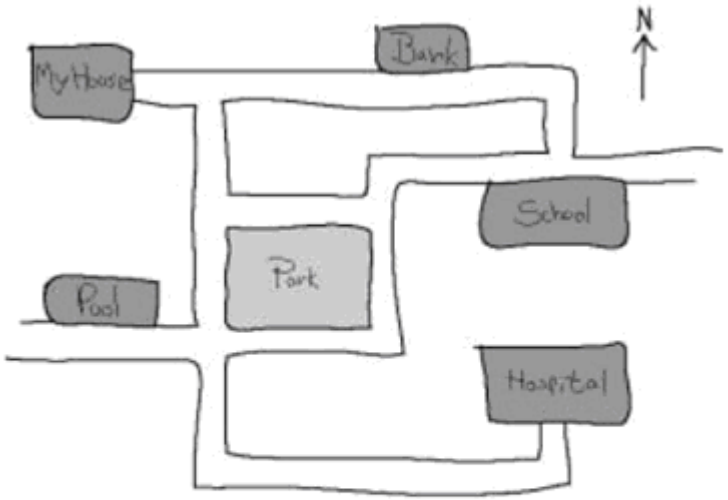
Student worksheet

Focus

Location and transformation

Question 1

Toby drew a map of the roads near his house and school.

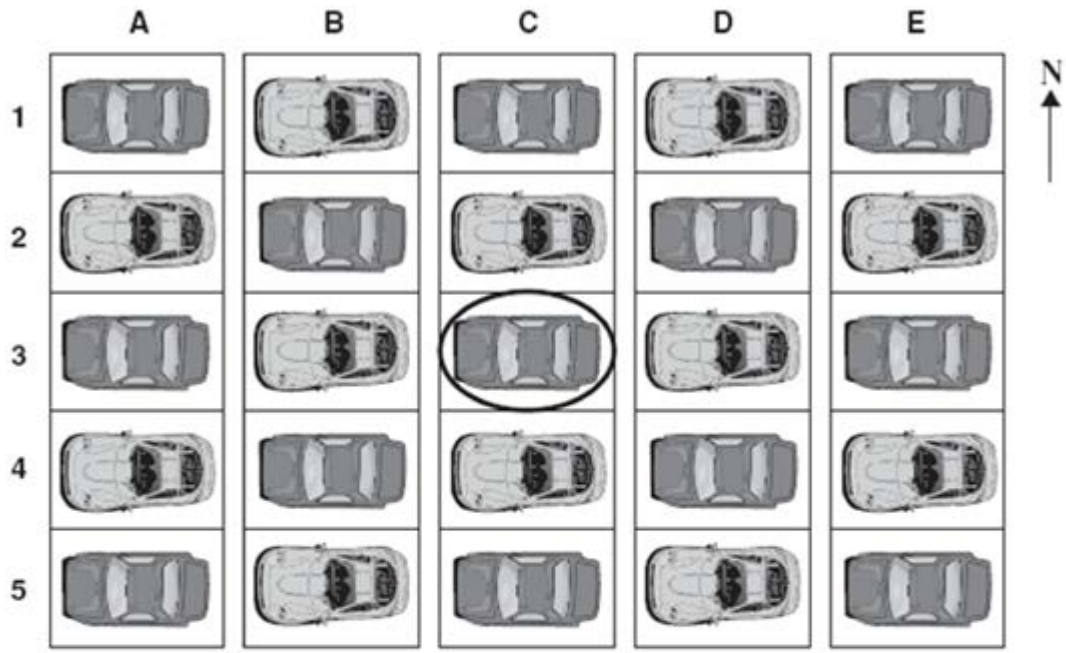


From Toby's house, which direction is the Bank?

- ❍ North
- ❍ South
- ❍ East
- ❍ West

Shade one bubble.

Question 2



Emma's car is circled.

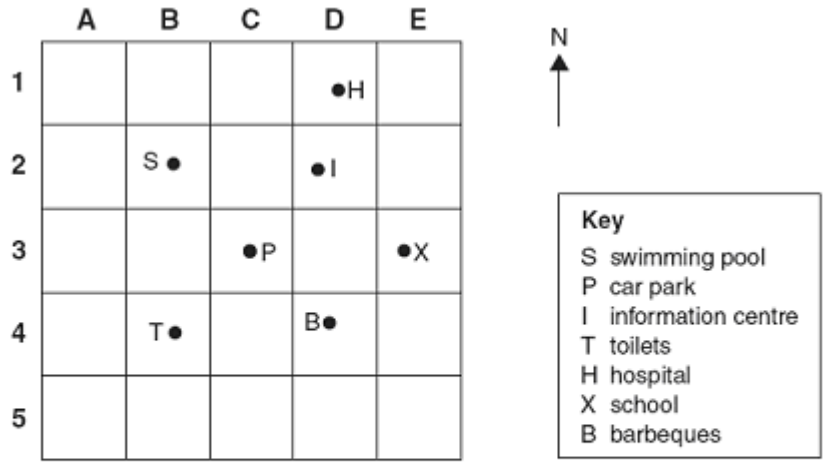
Jade's car is two cars south and one car west of Emma's car.

Jade's car is at

- ⬭ B1.
- ⬭ B5.
- ⬭ D1.
- ⬭ D5.

Shade one bubble.

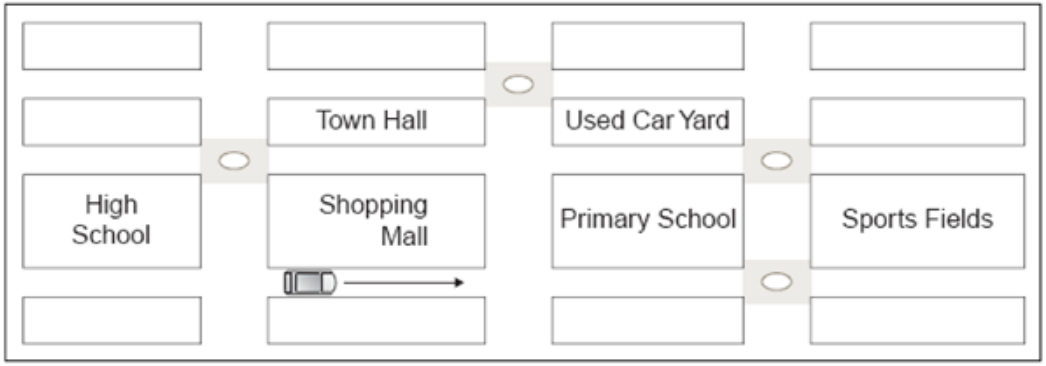
Question 3



1. What is the grid reference for the toilets?_____
2. What is the grid reference for the hospital? _____
3. What is located at grid reference B2? _____
4. What is located at grid refernce E3_____

Question 4

This is a map of Westown.



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