

Unit 10
Shape and Space;
Position, movement and scales, and solve problems
Year 6
Autumn term

Five daily lessons

**National
Numeracy Strategy**

Unit Objectives
Year 6

Read and plot co-ordinates in all four quadrants.

Recognise where a shape will be after two translations.

Identify and use appropriate operations (including combinations of operations) **to solve word problems involving numbers and quantities** based on 'real life' or measures (including time), using one or more steps.

Choose and use appropriate number operations to solve problems and appropriate ways of calculating (mental, mental with jottings, written methods, calculator). **Explain methods and reasoning.**

Record estimates and readings from scales to a suitable degree of accuracy.

Know imperial units, know rough equivalents of lb and kg, oz and g, miles and km, litres and pints or gallons.

Page 109

Page 107

Pages 83-89

Page 75

Page 95

Page 91

This Unit Plan is designed to guide your teaching.

You will need to adapt it to meet the needs of your class.

Resources needed to teach this unit:

- Resource sheet 10.1 / OHT 10.6
- OHT 10.1
- OHT 10.2a
- OHT 10.2b
- OHT 10.3
- OHT 10.4
- OHT 10.5
- OHT 10.6
- OHT 10.7
- OHT 10.8
- OHT 10.9
- Counting stick
- Squared paper
- Calculators
- Rulers with cm and mm
- Tape measures with cm and inches
- Whiteboards
- Related Key Stage 2 national test questions

Year 5 **Link Objectives** **Year 7**

Read and plot co-ordinates in the first quadrant.

Recognise where a shape will be after a translation.

Use all four operations to solve simple word problems involving numbers and quantities.

Choose and use appropriate number operations to solve problems, and appropriate ways of calculating (mental, mental with jottings, written methods, calculator).

Use conventions and notation for 2-D co-ordinates in all four quadrants; find co-ordinates of points determined by geometric information.

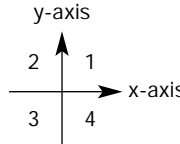
Recognise and visualise the transformation and symmetry of a 2-D shape translation.

Choose and justify the use of an appropriate and efficient method for solving problems.

Solve problems and puzzles in a variety of contexts.

(Key objectives in bold)

department for
education and skills

Planning sheet	Day One	Unit 10 <i>Shape and Space; Position, movement and scales, and solve problems</i>	Term: <i>Autumn</i>	Year Group: 6	
Oral and Mental		Main Teaching		Plenary	
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities / Focus Questions	
Order a set of positive and negative integers. <div>VOCABULARY positive negative</div> <div>RESOURCES Counting stick</div>	<ul style="list-style-type: none">Hold a counting stick horizontally and count from negative five through zero to positive five in steps of one. Remind the children of the symmetry involved. Ask them to identify the biggest number on the stick and the smallest. Quickly point to various divisions on the stick asking which numbers lie there. (It is helpful to keep your thumb on zero.)Repeat holding the counting stick vertically so that negative five is at the bottom.Explain that the stick now represents the range –25 to 25. Repeat the counting activity from –25 to 25 in steps of 5, first with the counting stick horizontally and then with the counting stick vertically.Remind the children that so far the zero has been in the middle. Ask them to identify the zero on the stick for different ranges of numbers, e.g. –10 to 40, –40 to 10, –20 to 30, –30 to 20, –15 to 35 etc. For each range get the children to identify the step size for the divisions and as a whole class count forwards and backwards to confirm this and the position of zero.	Read and plot co-ordinates in all four quadrants. <div>VOCABULARY quadrant x-axis y-axis origin vertex vertices</div> <div>RESOURCES OHT 10.1 Squared paper</div>	<ul style="list-style-type: none">Show the first quadrant on OHT 10.1 (cover the other 3 quadrants). Remind children that both axes begin at zero and identify the x-axis and the y-axis. Say that if they forget, it might help to remember that the x-axis goes across. Mark a point on the grid.<div>Q What are the co-ordinates of this point? Discuss and remind children about the notation, e.g. (3, 2). Q If I move the cross 2 squares down what will the co-ordinates be? Record the co-ordinates on the board. Q What if I move it 5 squares down? Establish that the cross would be off the grid.</div>Uncover the other 3 quadrants. Refer to the use of negative numbers on the stick in the oral/mental session. Explain that this is like two counting sticks crossing at zero which form four sections, or quarters. Say that these are called quadrants.Plot points in each quadrant of the grid, stress the (x, y) convention. Say that if they forget which comes first, it may help to remember that x comes before y in the alphabet and so they should read along the x-axis first. Label each quadrant (first, second, third and fourth) pointing out that the order is anti-clockwise around the origin (0, 0).	<ul style="list-style-type: none">Draw the diagram:<div></div><div>The Four Quadrants</div> Ask the children to give you instructions to plot (2, 5), (–2, 5), (–2, –5) and (2, –5), start from (0, 0) each time. Ensure that they are confident with this.Tell the children to draw axes (each from –10 to 10) on the squared paper and plot the following co-ordinates (–1, 1), (2, 5) and (5, 2). Tell the children that these are 3 of the 4 vertices of a square. Ask them to plot the fourth vertex and check this with a partner.Give the children other groups of co-ordinates to plot which are vertices of triangles and different quadrilaterals e.g. parallelogram. Get the children to identify and plot the missing vertices. Explain that there may be more than one answer if only two vertices are given. Collect children's results and correct any mistakes and misunderstandings.<div>Q A square has vertices at (–1, 0) and (1, –2). What are the positions of the other two vertices? On the board or OHT show the 3 possible squares that have vertices at (–1, 0) and (1, –2).</div>	<ul style="list-style-type: none">Write (4, 2), (8, 2), (–2, 4), (–2, 8) on the board. Explain that these should be the vertices of a square. Plot the points on OHT 10.1. Ask the children to suggest where mistakes have been made in the co-ordinate notation.<div>Q What must we remember when we plot co-ordinates?</div> Establish that the first number in a pair of co-ordinates always refers to the x-axis, the second to the y-axis. HOMEWORK – Give the children squared paper on which to plot points that make up 4 different shapes. For each shape the children are to name the shape. Shape 1 – (–4, 6), (–3, 10), (5, 8), (4, 4), Shape 2 – (–8, –4), (–8, 1), (–5, 4), (0, 4), Shape 3 – (–5, –5), (–2, 1), (–2, –8), (–1, 0), Shape 4 – (2, 4), (9, 1), (4, –3).<div>By the end of the lesson children should be able to:<ul style="list-style-type: none">Read and plot points beyond the first quadrant;Identify the co-ordinates of the 4th vertex of a square.(Refer to supplement of examples, section 6, page 109.)</div>

Planning sheet	Day Two	Unit 10 <i>Shape and Space: Position, movement and scales, and solve problems</i>	Term: <i>Autumn</i>	Year Group: 6
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities / Focus Questions
<p>Read and plot co-ordinates in all four quadrants.</p> <p>VOCABULARY parallel intercept</p> <p>RESOURCES OHT 10.1</p>	<ul style="list-style-type: none"> Ask the children to give you quickly the pairs of numbers which total 5. As they give these to you, write them in this order: $5 + 0$ $4 + 1$ $3 + 2 \dots$ so that they can see the pattern. Ask what pair would come next in the pattern after $0 + 5$, i.e. $-1 + 6$, $-2 + 7 \dots$ Using OHT 10.1 ask children to come up and plot the points represented by these pairs as co-ordinates, i.e. $(5, 0)$, $(4, 1) \dots (-1, 6)$, $(-2, 7) \dots$ <div>Q What do you notice about the position of the points?</div> <p>Discuss and establish that they lie on a straight line.</p> <p>Join the points up with a straight line. Ask if the intermediate points on the lines have meaning e.g. $(3\frac{1}{2}, 1\frac{1}{2})$.</p> <ul style="list-style-type: none"> Ask what you think will happen if you started with totals of 3 or 6? Repeat using 3 and 6. Highlight the fact that the points are on parallel lines and identify where they cut the axes. 	<p>Recognise where a shape will be after two translations.</p> <p>VOCABULARY trapezium translation orientation</p> <p>RESOURCES OHT 10.2a OHT 10.2b</p>	<ul style="list-style-type: none"> Collect names of shapes from homework. Correct any errors and misunderstandings. Use OHT 10.2a with trapeziums A to G. Ask for the coordinates of trapezium A. Using an overlay, OHT 10.2b, move shape A to shape B. <div>Q How has the shape moved?</div> <p>Discuss and establish that it has moved 5 squares to the right. Emphasise they must give direction and distance and refer to the axes for help. Emphasise it is the movement of each corresponding vertex that they are giving. Tell them this movement keeps the shape in the same upright position i.e. its orientation stays the same, and its area does not change.</p> <div>Q What do we call a movement in a straight line?</div> <p>Establish that it is a translation.</p> <p>Explain that in this case A is translated 5 places forward in the x direction. Write +5 in the x direction on the board. Discuss how this recording explains the translation.</p> <ul style="list-style-type: none"> Ask the children to describe the translations of A to C, A to D, A to E and write on the board: A to C is translation -9 in x direction A to D is translation $+5$ in y direction. A to E is translation -11 in y direction. <p>Get children to do the same for translations B to C, B to F, D to E, G to F etc.</p> <ul style="list-style-type: none"> Discuss with the children how to describe the translation C to D. Emphasise the 2 translations, C to A then A to D and write on the board: C to D is translation $+9$ in x direction and $+5$ in y direction. Ask children to describe G to B, C to E, F to C. Give the children squared paper. Get them to draw axes (-10 to 10), and to draw the trapezium in the same position as shape A on OHT 10.2.a Tell them you are going to give them some translations of shape A, e.g. $+4$ in x direction and -2 in y direction. They are to draw the shapes after the translations and identify the coordinates of the vertices. Give single and two-step translations and collect results. Check for errors and correct mistakes. 	<ul style="list-style-type: none"> Give the children the coordinates of the trapezium after a two-step translation. Ask children to describe the translation of shape A to this new position. Compare answers, drawing attention to the fact that the movements could be described differently. <div>Q Why do we sometimes need two instructions for moving a shape?</div> <ul style="list-style-type: none"> Establish that a translation involves a movement along a straight line in one direction. It is simplest to describe a translation by movements parallel to the graph axes. When the line of the translation is not parallel to either axis we need two instructions for moving a shape. <div>By the end of the lesson children should be able to:</div> <ul style="list-style-type: none"> Sketch the position of a simple shape after it has been translated. <p>(Refer to supplement of examples, section 6, page 107.)</p>

Planning sheet	Day Three	Unit 10 <i>Shape and Space; Position, movement and scales, and solve problems</i>	Term: <i>Autumn</i>	Year Group: 6
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities / Focus Questions
<p>Convert between km, m, cm, mm.</p>	<ul style="list-style-type: none"> Ask the children to give quick responses to questions: How many metres in 1km? How many cm in 0.5m? etc. Write calculations on the board such as the following: $3.6\text{km} + 550\text{m} =$ $7\text{m} - 240\text{cm} =$ $0.3\text{m} + 45\text{cm} =$ $1\text{km} - 725\text{m} =$ Ask the children to work out the answers to these and then share their strategies with a partner. Collect answers. Check that children can convert between units and deal with decimal points correctly. Give five other calculations for children to do on their own. 	<p>Use all four operations to solve measurement word problems, including time.</p> <p>Choose appropriate operations and calculation methods. Explain working.</p> <p>RESOURCES Calculators OHT 10.3</p>	<ul style="list-style-type: none"> Write on the board: A farmer buys 2.5km of wire for fencing. He uses 850m in one field and 1.25km in another. How much wire has he left? Ask the class to identify the key information. <div>Q What calculations are needed?</div> <p>Discuss the methods suggested and record, e.g. $2.5\text{km} - (1.25\text{km} + 850\text{m})$ or $(2.5\text{km} - 1.25\text{km}) - 850\text{m}.$</p> <ul style="list-style-type: none"> Emphasise that it is important to write down the calculations to help with checking solutions. Ask children to estimate the answer, then work through the calculation with the class, converting units and showing how to set out the solution. Emphasise the need to give the answer using the units. Review the stages used to solve the problem. Show OHT 10.3 step-by-step guide. Emphasise that the calculation can be done mentally or using a written method or with a calculator, but the calculations must be recorded. Work through another problem following the step-by-step guide, discussing each stage with the children, and showing them how to record the solution. Set the class problems to do. Ensure these include mixed units, the four operations and time; no calculators at this stage. <ul style="list-style-type: none"> Collect the results and discuss the solutions. Correct any errors and misunderstandings. Write on the board: Cars are about 1700mm wide. The width of a parking space adds 25% to the width of the car. How many spaces could be made along a school playground 35m long? Work out and record the calculations needed and the conversions of units with the class. Estimate the answer, then give out calculators and use them to find the solution, recording steps and interpreting the display. Highlight the need to round the answer to make it sensible. Set other problems which the children use the calculator to solve. 	<ul style="list-style-type: none"> Collect answers to problems. Emphasise steps and methods of recording. Remind children to decide whether to use a mental, written or calculator method. They should always ask: 'Can I do this in my head?' <div>Q If 24 million people watch TV for 150 minutes each day, how many minutes of watching TV does this total?</div> <ul style="list-style-type: none"> Get the children to do the calculation on the calculator, discuss what happens to the display. Then solve the problem mentally keeping the unit in millions i.e. 24×150 million minutes. <div> <p>By the end of the lesson children should be able to:</p> <ul style="list-style-type: none"> Solve 'story' problems involving: km, m, cm, mm, miles; seconds, minutes and hours and explain and record how the problem was solved. <p>(Refer to supplement of examples, section 6, pages 87 and 89.)</p> </div>

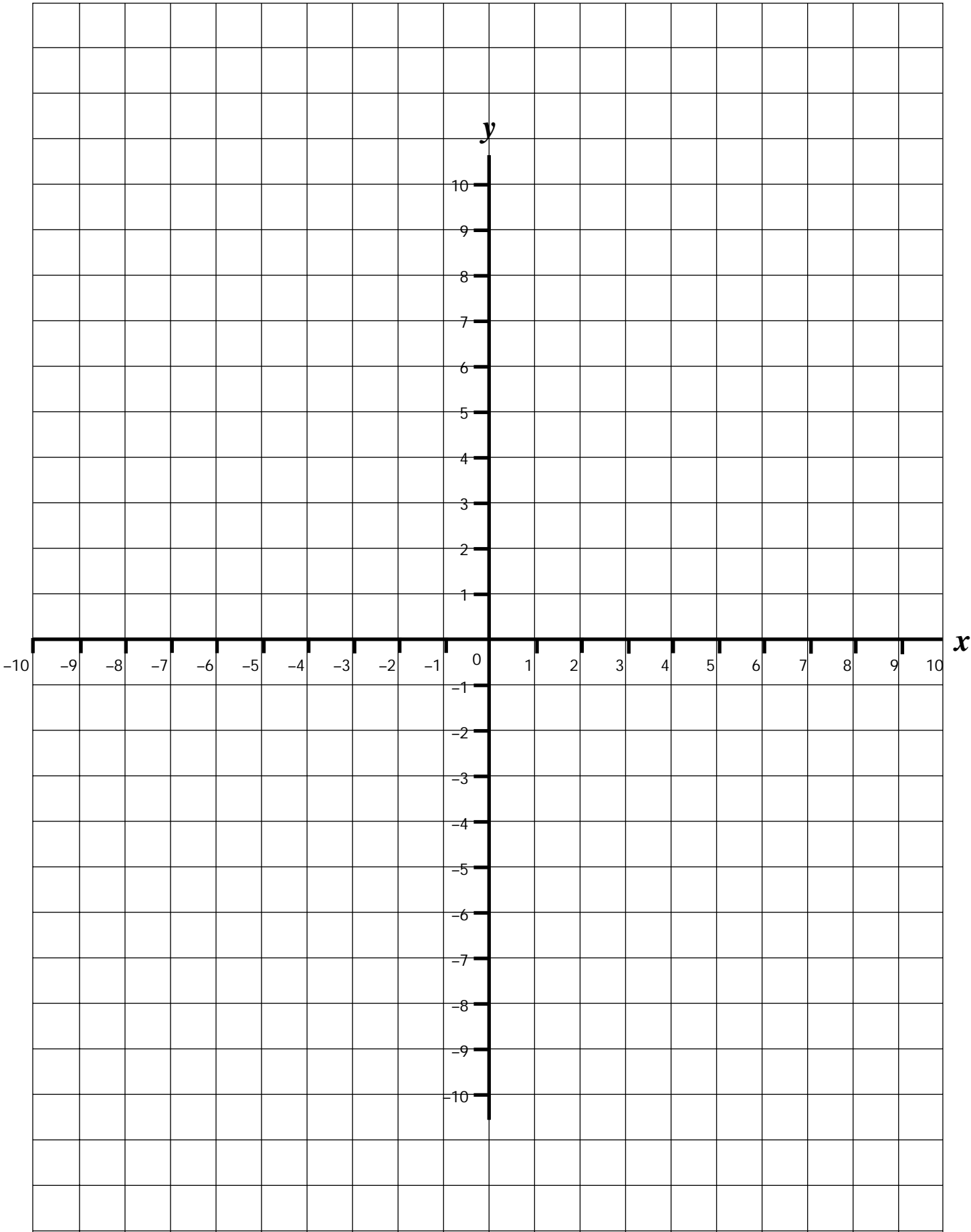
Planning sheet	Day Four	Unit 10 <i>Shape and Space; Position, movement and scales, and solve problems</i>		Term: <i>Autumn</i>	Year Group: 6
Oral and Mental		Main Teaching			Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities		Teaching Activities / Focus questions
Count on in steps of 0.1, 0.2, 0.25, 0.5 . . . and then back.	<ul style="list-style-type: none">Hold the counting stick horizontally and say that one end represents 1kg and the other 2kg. Point to various points asking what measurement lies there. <div>Q What does each division represent in kg?</div> <p>Establish that each tenth is 0.1kg.</p> <div>Q What do they represent in grams?</div> <p>Establish the answer as 100g.</p> <div>Q What does half a division represent?</div> <p>Establish 0.05kg or 50g.</p> <p>Count from 1kg in steps of 0.1kg. Then use grams counting from 1000g in steps of 100g.</p> <p>Repeat with one end representing 0.1kg and the other 0.2kg, and 0g to 500g, etc.</p> <ul style="list-style-type: none">Show the class the OHT 10.4 of the scales with the central needle/pointer missing. Ask the class what this might be used to measure and in what units. Point to 0.4 and ask for this in kg and g. Repeat with different measurements including between indicated values. Emphasise the accuracy that can be obtained.Show OHT 10.5 of the can for measuring litres and repeat the exercise.	<p>Record estimates and readings from scales to a suitable degree of accuracy.</p> <p>Know imperial units and rough metric equivalents.</p> <p>VOCABULARY inches feet yards pints gallons scale degree of accuracy</p> <p>RESOURCES OHT 10.6 Resource sheet 10.1 Rulers with cm and mm Measuring tapes with cm and inches</p>	<ul style="list-style-type: none">Ensure that each child has a ruler with cm and mm scales. Ask each child to measure their handspan, the length of their middle finger and the width of the nail on their little finger. Check that everyone measured from 0. Ask for the measurements in cm and mm. Ask if their measurements are likely to be accurate to the nearest cm, the nearest mm. Ask how many times longer their finger is than their nail, and their handspan than their finger. Agree a representative set of values for the class and explain that this is an estimate rather than an accurate measure.Give pairs of children measuring tapes which have both metric and imperial units (cm and inches). Discuss the two scales and ask children to convert from one to the other. Ask:<div>Q 4 inches is about how many mm?</div><p>Ask the children to measure their handspans in inches. Ask for this length to the nearest inch, the nearest $\frac{1}{4}$ inch, $\frac{1}{8}$ inch etc. Discuss other imperial units for length and establish that there are 12 inches in 1 foot and 3 feet in 1 yard. Discuss metric equivalents and establish that 1 metre is about 3 feet and 3 inches, or one yard and 3 inches, or 39 inches.</p>	<ul style="list-style-type: none">Write on the board: 1 litre is about $1\frac{3}{4}$ pints Get the class to say ‘A litre of water is about a pint and three quarters’. Use this to calculate that: 2 litres is about $3\frac{1}{2}$ pints 5 litres is about $8\frac{3}{4}$ pints.Remind the class that there are 8 pints in 1 gallon or 5 litres is just over 1 gallon. Show the class OHT 10.6 the litre/gallons scale. Give out copies (Resource sheet 10.1) for pairs to refer to. Ask:<div>Q How many litres in 3 gallons? How many gallons and pints in 15 litres?</div>Write on the board: 1 litre of water weighs 1kg. Reshow OHT 10.5.<div>Q If the watering can was full could you lift it up to water the plants?</div>Discuss how to use the litre/gallon scale to answer these questions and to check the values on the board. Use calculators to convert and discuss the degree of accuracy.Set litres to gallons questions for pairs to answer.	<ul style="list-style-type: none">Collect children’s responses.Write the following on the board: Measuring your waist for a new pair of jeans. Measuring out a dose of medicine. Putting petrol in the car. Weighing flour to make a cake. Measuring the bedroom floor before ordering a carpet. Telling someone the distance from where you live to the nearest supermarket. Measuring the amount of tread on a tyre. <div>Q These are all situations where we use some form of measurement. Can you suggest some others?</div> <div>Q How accurate do we need to be in each case? Can you think of any situations where we need to be really accurate?</div> <p>Suggest that in many cases, approximate measurements are sufficient. Accuracy could be critical in:</p> <ul style="list-style-type: none">– dispensing powerful drugs,– measuring engine parts for aircraft,– adjustments to car engines,– measuring accurate temperatures in certain manufacturing processes like brewing beer. <div>By the end of the lesson the children should be able to:<ul style="list-style-type: none">● Read measuring scales, converting the unit to an equivalent metric unit;● Read both metric and imperial units from measuring scales that show both units.(Refer to supplement of examples, section 6, pages 91 and 95.)</div>
RESOURCES Counting stick OHT 10.4 OHT 10.5					

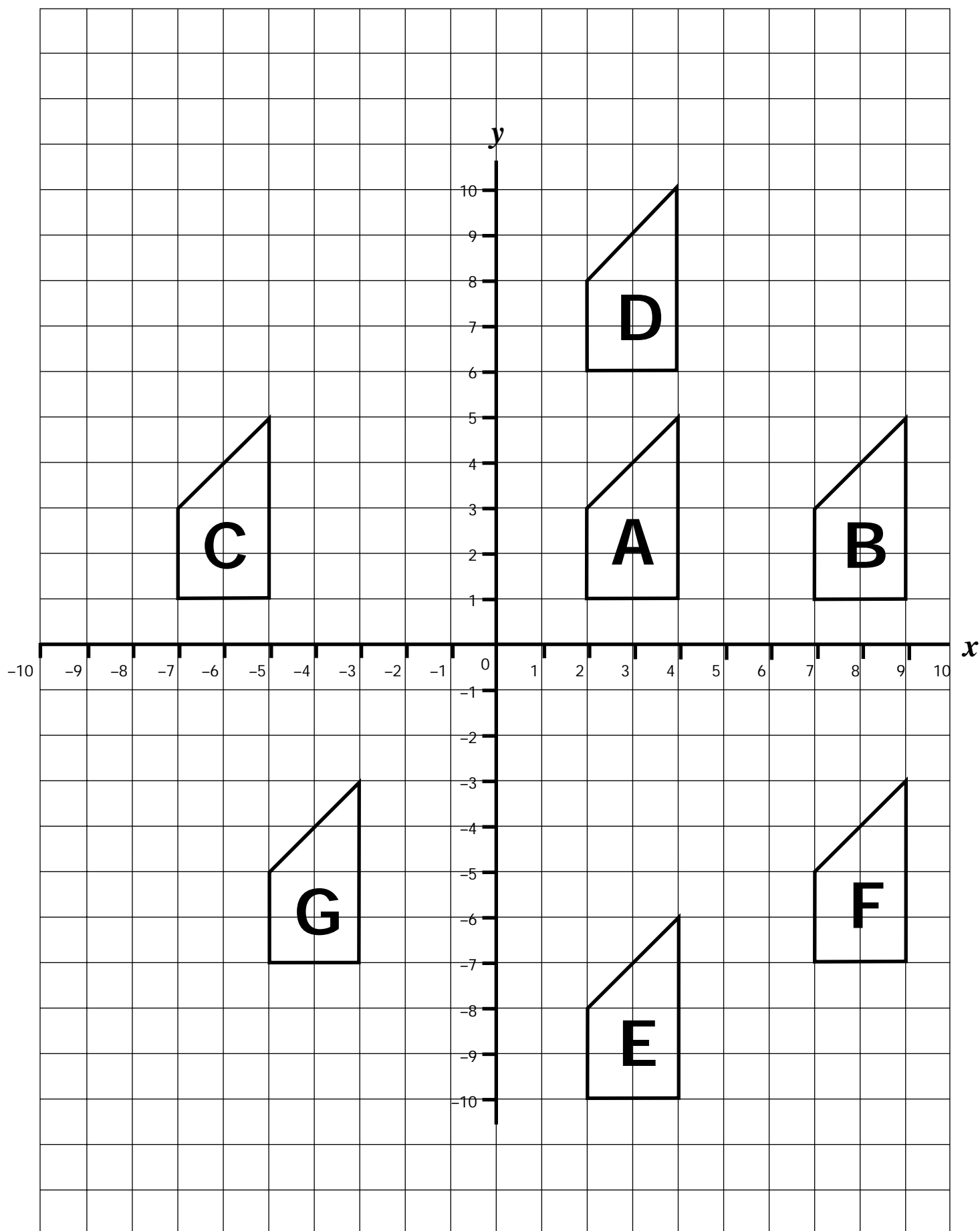
RESOURCES
Counting stick
OHT 10.4
OHT 10.5

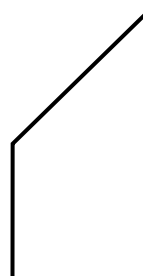
VOCABULARY
inches
feet
yards
pints
gallons
scale
degree of accuracy

RESOURCES
OHT 10.6
Resource sheet 10.1
Rulers with cm and mm
Measuring tapes with cm and inches

Planning sheet	Day Five	Unit 10 <i>Shape and Space; Position, movement and scales, and solve problems</i>	Term: <i>Autumn</i>	Year Group: 6
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities / Focus Questions
Solve problems based on measures. 				





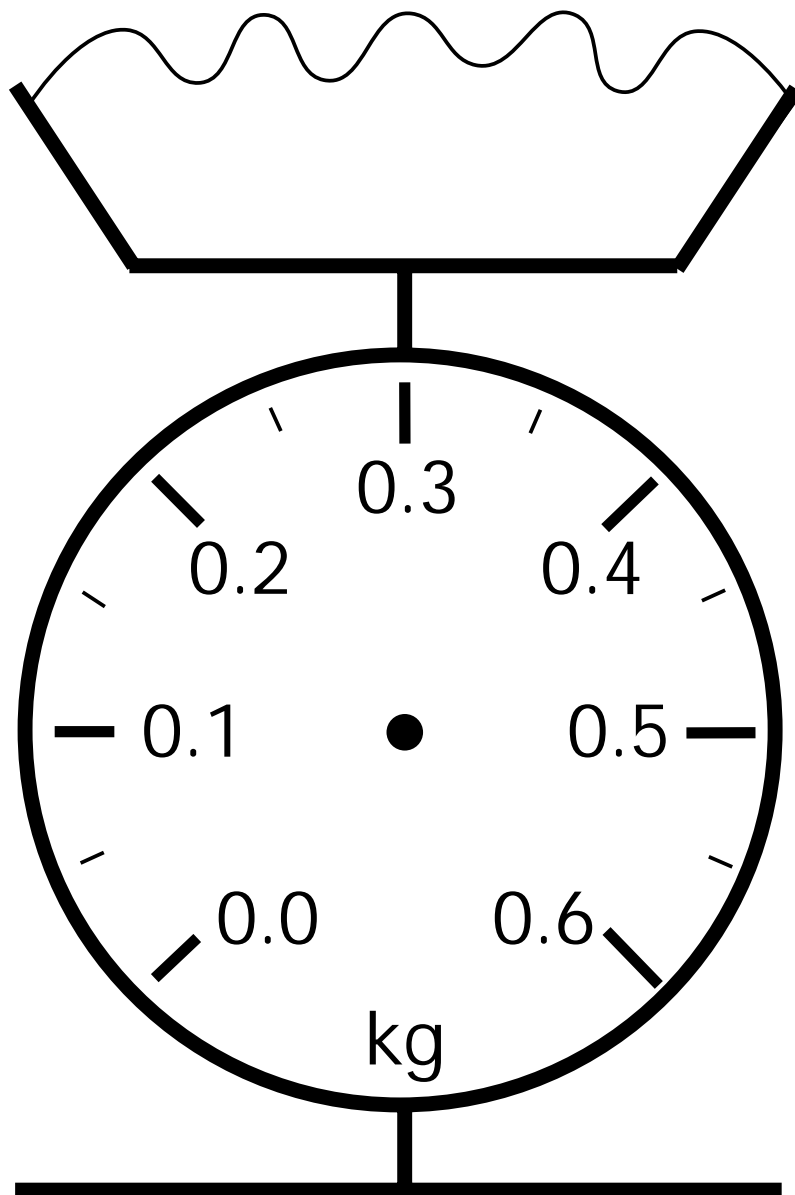


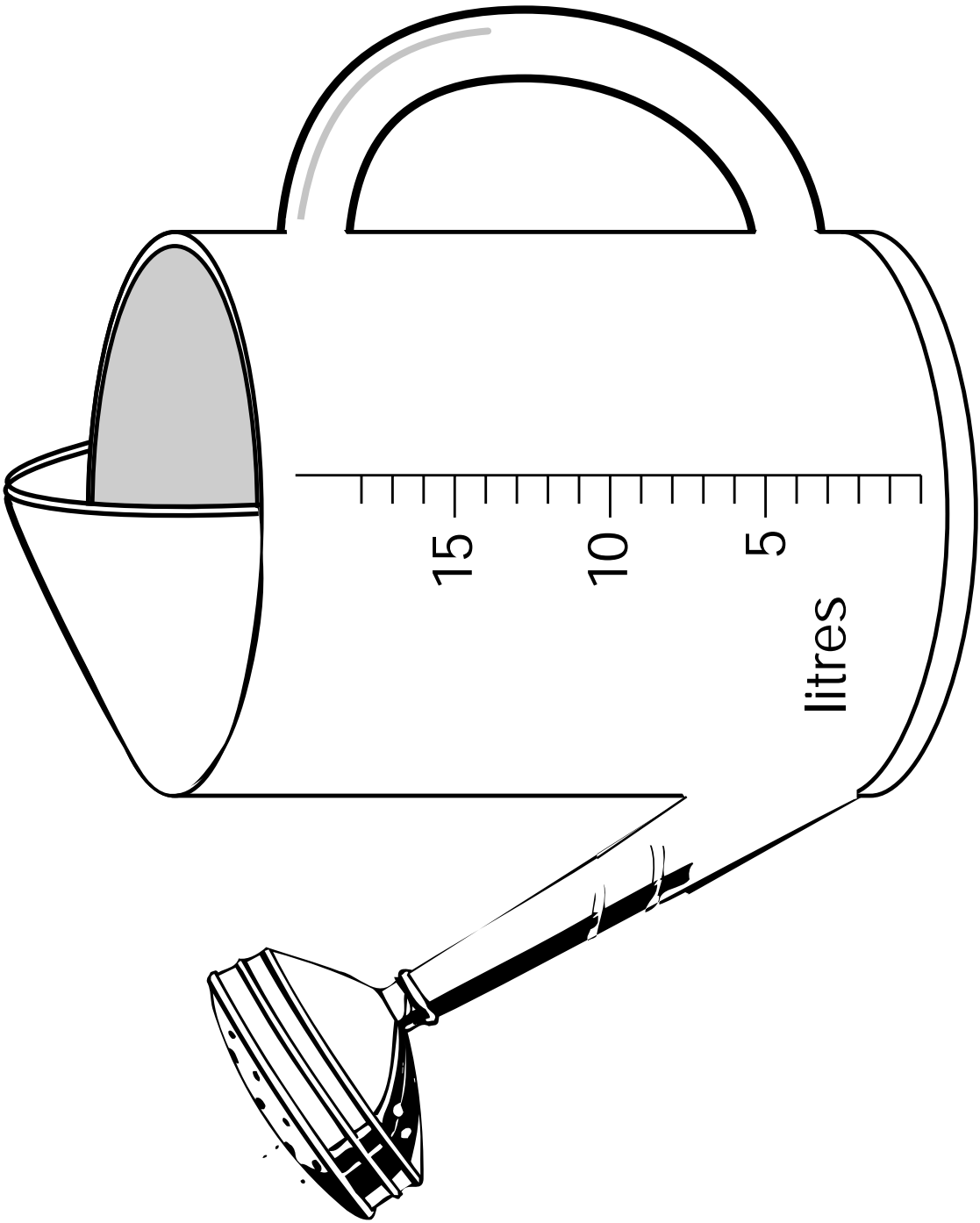
1. Read the question.
2. Decide what operation(s) to use.
3. Write down the calculation(s) you are going to do. Use brackets if you need to.
4. Work out the approximate answer.
5. Decide how you will work out the calculation.

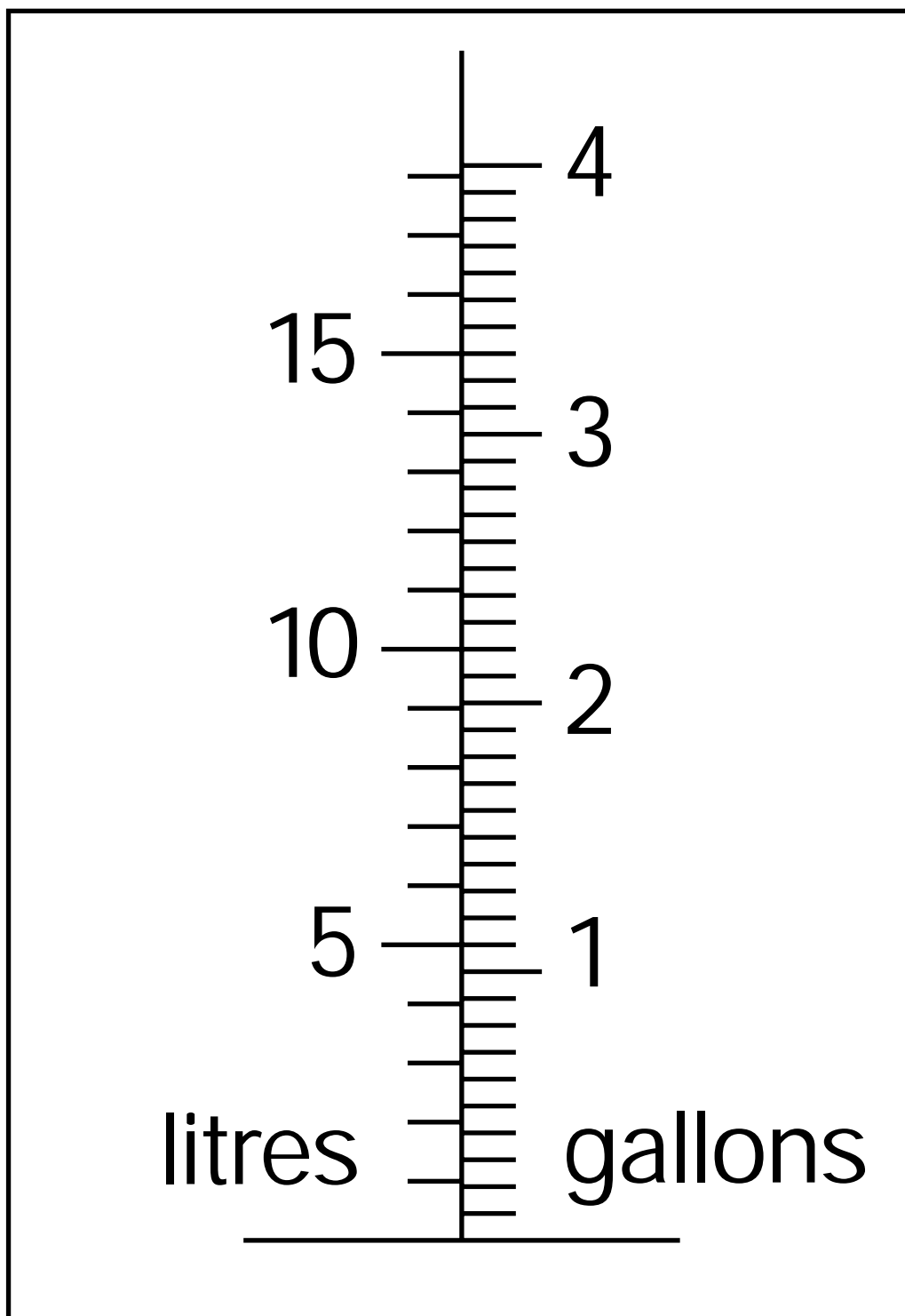
Ask: Can I do it in my head?

6. Do the calculation and interpret the answer. Include any units (e.g. km).

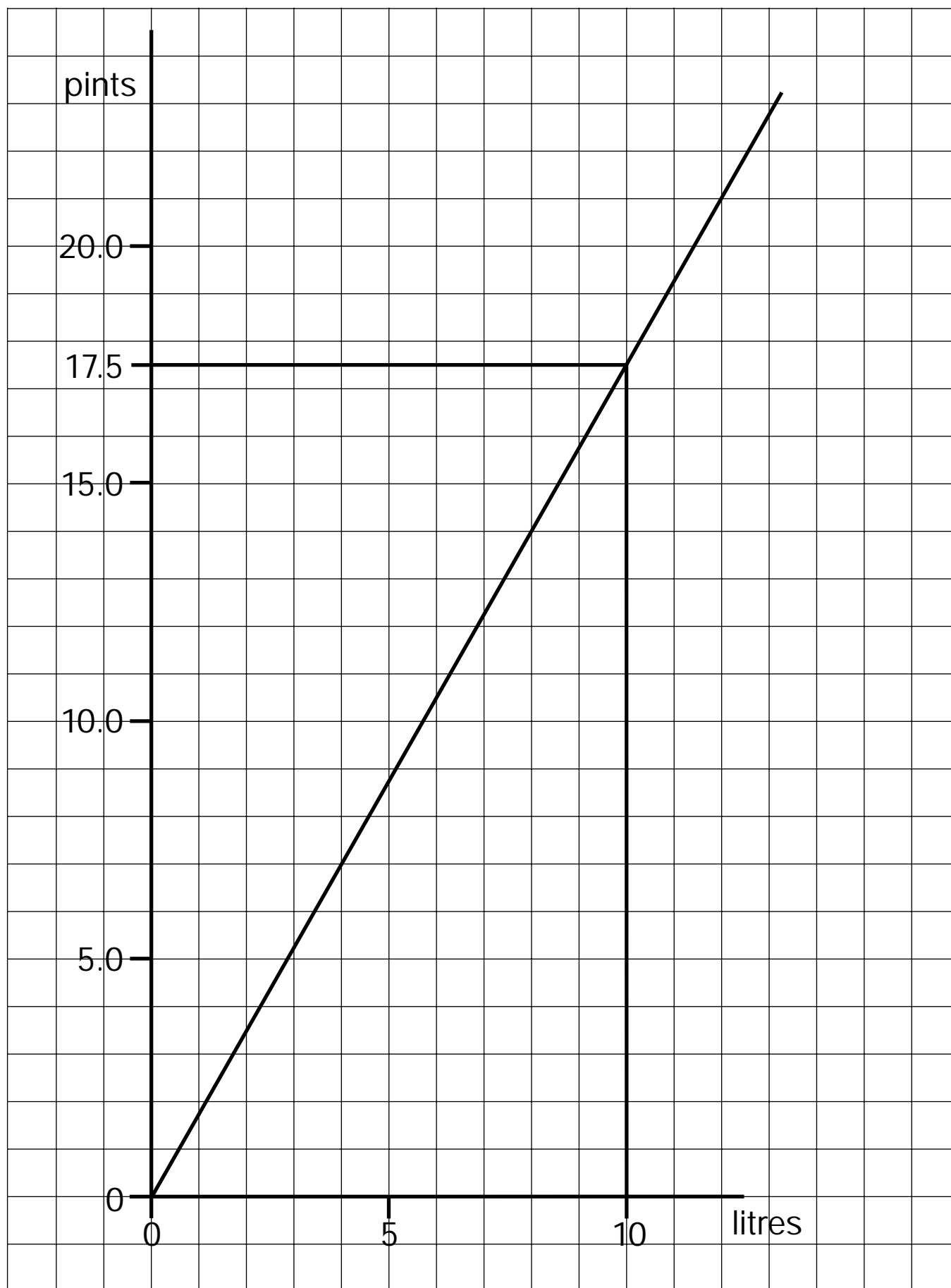
Ask: Does the answer make sense?





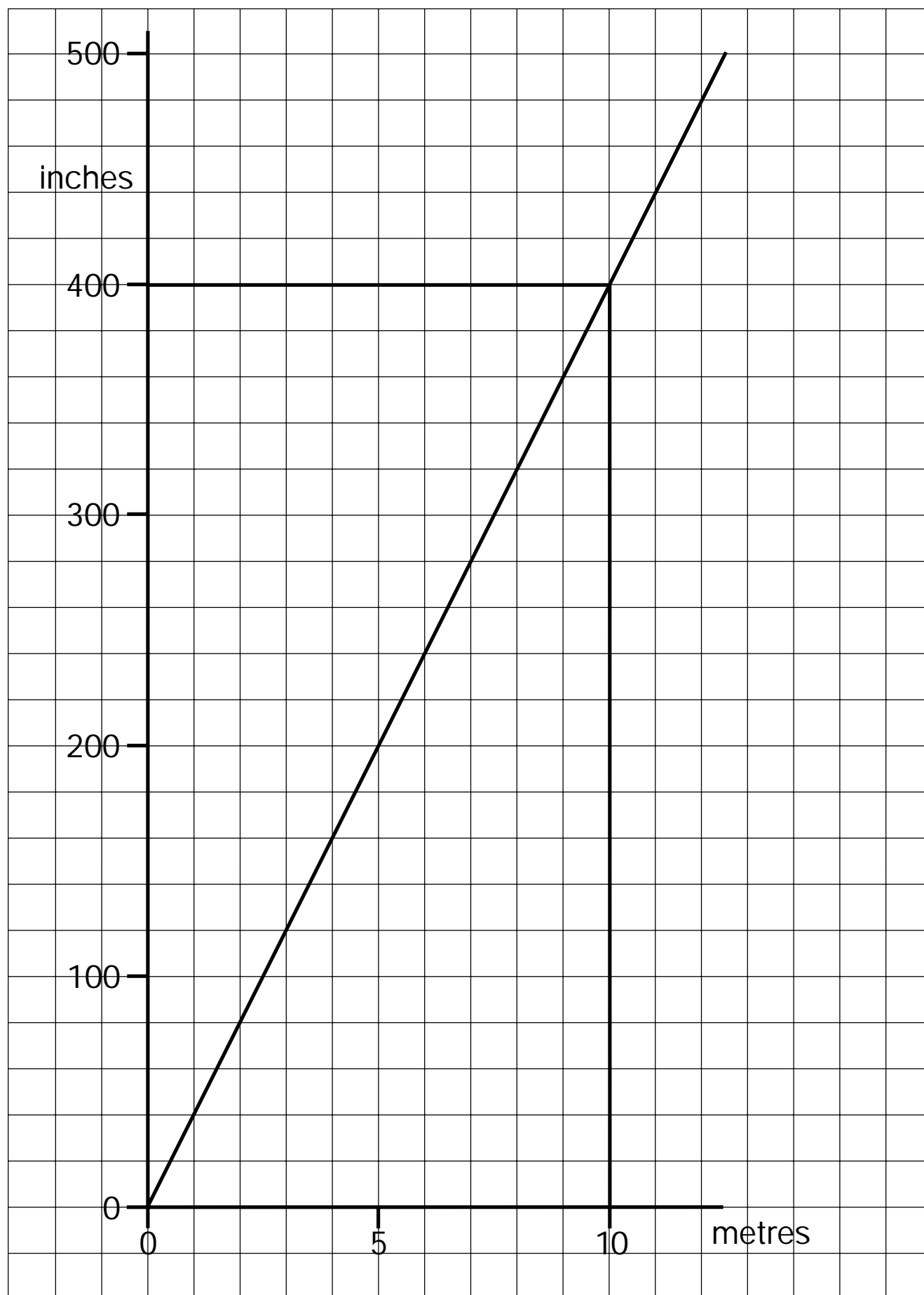


Conversion graph



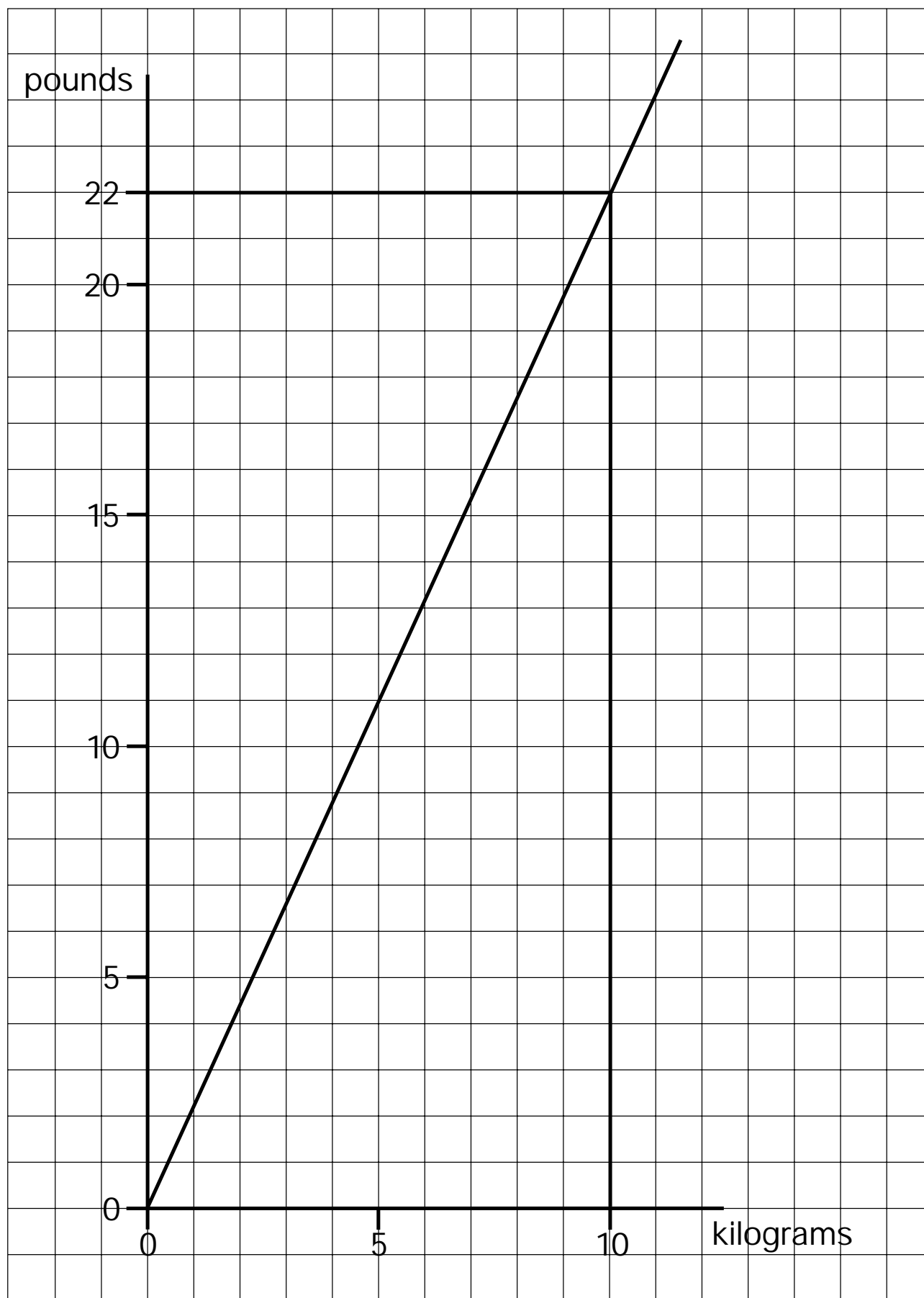
10 litres \approx 17.5 pints

Conversion graph



10 metres \approx 400 inches

Conversion graph



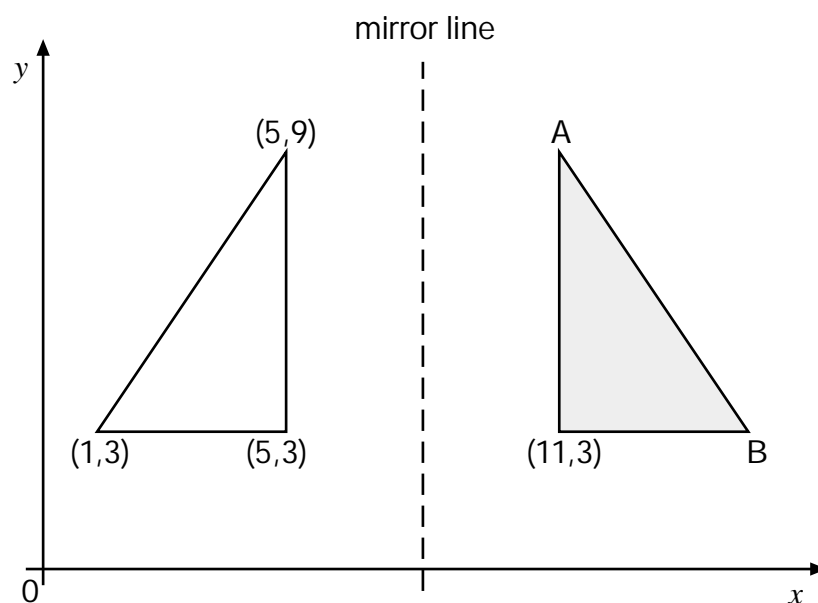
10 kg \approx 22 pounds

Related Key Stage 2 national test questions:

2000 Test A

22

The shaded triangle is a reflection of the white triangle in the mirror line.



Write the **co-ordinates** of point **A** and point **B**.

**A** is**B** is

22a

1 mark

22b

1 mark

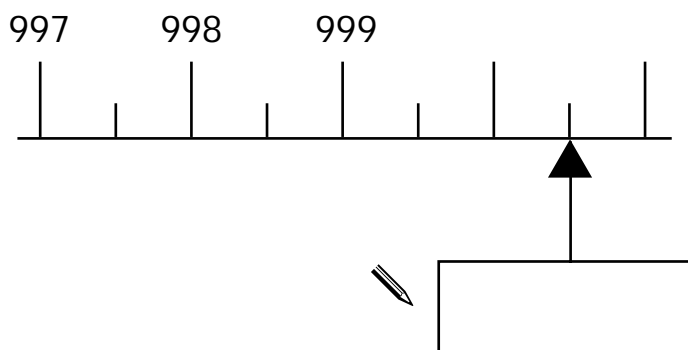
Total

2000 Test B

14

Here is part of a number line.

Write the number shown by the arrow.



14

1 mark

2000 Test A

16

Calculate $15.05 - 14.84$



10a

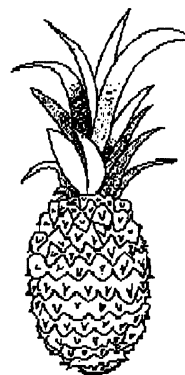
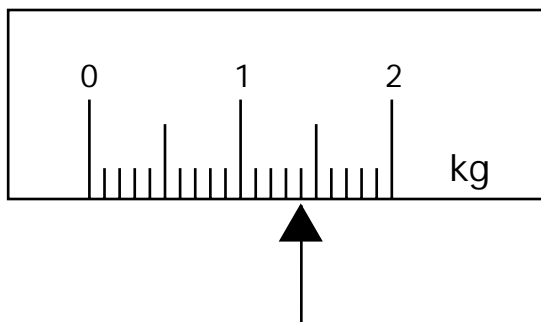
1 mark

Total

2001 Test B

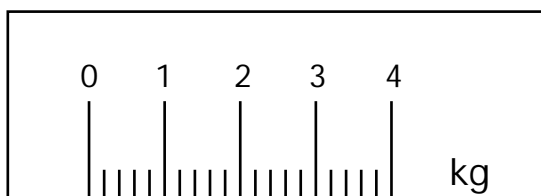
17

On this scale, the arrow (\uparrow) shows the weight of this pineapple.



Here is a **different** scale.

Mark with an arrow (\uparrow) the weight of the **same** pineapple.



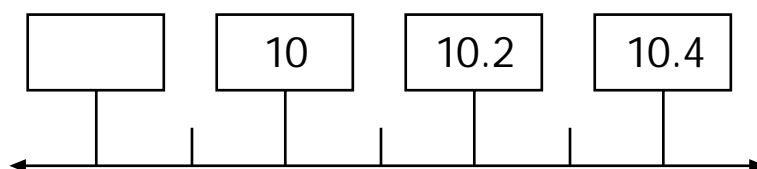
17

1 mark

2001 Test B

16

Write in the **missing** number on this number line.



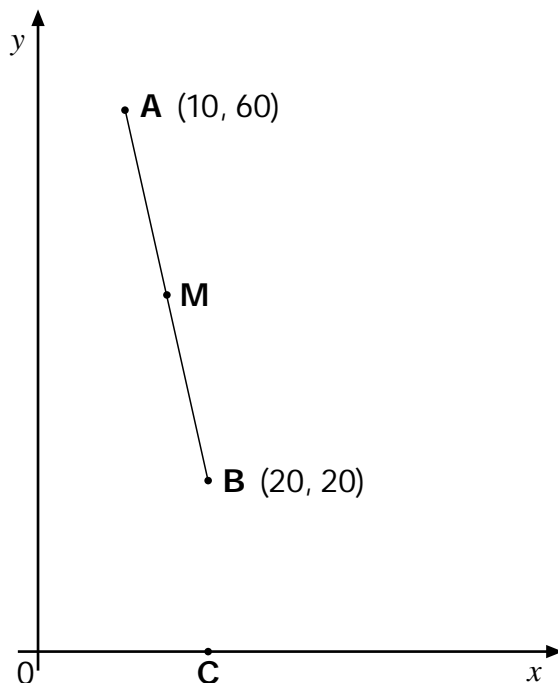
16

1 mark

Total

2001 Test A

20



A is the point (10, 60)

B is the point (20, 20)

M is the midpoint of line AB.

Write the co-ordinates of **M**.



1 mark

20a

C is on the x -axis, directly **below B**.

Write the co-ordinates of **C**.



1 mark

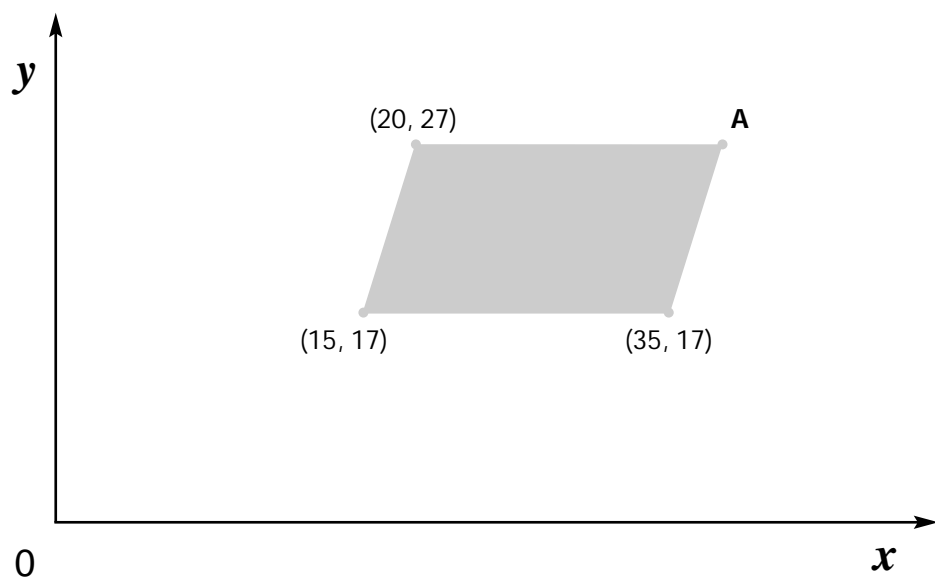
20b

Total

Unit 10 Year 6 (Autumn Term)

17

The shaded shape is a parallelogram



Write in the co-ordinates of point **A**



2 marks

10b

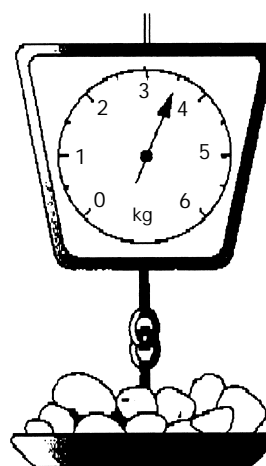
15

This table shows the weight of some fruits and vegetables.

Complete the table



	grams	kilos
potatoes	3500	3.5
apples		1.2
grapes	250	
ginger		0.03



2 marks

10b

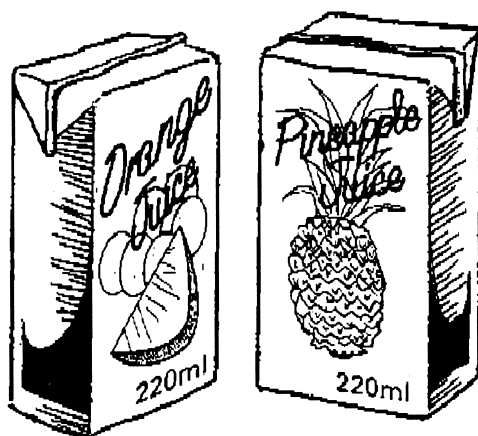
Total

2002 Test B

7

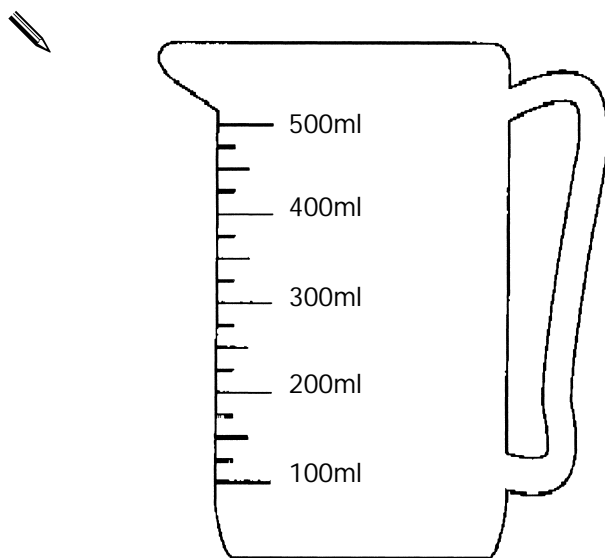
Mina has two cartons of juice

Each carton contains **220ml**.



She empties them both into this jug.

Draw an arrow (→) to show the level of the mixture in the jug.



10b

2 marks

Total