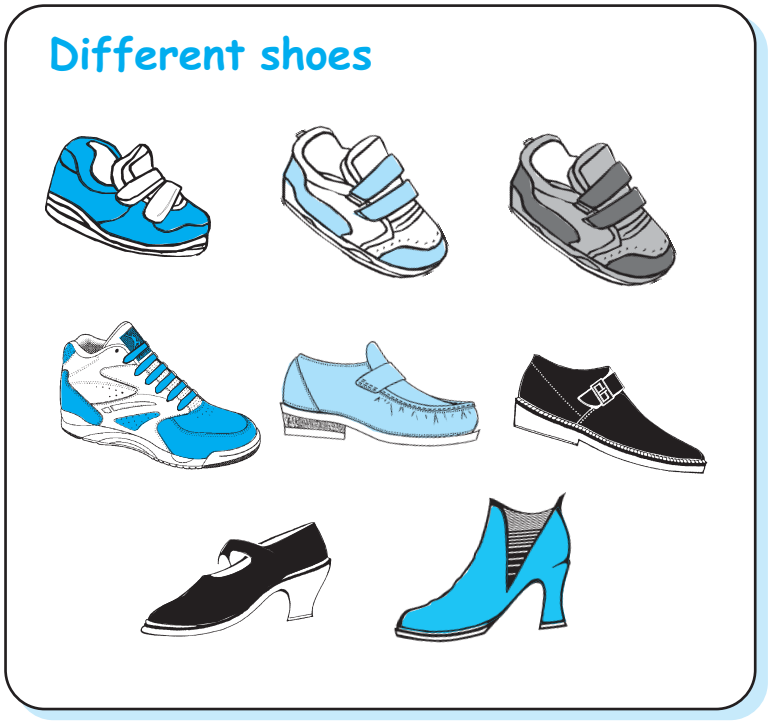
Logic problems — Foundation Stage — Activity 1



Necessary prior knowledge

Colour and pattern recognition Language of similarity and difference

Resources

- A collection of different types of shoes

Early Learning Goal from the *Curriculum guidance for the Foundation Stage*

- Use developing ideas and methods to solve practical problems

Objectives from the *NNS Framework for teaching mathematics from Reception to Year 6*

- Solve simple problems or puzzles in a practical context, and respond to 'What could we try next?'
- Sort objects, justifying the decisions made
- Use developing mathematical ideas and methods to solve practical problems involving counting and comparing in a real or role-play context

By the end of this activity, children will be able to:

- recognise similarities and differences;
- sort objects using several criteria and sort to their own criteria, justifying their choices;
- explain what they are thinking and doing.

Vocabulary

same different sort

  Ref: DfES 1386-2005 G

This sequence of activities can be developed within a session or over a period of sessions in a variety of different contexts.

Suggestions for additional supportive activities

Make a collection of different types of shoes for the children to look at and discuss. Using your collection of shoes, ask the children who might wear the different types of shoes, encouraging them to articulate their choices.

Use a collection of socks and a washing line to enable the children to sort the socks into pairs. Ask 'Can you find me all the socks that are red/stripy/long?'

Encourage the children to sort the coins in the till in role-play, or to sort cutlery, plates, cups or collections of teddies. Link to other sorting activities that will be happening in different contexts and other areas of learning.

Have a collection of different sized parcels in similar and different types of wrapping paper for the children to sort and discuss. 'Can you find the parcel that is red and spotty?' 'Can you find all the small green parcels?' Encourage the children to choose a parcel and describe it.

Whole-group or small-group activity

What's your shoe?

Share stories with the children that refer to shoes, e.g. *Cinderella, The elves and the shoemaker.* Using your collection of shoes, draw out the different types of shoes, colours and fastenings that you could have, e.g. boots, sandals, trainers, slip-ons, laces, hook-and-loop tape, and buckles. You may want to give the children a shoe to talk about in pairs.

Q. Who has got a shoe that is blue?

Q. Who has got a shoe with a buckle?

Encourage the children to describe the shoes that they are wearing. Develop sorting activities with the whole group or small group, e.g. 'If you have laces, stand up.' 'If you have black shoes, stand up.' 'If you have black shoes and laces, stay standing.' Encourage the children to check that their shoes do fit the criteria.

Use of different role-play contexts could form a focus for many other rich problem solving activities.

Encourage the children to use these criteria. This 'sophisticated sorting' is very helpful in solving logic problems.

Missing shoes

The scenario is that you have chosen a pair of shoes but unfortunately someone has mixed all the shoes into a large pile. 'I have a problem. I have brought a pair of shoes but someone has mixed all the shoes up. Can you help me find my shoes? Can you be shoe detectives?'

Q. How could we find my pair of missing shoes?

Q. What sort of shoe do you think I might have chosen?

Q. What type of shoe might I choose if I was going to the beach/for a walk in the woods/to a party?

Children need to understand that problem solving involves choices, so they have the opportunity to make decisions and justify them.

  Ref: DfES 1386-2005 G

Say that you will give clues about your shoes.
Q. My shoes have laces. What shall we do?
Agree that you will put all the shoes with laces to one side.

Q. My shoes are white; what shall we do now?

Q. Are all the shoes we sorted white and do they all have laces?

Take a white shoe without laces.
Q. This shoe is white. Why can't it be this one?

Continue to give descriptions of your shoes so that they find the right pair.
Q. What did you find out about my shoes?
Encourage the children to recall the different criteria you gave them.
'Yes, my shoes were white with laces and they were trainers. Well done, you solved the problem.'

Develop the activity further where the children are encouraged to choose a pair of shoes from a collection and give clues to the other children, so that they find the right pair of shoes. You could build on this activity and encourage the children to ask questions to try and find out what shoe has been chosen, e.g. 'Is the shoe black? Does it have a buckle?'

Q. What questions helped us work out what the shoe was?

Point out to the children which questions helped them to make the right choice, and those that didn't help.

If you have the use of an interactive whiteboard, you may want to create a screen with a collection of objects and sorting boxes into which the objects can be dragged and dropped. You could use different role-play contexts to support this area of learning, e.g. post office, bakery, garden centre, where the children have to sort items to given criteria and then sort to their own criteria, justifying the choices they have made.

How did the children tackle the problem? Did they understand the problem? Were they able to talk to others?

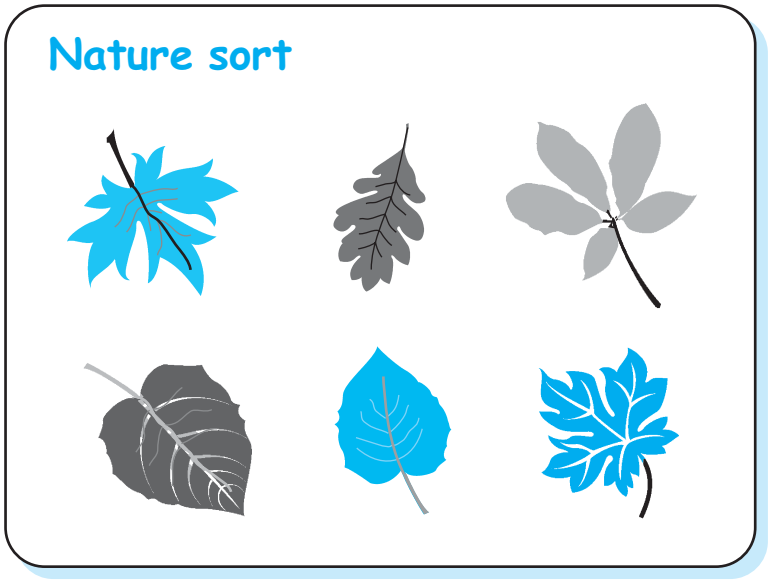
Here we are ensuring that children understand that the shoes meet two criteria.

This sorting according to several criteria not only develops the children's sorting skills but is essential for later problem solving.

Encourage the children to talk to one another about what they are thinking and doing. Engage in sustained shared thinking.

  Ref: DfES 1386-2005 G

Logic problems — Foundation Stage — Activity 2



Necessary prior knowledge

Colour and pattern recognition
Language of similarity and difference
Opportunities to discuss and explore different natural and manufactured materials

Resources

- Collections of different objects, both natural and manufactured, e.g. toys, toy vehicles
- Two hoops and/or yes/no or ✓/×, ☺/☹ cards
- Feely bag

Early Learning Goal from the *Curriculum guidance for the Foundation Stage*

- Use developing ideas and methods to solve practical problems

Objectives from the *NNS Framework for teaching mathematics from Reception to Year 6*

- Solve simple problems or puzzles in a practical context, and respond to 'What could we try next?'
- Sort objects, justifying the decisions made
- Use developing mathematical ideas and methods to solve practical problems involving counting and comparing in a real or role-play context

By the end of this activity, children will be able to:

- recognise similarities and differences;
- guess the criteria being used to sort objects;
- make and test hypotheses.

Vocabulary

same different sort
vocabulary linked to knowledge and understanding of the world

  Ref: DfES 1386-2005 G

Suggested supportive activities

Have a class collection of different types of materials for the children to explore, discuss and sort.

Create opportunities to produce drawings, paintings, rubbings and collages of objects sorted to a given criterion.

Play different types of pelmanism games with the children.

Have a collection of different sized parcels in similar and different types of wrapping paper for the children to sort and discuss. 'Can you find the parcel that is red and spotty? Can you find all the small green parcels?' Encourage the children to choose a parcel and describe it.

Encourage the children to sort the coins in the till in the role-play/cutlery/plates/cups/collections of teddies. Link to other sorting activities that will be happening in different contexts and other areas of learning.

If you have a digital camera you could photograph the different objects the children see to record their findings.

This could be made into a class book.

If you have an interactive whiteboard, you could use the software to move the photographs around according to different criteria.

Environmental activity (large or small group)

It would be useful to take the children on a walk, either around the school grounds or within the local environment, in preparation for the class-based activity. Encourage the children to describe what they see.

Look at this tree trunk.

Q. Do you think it is hard/soft/smooth/rough/shiny?

Q. Can you see something else that is [colour name]/hard/soft/smooth/rough/shiny?

Encourage the children to record different objects they see, which can be used as a discussion point back in the classroom.

Q. Did we see any things that were the same colour?

Q. How many did we see that were the same?

Q. Did we find anything that was brown and rough?

Feely bag

Explain to the children that there is a mystery object in the bag and that they are going to work out what it is. Display a range of objects including a duplicate of the object in the bag as a visual prompt. Ask a child to come forward and feel the object in the bag. They should describe it to the other children, using a range of vocabulary.

Q. How could we find out what is in the bag without looking?
Q. Can you describe how it feels?
Q. Can we see which object it might be? Is there anything else that is soft? Which objects can't it be?
Q. Can it be the pencil? Why not?

Remove to one side the displayed items that are excluded, to help the children to make more informed choices. Continue with the questioning until the right object has been guessed.
Pick out the descriptions that helped the children to work out what the object was.
You may wish to repeat the activity with the children asking questions to find out what is inside the bag.

Encourage the children to share ideas with a partner. Involve the children in sustained shared thinking.

Perseverance and persistence are important problem-solving skills.

Guess the collection

It would be useful to have physical objects to support this activity.

Tell the children a story about how a magpie likes to collect objects and put them in its nest. Get the children to share their ideas of what might be the same about all the things the magpie has collected.
You could use a puppet or soft toy to act as the magpie.
Explain that the magpie wants to make a collection of objects but you are not sure what it wants.

Q. What sort of things do you think a magpie might want to collect?
Q. How could we find out what it wants to collect?

  Ref: DfES 1386-2005 G

You could also bury objects in the sand tray that are all similar. The children could record the items they have found. 'All these things are red/hard/shiny/animals.'

Make collections of different objects and invite the children to sort them for everyone else to guess what the criterion is. These could be photographed.

Explain that the children are going to choose an object and ask the magpie (puppet) whether it wants it in the collection. Place the two hoops down and explain that one hoop will be for the items the magpie wants and the other hoop is for the items it doesn't want. Label each hoop yes/no or ✓/× or ☺/☹. Ask a child to choose an item and ask the magpie whether it would like the item.

Q. What do you think the magpie wants to collect?
'It wanted the spoon but not the pencil.'
Q. Can we find anything else that it might like? How are they the same?
Q. Do you think the magpie would like the silver tray?
Q. Why do you think that?
Q. Would it like the book?
Q. Why do you think that?

How did the children tackle the problem? Did they understand the problem? Did they begin to make connections between the objects that had been accepted by the puppet? Are they spotting common characteristics?

Continue the activity with the children selecting items and the magpie indicating whether it wants it (if it is shiny) or not.

You could provide materials for the children to record their findings.

You could photograph the findings.

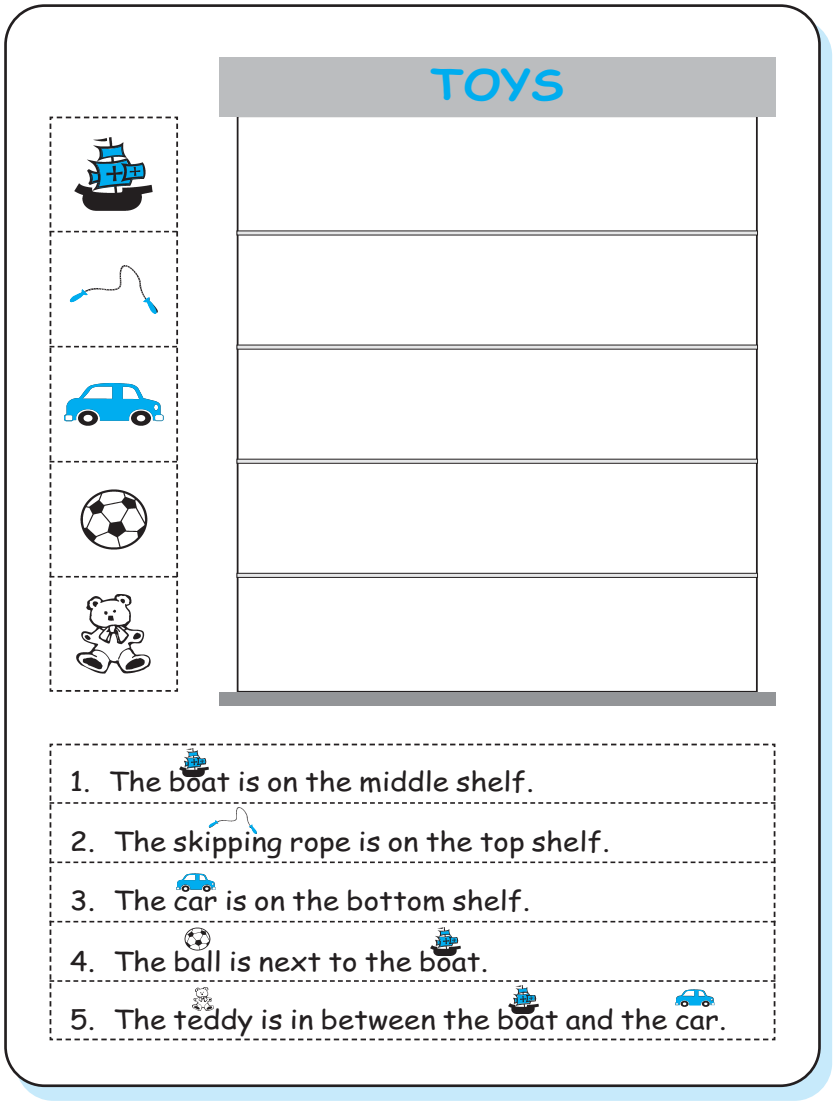
Q. Can we see anything that is the same about all the items in the collection?
Q. Can we guess what the magpie likes collecting? How do you know it likes collecting that?
Q. Is everything in the collection shiny?
Q. Can you think of something else around the class that we could put into the magpie's hoop?
Q. Why does that go in the hoop?

This is encouraging children to develop early problem-solving skills of trial and improvement. Encourage them to reflect on their answers after each object is placed. Children need to know that it is fine for their first guess not to be correct, but that they will refine their guesses with more information.

The activity could be repeated with the children choosing the criterion for the puppet.

  Ref: DfES 1386-2005 G

Logic problems — Year 1 — Lesson 1



Objective

- To solve mathematical problems or puzzles, to recognise simple patterns or relationships, generalise and predict. Suggest extensions by asking 'What if …?' or 'What could I try next?'

By the end of this lesson, children will be able to:

- solve a problem using given facts;
- use one piece of information and see what effect it has;
- check that the answer meets all of the criteria.

Vocabulary

next to	top	bottom	behind	between
above	first	in front	last	

Necessary prior knowledge

Positional language such as before, after, next to, first, second, etc.
Experience of working collaboratively in small groups

Resources

- Resource sheet 1
- Resource sheets 2a and 2b
- Real toys or clip art of toys to show on an interactive whiteboard
- Model shelf (e.g. stack of boxes, class shelving)

  Ref: DfES 1386-2005 G

Main teaching activity

Use real toys and a stack of five boxes piled on top of each other to introduce the problem of placing the toys on the shelves on Resource sheet 1.

Using given facts in order to solve a problem is a key skill in solving logic problems. This activity introduces the concept as 'giving clues'.

A story could provide a good context.

An alternative context could be provided using interactive whiteboard and clip art.

The 'shelf' could contain objects relevant to any topic, e.g. sea creatures, transport.

Q. Where do you think each toy should go? Why do you think that?
Explain that the toys must be put in special places and that you have some clues to help them work out where each toy must go.
Introduce the clue cards from Resource sheet 1 one at a time:
Read card 1. 'The boat is on the middle shelf.'
Q. What is the helpful word in this clue card?
Draw out the positional word 'middle'.
Invite a child to use the clue to place the boat in the correct place.
Continue through clues 2 and 3.
Read card 4. 'The ball is next to the boat.'
Q. What are the helpful words on this card?
Draw out the words 'next to'.
Q. Is there more than one place that the ball could go?
Model the trial and improvement process by placing the ball in one of the possible places and then explain that the next clues might help to find the final place.
When looking at card 5, 'The teddy is in between the car and the boat', demonstrate how that clue helps to locate the position of the teddy and also the ball.

This question begins the reasoning process.

This activity supports the group discussion and interaction strand of *Speaking, listening, learning.*

Q. Did we need all of the clues?
Q. What would happen if you lost one of the clues?

This modelling introduces children to a key skill in solving logic problems.

  Ref: DfES 1386-2005 G

Model the checking process by going through each clue card and checking that the position of the toys meets the criteria on the cards.
Pose some more questions to reinforce the positional vocabulary, e.g.
Q. What is in between the skipping rope and the boat? Is it the only toy?
Display the key positional vocabulary on the board for the children to refer to later.

Split the class into mixed-ability groups of five. Each group will need a blank bus queue, five character cards and five clue cards from Resource sheet 2.
Explain that they will now have a similar problem to solve as a group, using clues to place the characters in the correct place in a bus queue.
Each child in the group will have one clue each. They will be expected to contribute their clue to the group to help solve the problem.
Ask the children to read their clues in pairs and to discuss what information it gives them, but not to place any characters at the moment.

You may prefer to have six members in a group and allocate one person to place the characters.

Circulate around the class to observe children's reasoning.

How is the mixed-ability group work supporting the children?

Drawing together

Draw the class together in order to reflect on the effect of different clues.

Q. How is your clue helpful?
Q. Could you place a character using your clue?
Q. Why can't you put Billy Goat into the queue straight away?

Pursue the conversation to assess children's understanding, using questions such as 'How do you know that?' 'Why do you think that?'

Remind the class to take turns to listen to each clue in turn in order to solve the group problem.

  Ref: DfES 1386-2005 G

Plenary

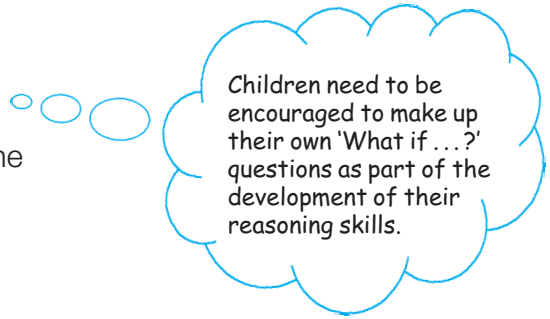
Use a large version of the characters, the queue and the clues to review children's solutions to the problem and check the final solution against the clues.

Introduce a new character, Mr Wolf, who joins the queue somewhere in the middle (see Resource sheet 2b).

Q. If the wolf stands here in the queue, then which clues are still true and which are now false?

Q. If the wolf stands here, then where are the characters standing now?

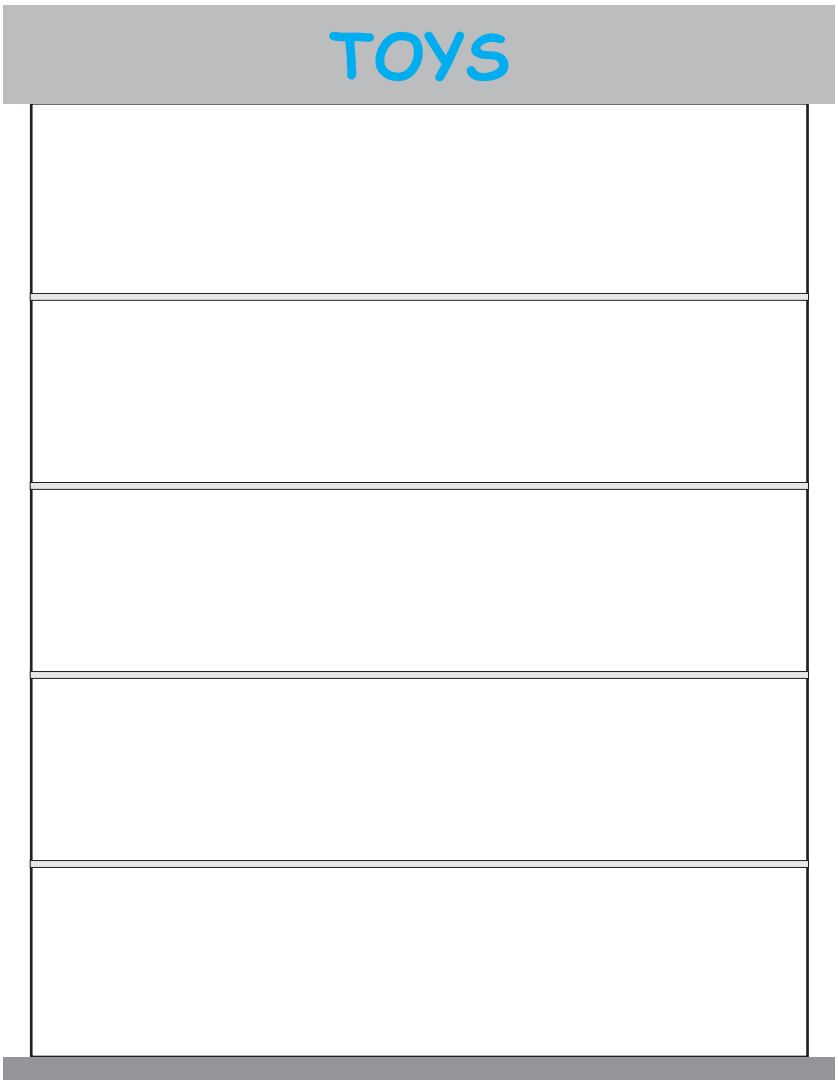
Invite the children to offer alternative changes to the queue and suggest how the clues change, e.g. if another little pig joins the end of the queue then Red Riding Hood isn't at the end any more.



Logic problems

Year 1 Lesson 1

Resource sheet 1

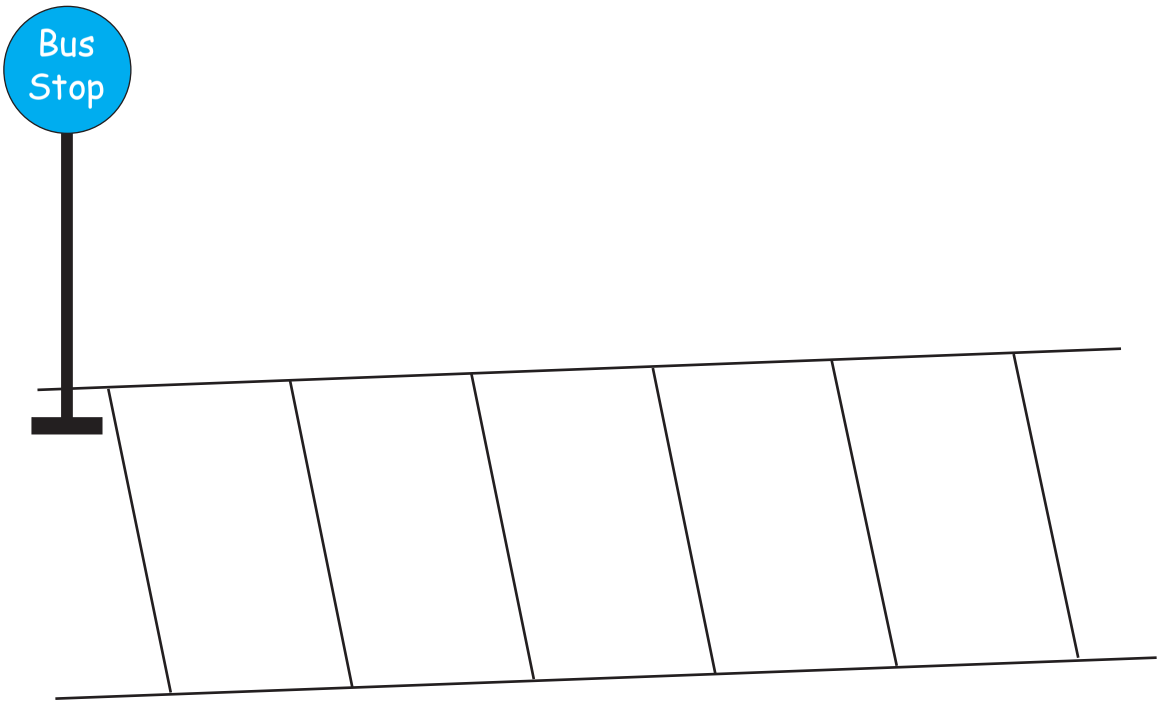


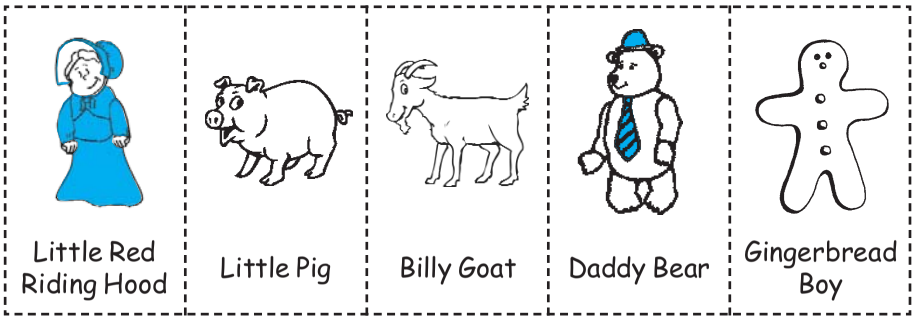
1. The boat is on the middle shelf.
2. The skipping rope is on the top shelf.
3. The car is on the bottom shelf.
4. The ball is next to the boat.
5. The teddy is in between the boat and the car.

Logic problems

Year 1 Lesson 1

Resource sheet 2a



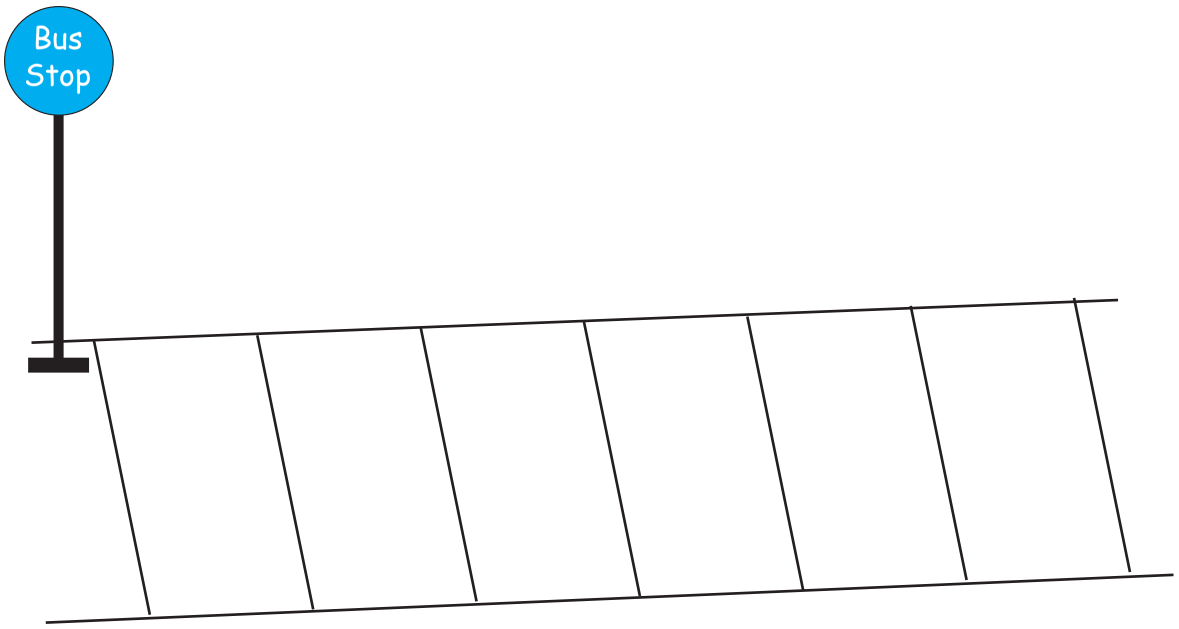


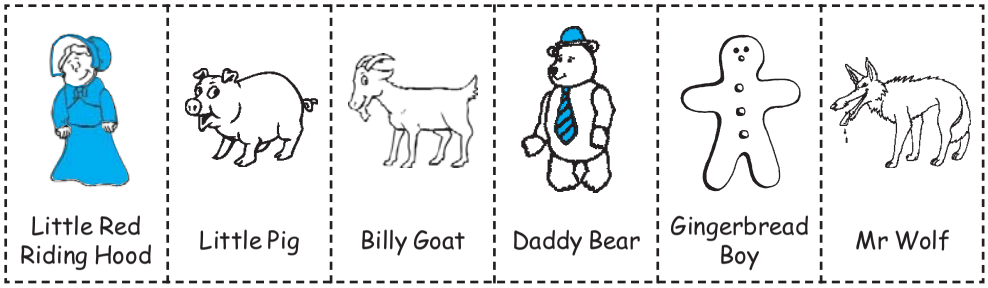
1. Little Red Riding Hood is last in the queue.
2. Billy Goat is next to Daddy Bear.
3. Gingerbread Boy is first in the queue.
4. Little Pig is behind Gingerbread Boy.
5. Daddy Bear is in the middle of the queue.

Logic problems

Year 1 Lesson 1

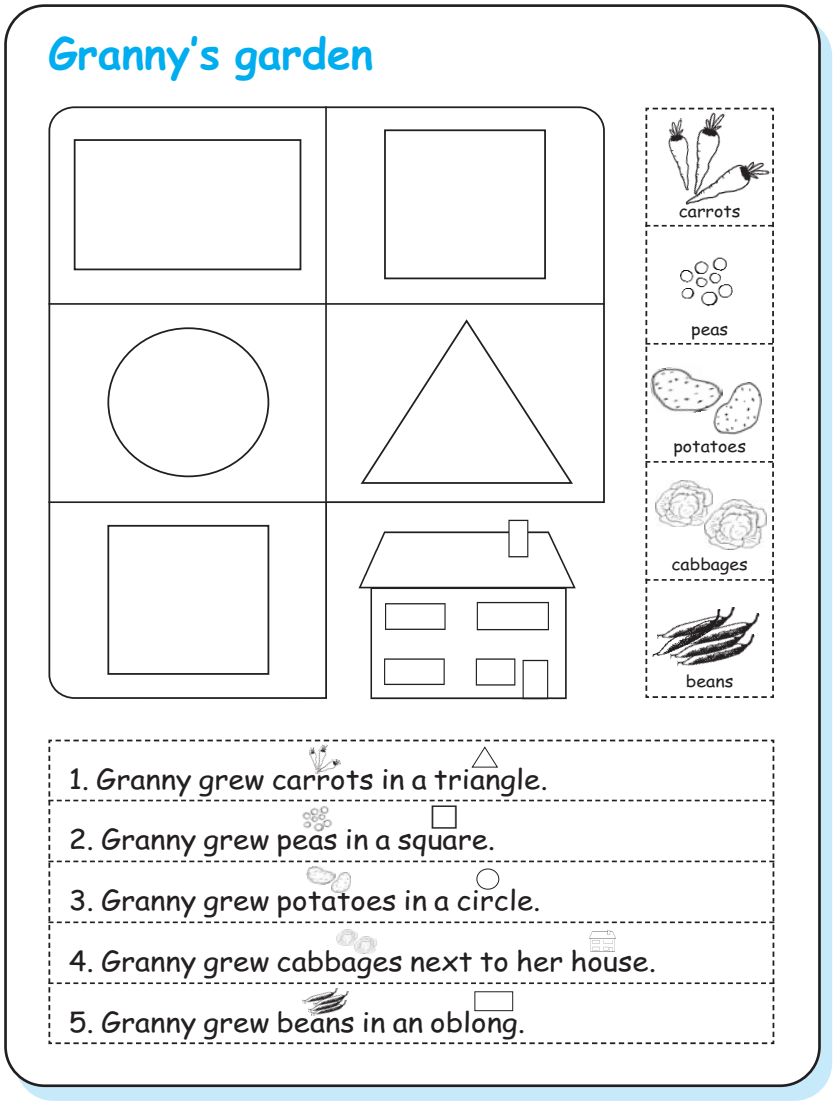
Resource sheet 2b





1. Little Red Riding Hood is last in the queue.
2. Billy Goat is next to Daddy Bear.
3. Gingerbread Boy is first in the queue.
4. Little Pig is behind Gingerbread Boy.
5. Daddy Bear is in the middle of the queue.

Logic problems — Year 1 — Lesson 2



Objective

- To solve mathematical problems or puzzles, to recognise simple patterns or relationships, generalise and predict. Suggest extensions by asking 'What if …?' or 'What could I try next?'

By the end of this lesson, children will be able to:

- solve a problem using given facts;
- use one piece of information and see what effect it has;
- check that the answer meets all of the criteria.

Vocabulary

next, between, above, top, bottom, first, last, in front, behind, circle, square, triangle

Necessary prior knowledge

Positional language such as next to, in between
2D shape recognition
Experience of using clues to help solve problems

Resources

- Resource sheet 3
- A selection of vegetables or clip art of vegetables on an interactive whiteboard

You might want to link the problem with work on *The enormous turnip.* Alternative contexts might be to use different types of counters or cars in a car park.

You could move objects around on the interactive whiteboard.

Main teaching activity

Introduce the problem using a large version of the garden from Resource sheet 3 and the selection of vegetables. Explain that the task is to place the vegetables in the correct places in the garden.

Q. What will you need in order to help you to work out where each vegetable will go?

Remind the class that in the last lesson they used clues in order to solve the problem.

Q. What did the clues do?
Q. How were some clues more helpful than others?
Q. Were all of the clues important? Why?

Ask children to work in pairs to look at the clues and decide which vegetables they can place straight away. They should sort them into two piles: those vegetables which can be placed straight away and those which have more than one possible place.

Paired work gives more opportunity for children to develop their reasoning and communication skills.

Allow several minutes for independent work.

Drawing together

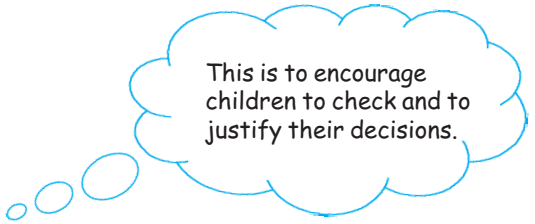
Q. Which vegetables can you place straight away? Why?
Q. Which clues need some more information?
Q. Can you pair any clues together?
Q. Which clue do you need to save until last?

Pursue the conversation to assess the children's understanding using questions such as 'How do you know that?' 'Why do you think that?'

  Ref: DfES 1386-2005 G

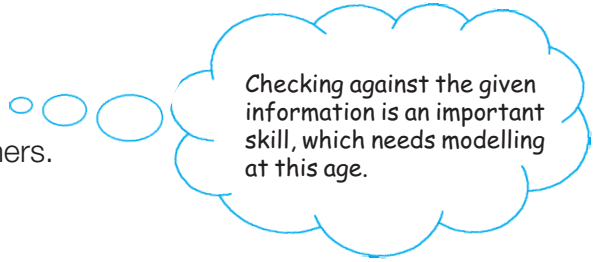
Respond to any difficulties or misconceptions observed as the children worked independently, e.g. if assumptions were made about the position of the peas.

Ask children to continue working in pairs to solve the problem.



Drawing together

Ask children to share their solutions with another pair.
Q. What will you do if you have different answers?
Q. How will you know that you are right?
Encourage children to check their solution against the clues.
Allow a further few minutes for discussions of solutions between partners.



Plenary

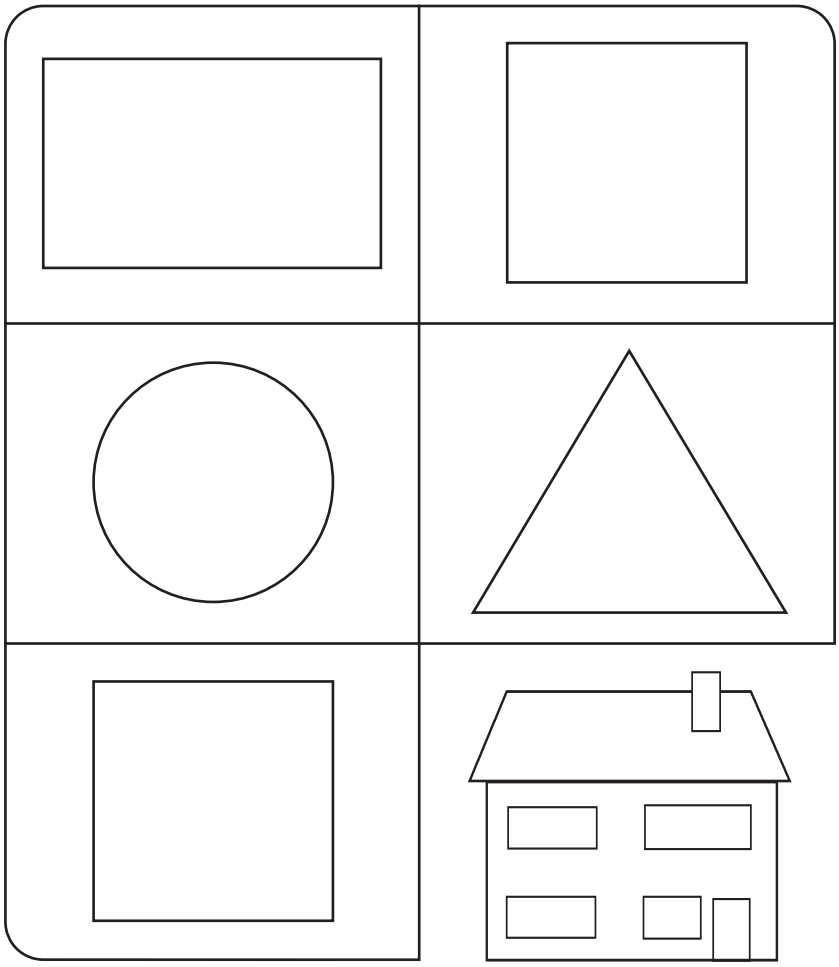
Draw the class together in order to check the solution against the clues.
Q. Which clue was the most helpful?
Q. Why couldn't you place the cabbages or peas straight away?
Q. What did you do?
Q. Which clue helped you to place the peas?

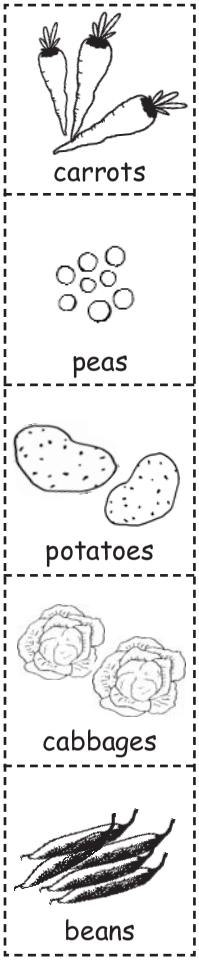
Move the vegetables into different positions. Invite children to verbally offer their own clues to describe where the vegetables are now placed. Write these on the board and then check the position of the vegetables against them.

  Ref: DfES 1386-2005 G

Resource sheet 3

Granny's garden





1. Granny grew carrots in a triangle.
2. Granny grew peas in a square.
3. Granny grew potatoes in a circle.
4. Granny grew cabbages next to her house.
5. Granny grew beans in an oblong.

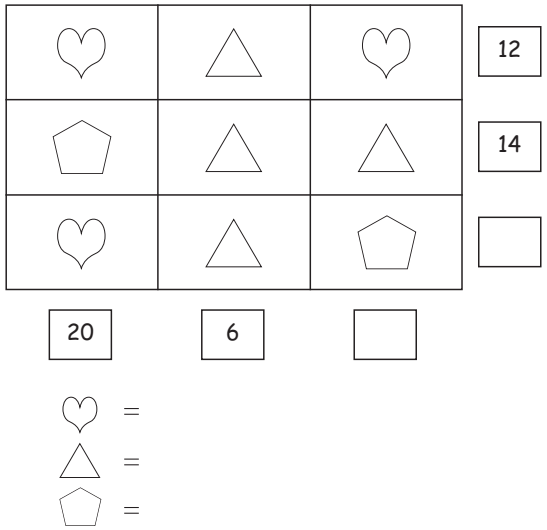
Logic problems — Year 2 — Lesson 1

Shape puzzle

Each shape stands for a number.

The numbers shown are the totals of the line of three numbers in the row or column.

Find out which number each symbol represents and find the other totals.



Resources

- Activity sheet 1
- OHT 1

Objectives

- Solve mathematical problems or puzzles, recognise and explain patterns and relationships, generalise and predict. Suggest extensions by asking 'What if . . . ?'
- Identify the given facts and prioritise them
- Use one piece of information in the problem and see what effect it has
- Look for any relationships and patterns in the information given
- Check that the answer meets all the criteria

By the end of this lesson, children will be able to:

- solve a problem by identifying given facts and prioritising them;
- confirm that they have found the correct solution by checking in another way.

Vocabulary

sum add total row column double halve

Necessary prior knowledge

Add and subtract mentally
Number bonds for numbers up to 20
Recognise the use of a symbol to stand for an unknown number

Main teaching activity

Write the number sentence 10 + □ = 20 on the board. Read it together, saying: '10 plus something equals 20.' Ask the children to work in pairs to complete the number sentence on whiteboards.

Working in pairs can support children and gives opportunity for them to develop their reasoning skills.

If children find it difficult to understand the idea of a symbol representing a number, write the complete number sentences and cover numbers with shapes instead. Say that if there are three squares, the numbers underneath them are the same.

Q. How did you work it out?
Some children will know this as a double and others may have counted on from 10.
Repeat with other problems, e.g.
2 + 2 + 1 = □
□ + □ + □ = 15
♡ + △ = 10

This activity is preparing children for the main problem.

Q. How is this last one different?
Draw out that the symbols are different and so the numbers are different.

Ensure that children are using the mental strategy of looking for pairs of numbers that total 10.

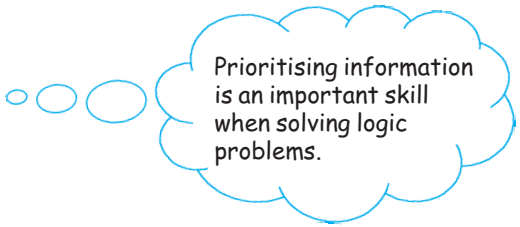
Q. Can we work out the answer? What could △ be? So what could ♡ be? Are there any other possibilities?

Write: △ + △ = 8
Q. What is △ ? If △ is the same number in ♡ + △ = 10, what is ♡ ?

Allow some time for children to 'get their heads around the problem'.

Show Activity sheet 1 and explain that each symbol represents a number and they have to find out what the numbers are.
Ask children to discuss in pairs how they might start to solve the problem.

Drawing together



If some children finish this quickly then set them the following problem.

Add one shape to each row so that each row has a different total, less than 25. Use each shape once.

Q. Which is the most important row or column? Why?
Agree that the column with the three triangles is the most important because it includes only one shape and the total was given and so we can find out what the triangle represents.
Write: △ + △ + △ = 6 and ask the children to work out what the triangle represents. Agree that it is 2.

Q. Which column or row should we try next? Why?
Agree that either the top row or the second row could be done next because in each the total is given and we know what the triangle represents.
Work through row 1. Write:
♡ + △ + ♡ = 12

Q. What is △?
Q. So if two hearts and a triangle make 12, what do two hearts make?
Write: ♡ + ♡ = 10
Agree that two hearts make 10, so one heart must be half of 10.
Q. So what does the heart represent? (5)

Q. Which row or column could help us to find the pentagon?
Q. Which row or column could you use to check the pentagon?
Agree that they could use column 1 or row 2 to find the pentagon and use the other to check.
Ask the children to find the pentagon and then to complete the missing totals.

  Ref: DfES 1386-2005 G

Establish that we now know what all the symbols represent and so the whole problem can be completed.
Ask the children to complete the grid.

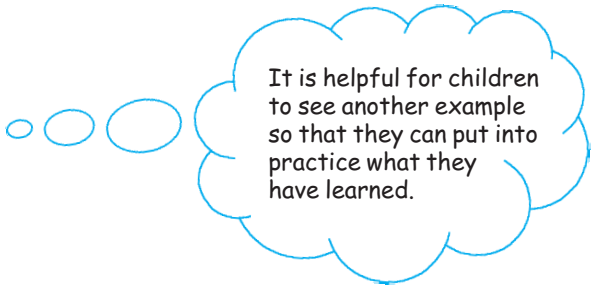
Plenary

Q. What information helped you to solve the problem?
Ask the children to discuss this in pairs.

Establish that they were given:
1. the total of three triangles so we could work out the triangle;
2. the total of only triangles and a pentagon so we could work out the pentagon;
3. the total of only hearts and a triangle so we could work out the heart;
4. the total of only hearts and a pentagon which we could use as a check.

Q. Could we have solved this problem without the total of three triangles?
Q. Did it matter whether we found the heart or the pentagon next?
Q. Did we need the other three clues?
Agree that we needed the first three clues, but the fourth total was useful as a check.

Show OHT 1 but cover the second and third cells in the third row with counters.
Q. Which shape should we work out first?
Q. What does a square represent? (10)
Ask the children to discuss in pairs which shape they should find next and which row or column is helpful.



Agree that the first row and column will help them to work out the circle and triangle.
Ask the children to do this and then to discuss in pairs which shapes are hidden by the counters.
Q. How did you know?

Conclude the lesson by saying that sometimes we are given lots of information and the most important part of the problem is deciding which information is most important so that we know where to start.

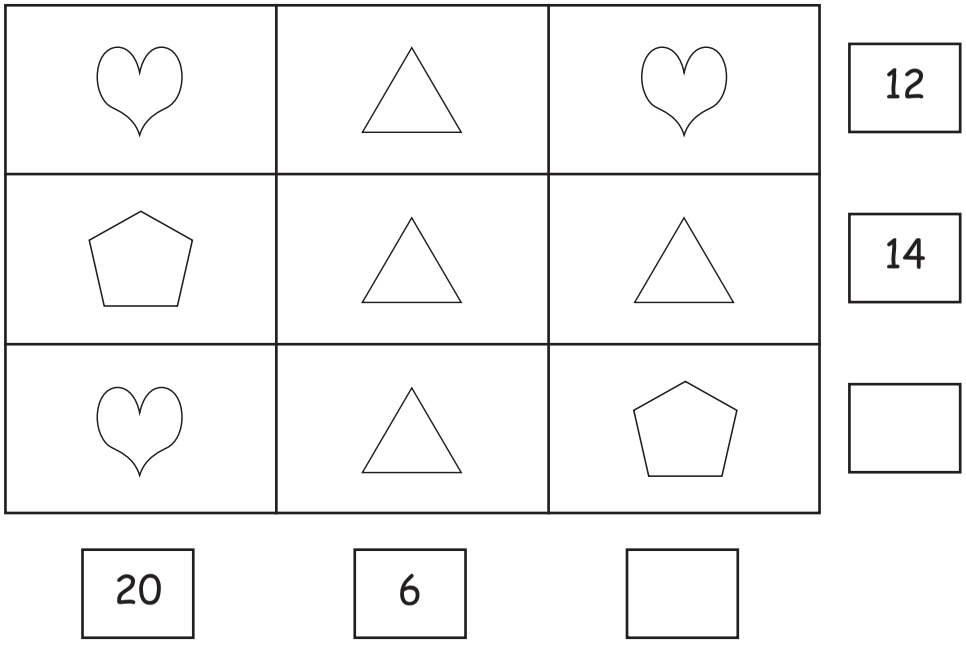
  Ref: DfES 1386-2005 G

Shape puzzle

Each shape stands for a number.

The numbers shown are the totals of the line of three numbers in the row or column.

Find out which number each symbol represents and find the other totals.

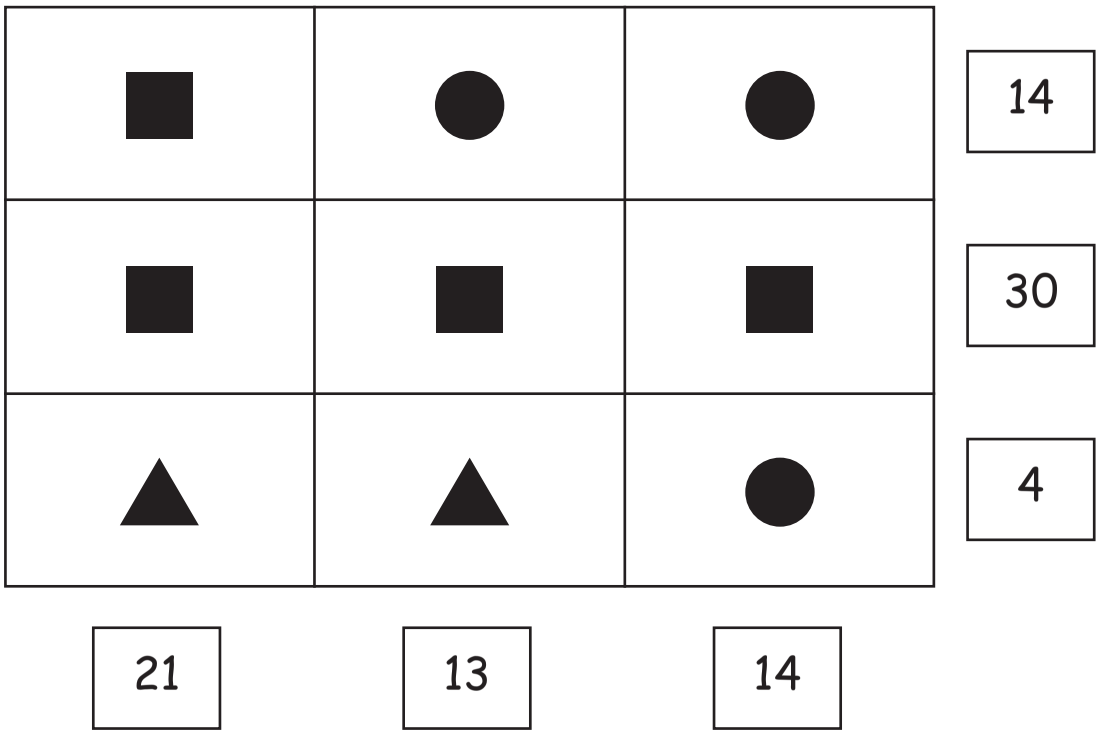


♡ =

△ =

⬠ =

Shape puzzle



Logic problems — Year 2 — Lesson 2

Sally's super sandwich shop

Sally runs a sandwich shop.

She gets a very muddled order for lunchtime sandwiches from the office next door.

Can you sort it out using the clues?

How many of each sandwich must Sally make for the office?

Sandwiches can be brown bread or white bread.

They can be cheese or salad.

We need 6 white bread sandwiches

We need 2 white bread sandwiches with cheese

We need 9 cheese sandwiches

We need double the number of brown bread salad sandwiches as white bread salad

Resources

- OHT 2
- OHT 3
- Resource sheet 1
- Activity sheet 2

Objectives

- Solve mathematical problems or puzzles, recognise and explain patterns and relationships, generalise and predict. Suggest extensions by asking 'What if . . . ?'
- Identify the given facts and prioritise them
- Use one piece of information in the problem and see what effect it has
- Look for any relationships and patterns in the information given
- Check that the answer meets all the criteria

By the end of this lesson, children will be able to:

- solve a problem by identifying given facts and prioritising them;
- use recording to help them make sense of the information given and to find missing information.

Vocabulary

total table number sentence

Necessary prior knowledge

Add and subtract mentally
Pairs of numbers which equal 20

  Ref: DfES 1386-2005 G

Main teaching activity

Remind children that in the previous lesson we used shapes to stand for mystery numbers.
Write the following problem on the board:

I have 20 apples. 6 apples are red. How many are green?

Q. Could we write this in a number sentence? Could we use symbols or shapes to help?
Ask children to discuss this in pairs and record their number sentences on their whiteboards. Ask a child who has used a symbol or empty box to explain the recording.

If no one used empty boxes ask a child to explain how they worked it out and model this using the empty box number sentences.

$6 + \square = 20$
$6 + 14 = 20$

I had 14 green apples.

Write the following problem on the board. Ask children to work in pairs and to record a number sentence.
I have 16 pens. Some are red and some are blue.
I have 9 red pens. How many blue pens are there?
Ask a child who recorded using an empty box to share this with the class.

$9 + \square = 16$
$9 + 7 = 16$

I had 7 blue pens.

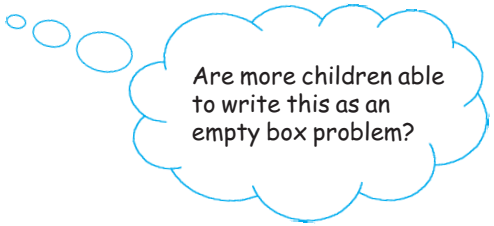
How is the paired work supporting teaching and learning?

This work is providing children with one strategy to solve the lesson's main problem.

Are more children able to write this as an empty box problem?

Write the following problem on the board. Ask children to discuss how they might work this out.

I have 24 cars. Some are large and some are small.
I have an equal number of large and small cars.
How many large cars are there?



Q. Which word in the problem is a key piece of information?

Agree that the word 'equal' was the key word and this means that the number of large cars is the same as the number of small cars. Ask children if they can record this as a number sentence.

□ + □ = 24

Q. How can we work out what □ is?
Agree that we can halve 24.

Main teaching activity

Show OHT 2 and read it together.

Q. What are the important parts of the problem?
Q. What are we asked to find out?

Ask children to talk about this in pairs.
Ask some children to come and highlight key words on the OHT such as 'how many', 'brown bread', 'white bread' and 'cheese or salad'.

Q. How many different sorts of sandwiches are there?
Agree that there are four.

Tell the children that they will work in groups of four to solve the problem. Show the children the clue cards and read them through together. Tell them that each child will have a clue card to read to their group. If the group has five children one child will record the work.

Show the children Activity sheet 2 and read this together. Explain that they should record their solution to the problem on this sheet.

Some children may benefit from using toy sandwiches from the role-play area.

Ask the children to work in their groups to solve the problem. Remind them of yesterday's lesson where we solved a problem and how we looked for a starting point to help us start the problem. We did not just guess the numbers but worked them out from the information we had.

While the children are working, look for the different ways in which children make a start to this problem.

Providing the children can read the clues, this activity may work well in mixed-ability groups.

Let the children have time to make a start on the problem and begin to complete some of Activity sheet 2.

This activity covers the group discussion and interaction strand of *Speaking, listening, learning.*

  Ref: DfES 1386-2005 G

Drawing together

After the children have made a start on the problem, draw them together to discuss their strategies.

Q. Which of the items on the list can we complete straight away?

Ask the children who have the relevant clue to show and read it.

Establish that we know that the office needs two white bread sandwiches with cheese. Say that we can fill this in on Sally's list.

Q. How many white bread sandwiches does the office need?

Ask the children who have the relevant clue to hold it up.
Establish that we know that the office needs six white bread sandwiches.

Q. What can we work out from these two pieces of information?

Establish that the total of white bread sandwiches is six. Write: $2 + \square = 6$
Agree that therefore there must be four white bread salad sandwiches because $2 + 4 = 6$.

Q. What kind of sandwiches do we need to find out about next?
Establish that we have found out all the white bread sandwiches and now we need to work out the brown bread sandwiches.

Ask the children to look at the two remaining clues to find out how many of each brown bread sandwich are needed, remembering to use the information they already have.

If children are finding it difficult to remember the four sorts of sandwiches, show them how to record the information using a table:

	Cheese	Salad	Total
White	2	?	6
Brown	?	?	?
Total	9	**?**	**?**

How is the problem-solving process supported by collaborative work and limiting the number of children recording?

Did the children realise that it was important to prioritise the clues and that some clues gave answers which are needed to complete other answers?

Encourage children to explain *and* use recording to help this on the whiteboard using number sentences.

Drawing together

Q. How do you know how many brown bread cheese sandwiches are needed? Which clue helped you find this out?

Ask the children who had this clue to show it and read it.
Ascertain that we know there are nine cheese sandwiches needed and there were two white bread sandwiches needed, therefore $2 + \square = 9$
There are seven brown bread cheese sandwiches needed.

Q. Which clue helped you find out the total of brown bread salad sandwiches needed?

Agree that the last clue did.
Q. Which other information did you use?
Agree that we needed to use the total of white bread salad sandwiches to work this out.

Show the top part of OHT 3, and ask the children to help you to fill in each part. Point out how this is similar to the shape puzzle in the previous lesson.

	Cheese	Salad	Total
White bread	2	4	6
Brown bread	7	8	15
Total	**9**	**12**	**21** altogether

While the children are engaged in this activity, listen for their reasoning and their ability to ask each other questions.

Encourage the use of number sentences when giving explanations.

  Ref: DfES 1386-2005 G

Rub out the numbers. Read the lower part of the OHT and ask which numbers you can put in straight away. Ask the children to work out the remaining information and to record it on Activity sheet 2.

Plenary

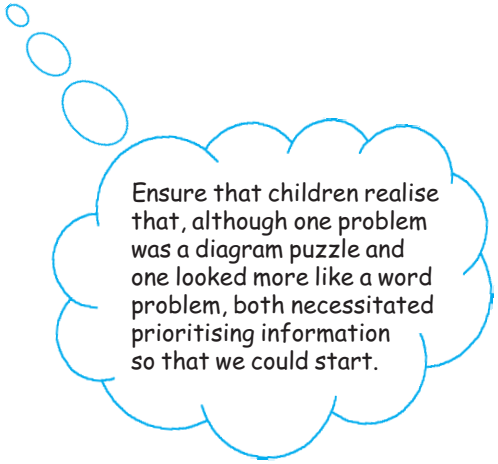
Q. Think about the information you used to solve the problems. Was it all in the clues?

Establish that some information was gained as we solved the problem. One piece of information helped us with the next part of the problem.

Q. How was this problem similar to the shape puzzle?

Point out how we had to read through the clues and decide where to start, just as in the previous lesson.

Say that in today's lesson we have used number sentences and a table to record our information and to help us work out the missing information. Ask the children to discuss which they found most helpful. Explain that some form of recording can often help us to solve problems by making the information clearer and easier to use.



Sally's super sandwich shop

Sally runs a sandwich shop.
She gets a very muddled order for lunchtime sandwiches from the office next door.

Can you sort it out using the clues?
How many of each sandwich must Sally make for the office?

Sandwiches can be brown bread or white bread.
They can be cheese or salad.

Sally's super sandwich shop

	Cheese	Salad	Total
White bread			
Brown bread			
Total			

The next day, the office asks for:

- 10 brown sandwiches;
- 6 cheese sandwiches;
- 5 cheese sandwiches on brown bread;
- Twice as many salad sandwiches as cheese sandwiches.

Logic problems

Year 2 Lesson 2

Resource sheet 1

Cut out a set of the following clues for each group of children.

Enlarge one set and cut out for the teacher to use.

We need 6 white bread sandwiches

We need 2 white bread sandwiches with cheese

We need 9 cheese sandwiches

We need double the number of brown bread salad sandwiches as white bread salad

You will need one A3 copy for the teacher and one A3 copy for each group.

Sally's super sandwich shop

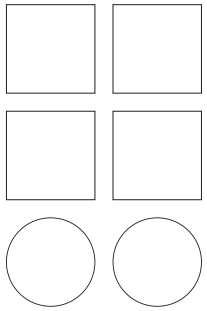
Sally makes a list.

	Day one	Day two
Number of white bread sandwiches with cheese Number of white bread sandwiches with salad Total white bread sandwiches		
Number of brown bread sandwiches with cheese Number of brown bread sandwiches with salad Total brown bread sandwiches		
Total number of sandwiches		

Logic problems — Year 3 — Lesson 1

Coloured shapes

What colour is each shape?
Write it on the shape.



Clues

- Red is not next to grey.
- Blue is between white and grey.
- Green is not a square.
- Blue is on the right of pink.

Resources

- OHT 1, from page 34 of *Mathematical challenges for able pupils in Key Stages 1 and 2* (ref. DfEE 0083/2000; NNS publication)
- Activity sheet 1
- Activity sheet 2

Objectives

- Solve mathematical problems or puzzles, recognise simple patterns or relationships, generalise and predict. Suggest extensions by asking 'What if . . . ?' or 'What could I try next?'

By the end of this lesson, children will be able to:

- solve a puzzle by identifying the facts and prioritising them;
- use one piece of information in the problem and see what effect it has;
- check that their solution meets all the criteria.

Vocabulary

position	right
next to	left
beside	check
above	facts
below	clues

Necessary prior knowledge

Positional language
Experience of using clues to help solve problems

Main activity

Explain to the children that they are going to solve a puzzle and that they are going to have some clues to help them.

Show OHT 1.

Q. Can you explain to a partner what you need to do?
Q. What have you got to find out?
Q. Where are you going to start?
Q. Why do you think that?
Q. What do you know?

Ask children to share their responses to the above questions with a partner, explaining their reasoning, before taking feedback.

The use of manipulatives, six squares and six circles, one of each shape in red, blue, green, white, grey and pink on an interactive whiteboard would help you to test children's ideas.

Give out Activity sheet 1. Ask children to work in pairs and to begin working on the puzzle. Say that children can cut out the words to help them begin to solve the problem.

Drawing together

When the children have worked on the problem stop them to ask them their strategies.

Q. Which clues gave you a good place to start?
Q. What do we know about the position of blue? (It is between white and grey and on the right of pink.)

Agree that two clues tell us about the blue shape and if we put them together we know it is in the middle row on the right.

If children finish quickly, you could ask them to write other clues that would help children to solve the puzzle.

Allow enough time for children to talk about their ideas.

While children are engaged in this activity, listen for their reasoning for choosing a starting clue as exemplification.

How is the paired work supporting the children?

Discuss what this tells us, and how we can work out which shape is blue.

Q. What other colour do we now know?
Draw out that we will need to check this, as one piece of information affects another.

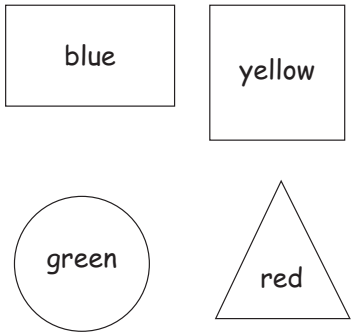
Q. What do you know about the green shape?
At this point establish that an '… is not …' clue can give information and that 'Green is not a square' tells us that it must be a circle.

Ask children to continue with solving the rest of the puzzle.
Q. Is your solution the same as that of another pair on your table?

Drawing together

Share the solution and point out how using some clues enabled us to use other clues to place the remaining colours.

Draw the following shapes on the board:



Q. What clues would you write to help someone to solve this puzzle?
Q. Could you think of a '… is not …' clue that gives us useful information?

Ask the children to discuss this in pairs, jotting down one or two clues to try out.

Record some suggestions from the children and discuss how much information these give.

Depending on how confidently pairs or groups of children approach this, you may decide to give Activity sheet 2 to some children.

Q. Is there a clue that would be a good one to start with? Why?

Explain to the children that they are to use these four shapes and colours to create their own puzzle. They should use the same arrangement of shapes, but choose their colours.

Ask children to write enough clue cards to make sure that someone else could completely solve the puzzle.

Follow their conversations to assess children's understanding, using questions such as 'How does this clue affect another clue?' 'Why do you think that?'

Drawing together

Q. What is the least number of clues you need to solve the puzzle?
Q. What if we could only use three clues – what might they be?

'What if . . . ?' questions provide useful extensions to problems.

Establish that the puzzle could be solved using only three clues, but that there are lots of possible clues that could be written.

Ask children to choose three clues that someone else could use to completely solve their puzzle.

Plenary

Select and record examples of children's clue statements on the board .

Use these to develop children's evaluation of each other's work by asking children to try out other children's clues and asking questions such as:

Children evaluating each other's work will give them opportunities for self-assessment.

Q. Which clues should we use first?
Q. How helpful is this clue? Does it work?
Q. Is this a good clue for helping us to solve the puzzle? Why is that so?
Q. Could you change it to make it better? How would you do that?
Q. What difference does this make to the problem?
Q. Could we solve this problem using only two clues? If so, how might we use the other clues?

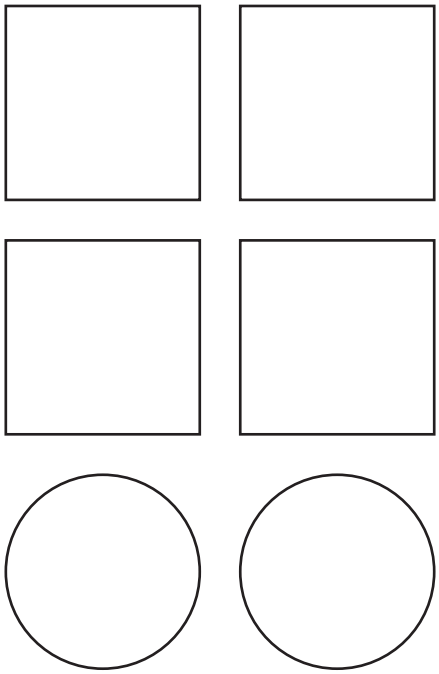
Draw out strategies that are useful for solving other logic problems rather than only focusing on the problems solved in the lesson.

Agree that we can use them to check our solution.

Ask children to reflect on how they solved the puzzles in this lesson. Draw out that, once they had read the clues, they didn't work through them in order but selected which ones were most useful to use first. Placing some colours enabled them to then use the other clues to solve the problem. Point out the importance of checking the solution against the clues to check that it meets all the criteria.

Coloured shapes

What colour is each shape?
Write it on the shape.



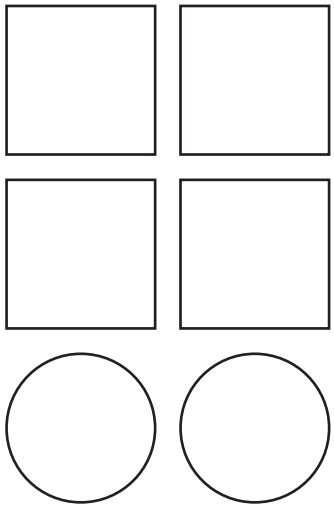
Clues

- Red is not next to grey.
- Blue is between white and grey.
- Green is not a square.
- Blue is on the right of pink.

(from page 34 of *Mathematical challenges for able pupils in Key Stages 1 and 2.* Ref. DfEE 0083/2000; NNS publication)

Coloured shapes

What colour is each shape?
Write it on the shape.



Clues

- Red is not next to grey.
- Blue is between white and grey.
- Green is not a square.
- Blue is on the right of pink.

Red	White	Grey
Blue	Pink	Green

Logic problems

Year 3 Lesson 1

Activity sheet 2

. . . . . is not a triangle.

. . . . . is on the right of . . . . . .

. . . . . is above . . . . . .

. . . . . is not a circle.

Logic problems — Year 3 — Lesson 2

Rebecca's favourite school day

Monday	Maths	Literacy	Lunchtime	Science	ICT in the ICT room
Tuesday	Science	Literacy		Maths	Art
Wednesday	Literacy	Maths		Swimming	History
Thursday	RE / PE	Maths		Literacy	Music
Friday	Literacy	Maths		Geography in Mr Singh's room	PE

Rebecca's clues

- Maths is her favourite subject.
- She prefers to do maths in the morning.
- She doesn't like PE other than swimming.
- She prefers to be in her own classroom at the end of the day.

Resources

- OHT 2
- Resource sheet 1
- Resource sheet 2

Objectives

- Solve mathematical problems or puzzles, recognise simple patterns or relationships, generalise and predict. Suggest extensions by asking 'What if…?' or 'What could I try next?'

By the end of this lesson, children will be able to:

- solve a puzzle by identifying the facts and prioritising them;
- use one piece of information in the problem and see what effect it has;
- check that their solution meets all the criteria.

Vocabulary

timetable clue

Necessary prior knowledge

Reading simple timetables
Using clues to solve problems

  Ref: DfES 1386-2005 G

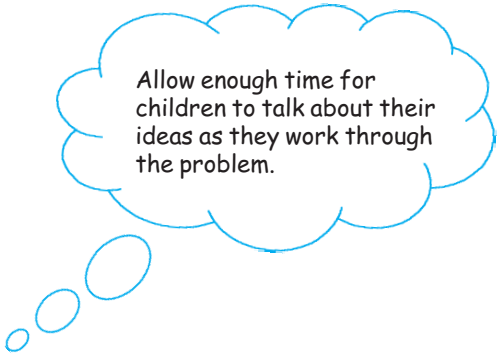
Main teaching activity

Show OHT 2 and explain that this is a class timetable.

The amount of discussion will, of course, depend on children's familiarity with timetables.

Q. What lesson is first on Monday?
Q. Which lessons are mainly in the mornings?
Q. Which lessons only happen once a week?

Say that Rebecca has a favourite day at school and that she has written clues to help you work out which day it is. Read through the clues together.



Q. Which clues help us to eliminate certain days?
Q. Which clues help us to eliminate more than one day?
Q. What happens when we put these clues together?
Q. Are there any useless clues?

Agree that the first clue is unhelpful as maths is on the timetable every day. Work through the problem together, crossing out days as they are eliminated by clues. Agree that Rebecca's favourite day is Wednesday. Check through each clue to make sure.

Mixed-ability grouping may help to ensure fuller support and engagement. This activity covers the group discussion and interaction strand of *Speaking, listening, learning*.

Give out Resource sheet 1. Explain that the children will work in groups of four.

Each person in the group will have a different clue which they cannot show to the rest of their group, but can read as many times as needed and others can ask them questions about their clue.

Give each group a set of clue cards from Resource sheet 2. Ask children to work in their groups to find Sam's favourite day.

One member of the group could be responsible for recording and editing the solution as they work through, but only with the agreement of the whole group.

Drawing together

Q. How is your group managing to keep track of the possible activities that fit the clues?

While children are engaged in this activity, listen for their reasoning and their ability to ask each other questions to clarify information.

Remind children about the previous lesson, about how one piece of information affects another, and the need to re-check that the choices still fit all of the criteria so far.

Q. How does another clue help you cross off some of your choices?

Ask the children if they could order the clues to see if they could solve the problem more quickly, putting the key information first.

Q. Which clue or clues gave you a good place to start?
Q. What does a 'key' clue do?
Establish that these clues give a good starting point or reduce the number of possible choices.

How is the problem-solving process supported by the collaborative work and limiting the number of children recording the possible solutions?

Using the same timetable ask the children to rearrange or change Sam's favourite day.

  Ref: DfES 1386-2005 G

They should then write three or four clues so that someone else could find Sam's favourite day.

Remind the children to 'try it out' to check that their clues work.

Q. Can you think of a 'Sam does not . . . ' clue that gives useful information?
Q. Can you think of a 'key' clue?
Q. If you use your clues in a different order, how does it change how quickly you can solve the problem?

Plenary

Select and record, on a board, examples of a group's clue statements.

Use these to develop children's evaluation of each other's work by getting them to try out each other's clues and asking questions such as:

Q. How helpful is this clue?
Q. Does it work?
Q. Is this a good clue for helping us to solve the problem?
Q. Why is that so?
Q. Could you change it to make it better?
Q. How would you do that?
Q. What difference does this make to the problem?

Rebecca's favourite school day

Monday	Maths	Literacy	**Lunchtime**	Science	ICT in the ICT room
Tuesday	Science	Literacy		Maths	Art
Wednesday	Literacy	Maths		Swimming	History
Thursday	RE / PE	Maths		Literacy	Music
Friday	Literacy	Maths		Geography in Mr Singh's room	PE

Rebecca's clues

- Maths is her favourite subject.
- She prefers to do maths in the morning.
- She doesn't like PE other than swimming.
- She prefers to be in her own classroom at the end of the day.

Logic problems

Year 3 Lesson 2

Resource sheet 1

Monday	Maths	Literacy	**Lunchtime**	Science	ICT in the ICT room
Tuesday	Science	Literacy		Maths	Art
Wednesday	Literacy	Maths		Swimming	History
Thursday	RE / PE	Maths		Literacy	Music
Friday	Literacy	Maths		Geography in Mr Singh's room	PE

Logic problems

Year 3 Lesson 2

Resource sheet 2

One copy for each group

Sam likes maths after literacy.

Sam likes maths before lunchtime.

Sam enjoys PE.

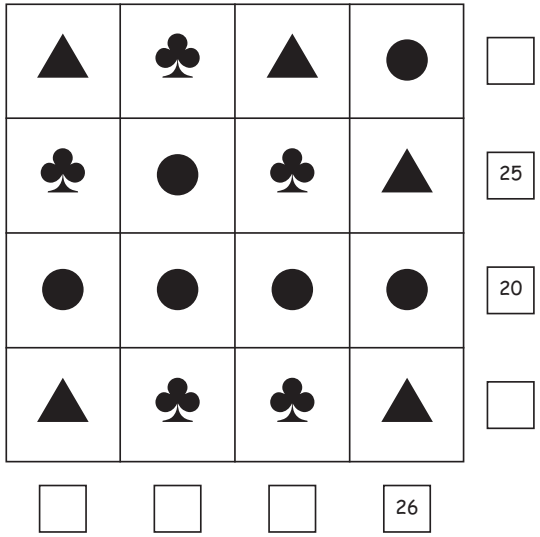
Sam doesn't like to always work in his classroom.

Logic problems — Year 4 — Lesson 1

Shape puzzle

Each shape stands for a number.

The numbers shown are the totals of the numbers in the row or column.



Find the totals of the remaining rows and columns.

Resources

- OHT 1
- Activity sheet 1

Objectives

- Solve mathematical problems or puzzles, recognise and explain patterns and relationships, generalise and predict. Suggest extensions by asking 'What if . . . ?'
- Identify the given facts and prioritise them
- Use one piece of information in the problem and see what effect it has
- Look for any relationships and patterns in the information given
- Check that the answer meets all the criteria

By the end of this lesson, children will be able to:

- solve a problem by identifying and prioritising given facts and information;
- use what they know about the structure of a problem to create one of their own.

Vocabulary

sum	add	total	row
column	double	halve	

Necessary prior knowledge

Add and subtract mentally
Recognise the use of a symbol to stand for an unknown number

  Ref: DfES 1386-2005 G

You could use a spreadsheet to create a 4 × 4 grid of numbers covered by shapes, entering the sum of each row and column at the ends. Hiding the formula bar and writing the numbers in white will prevent the children from seeing what you have entered.

Main teaching activity

Display OHT 1 and explain that each of the three shapes represents a different number. Say that each row and column has a particular total. Ask children to discuss in pairs which three totals would be useful to know and why.

Q. If the total of the third row was 12 what would you work out?
Q. If the total of the fourth column was 16 what would you work out? How?

Write ● + ● + ● + ● = 12
● = 3
● + ▲ + ● + ▲ = 16
3 + ▲ + 3 + ▲ = 16
so ▲ + ▲ = 10
so ▲ = 5

Give out Activity sheet 1 which shows the totals of some of the rows and columns.

Q. Are these three totals helpful?
Q. Do you have enough information to solve this problem?

Ask children to work in pairs to solve the problem on Activity sheet 1. Suggest that they record number sentences if they find it helpful.

How is the paired work helping the children?

The aim here is to focus the children on the important information.

While children are working, look for examples that show different ways of recording to use as exemplification later. You may want to observe and interact with one particular group.

Drawing together

Which children can explain their reasoning?

Q. What are the values of ▲, ● and ♣? (8, 5 and 6) Ask the children to write totals of each row and column on the OHT.
Q. How did you solve the problem?
Q. Which was the most important row or column?
Q. Why was it the most important?

Establish that the row with four circles was the most important because the total was given and there was only one shape.

Q. What calculation did you have to do to establish what ● was?

Agree that they needed to divide 20 by 4.

Q. Which column or row did you do next? Why?

Establish that the fourth column, which contained two circles and two triangles, was the next column to prioritise.

Q. What calculations did you do to find out the value of ▲?

Do any children write calculations on their boards using the shapes? e.g. ▲ + ▲ + 5 + 5 = 26

Ask the children to show their recording.

Q. How did your recording help?

Suggest that recording can help to make the problem clearer.

  Ref: DfES 1386-2005 G

Q. What did you do next?
Q. Why were you now able to solve the whole problem?
Q. How many pieces of information were you given at the start of the problem?
Q. What information was it?

Establish that in order to solve the problem the following information was used:
- a total given for one whole row or column which had identical shapes;
- a total given for one row or column which had only two shapes, one of which could be found from above;
- a total given for a row or column that contained the third shape.

Ask the children to make a shape puzzle for a friend to solve, using a three by three grid and three different shapes.

Q. What is the least number of totals that you can give a friend so that they can solve your puzzle?

Children will need to have a good understanding of these rules before they can create their own puzzles.

Plenary

It is not possible to solve a problem with three shapes without three pieces of information.

Q. Has anyone created a puzzle that only provides one or two totals? Why do you think this wasn't possible?

Display a shape puzzle that one child has created. Solve the puzzle together.

Q. How many pieces of information did Sharon give us?
Q. Which was the most important?
Q. Could we solve the problem if we took one piece of information away?

While the children are working, look for examples that have tried to give limited information. These can be used in the plenary.

  Ref: DfES 1386-2005 G

Choose a child's puzzle with more than three totals (or add a total to one with only three).

Q. Do we need all of these totals? Which are the most important? Even if we don't need more than three totals, how could you use the extra one(s)?

Agree that they could be used for checking.

Reflect on the way the problems were solved.

Q. Did we just start at the top and work our way down? Why not?

Establish the need to identify and prioritise information to solve a problem.

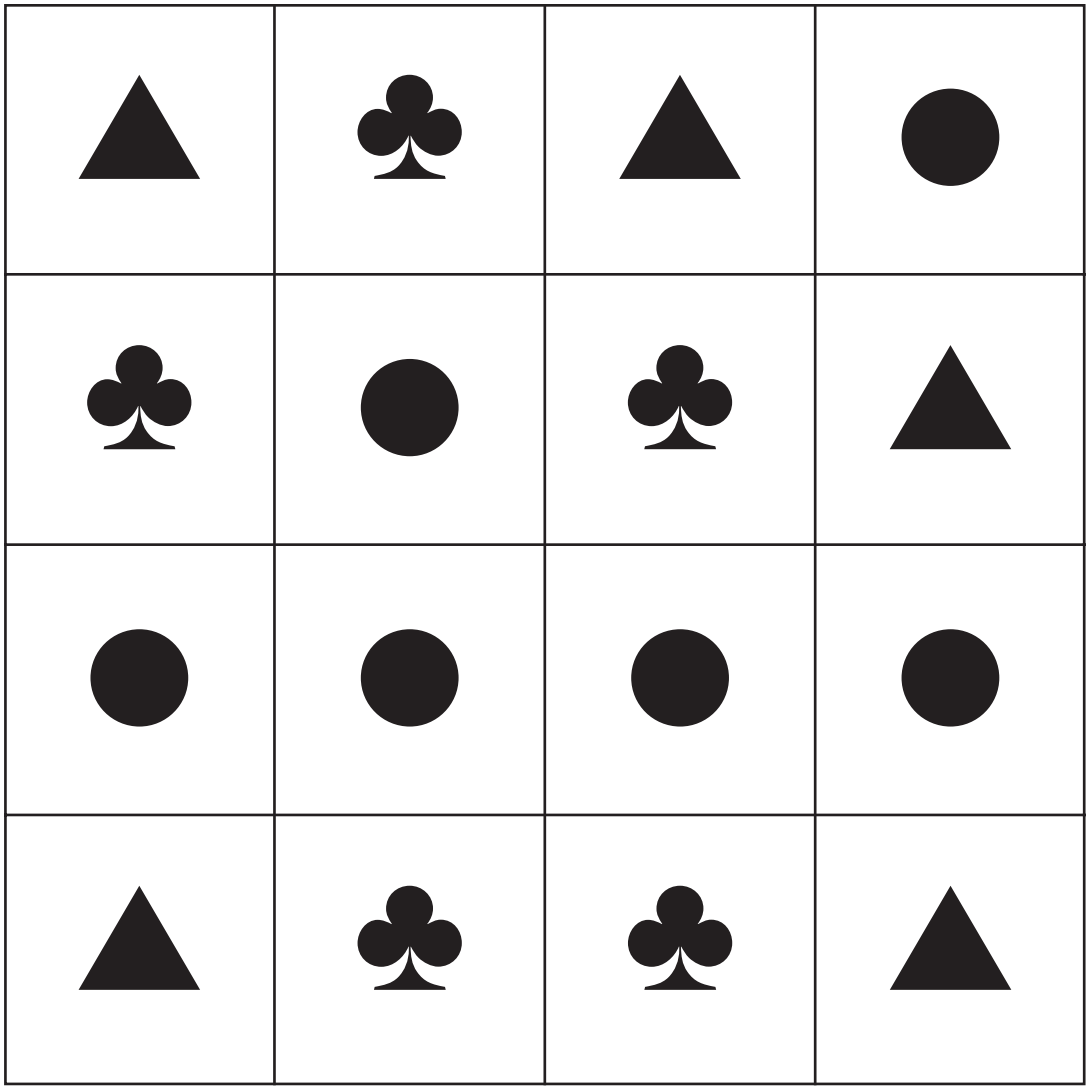
Set homework task: Make a shape puzzle for a friend to solve, use a four by four grid and three different shapes. What is the least number of totals that you can give a friend so that they can solve your puzzle?

The plenary will provide a valuable opportunity for children to evaluate each other's puzzles and to generalise their strategies by looking at several examples. It may be useful to allow more time for the plenary than normal.

  Ref: DfES 1386-2005 G

Shape puzzle

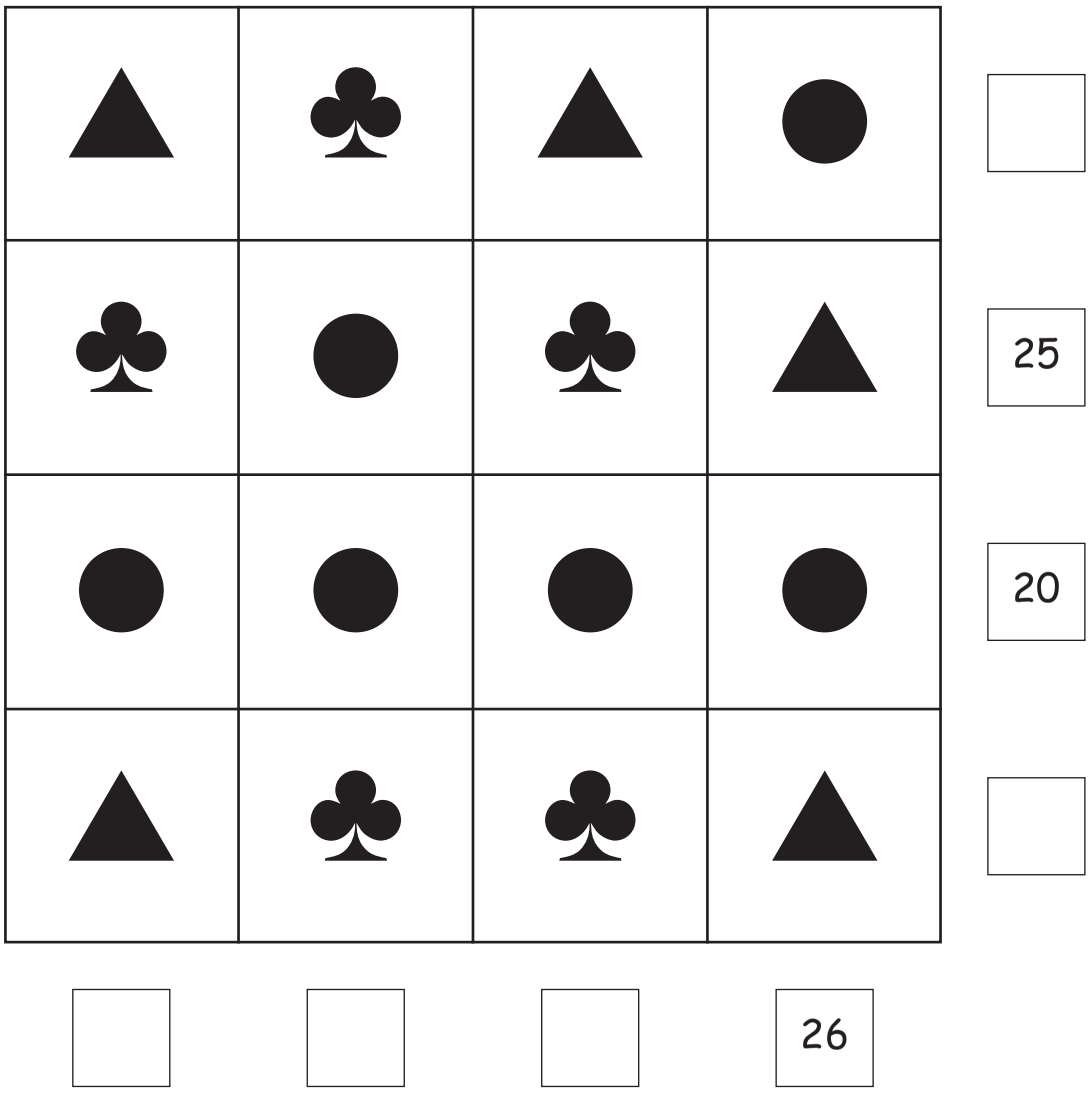
Each shape stands for a number.



Shape puzzle

Each shape stands for a number.

The numbers shown are the totals of the numbers in the row or column.



Find the totals of the remaining rows and columns.

Logic problems Year 4 Lesson 2

Numbers of boys and girls

Use these clues to find the number of boys and girls in each class.

There are a total of 114 children in the school.

There are 14 girls in Class 2.

Class 4 has twice as many girls as class 2.

There are 52 boys in the school in total.

In class 1 there are half as many boys as in class 2.

In class 2 there are a total of 30 children.

In class 3 there are an equal number of girls and boys.

In class 4 there are 10 boys.

There are a different number of boys and girls in the school.

There are a different number of boys and girls in the school.

Resources

- OHT 2
- Activity sheet 2
- Resource sheet 1
- Mini-whiteboards

Objectives

- Solve mathematical problems or puzzles, recognise and explain patterns and relationships, generalise and predict. Suggest extensions by asking 'What if . . . ?'
- Identify the given facts and prioritise them
- Use one piece of information in the problem and see what effect it has
- Look for any relationships and patterns in the information given
- Check that the answer meets all the criteria

By the end of this lesson, children will be able to:

- solve a problem by checking possible solutions against given criteria;
- solve a problem by identifying and prioritising given facts and information.

Vocabulary

sum	row	double	total
add	column	halve	

Necessary prior knowledge

Add and subtract mentally
Add and subtract using informal paper and pencil procedures

  Ref: DfES 1386-2005 G

Main teaching activity

Display OHT 2, a table that shows the number of packed lunches and school dinners eaten by a class during one week.

Ask a range of questions about the table, with children working in pairs and responding on individual whiteboards.

Q. How many children ate a school dinner on Tuesday?
Q. How many children ate a packed lunch? How do you know? (Show how to record this as 17 + □ = 30)
Q. How many children ate lunch on Monday?
Q. What was the total number of school dinners eaten over the week? What do you need to work out first?

A laminated copy of the table will allow the children to edit their work as they solve the problem.

Give out Activity sheet 2 and read through the problem with the class.

Explain that they are going to solve the problem by working as a group and that they will be having a set of clue cards to help them.

Mixed-ability grouping may help to ensure fuller support and engagement.

Split the class into mixed-ability groups of six. Each group will need an enlarged copy of the blank table (Activity sheet 2) and a set of 10 clue cards (from Resource sheet 1). Each group must choose a scribe who will enter the information onto the table. The other five children should each have two clue cards that they need to read to the group. The group needs to decide what to do with each clue card.

How is the paired work helping the children?

This activity is not intended to develop problem-solving skills. Its purpose is to ensure that children can read information from a table so that they are able to enter data in their own table later in the lesson and use this to work out the missing information.

While children are engaged in this activity, listen for their reasoning skills and their ability to ask each other questions to clarify information. Also look for recording that might be useful to show for plenary.

This activity covers the group discussion and interaction strand of *Speaking, listening, learning.*

  Ref: DfES 1386-2005 G

Drawing together

Remind the children of the shape puzzle that they solved in the previous lesson. To solve the problem they needed to prioritise information and see how one piece of information affected another.

Q. In this problem, which clues are the most useful? Why?
Establish that some clues enable children to put information directly into the table without needing any other clues or doing any calculations.

Q. Which clue is least useful?
Agree that 'there are different numbers of boys and girls in the school' is the least useful and is only helpful as a check.

Q. Have you been able to put the clues into any order?
Q. How does one piece of information in a clue help you identify other facts?

Allow the groups to continue to solve the problem.

Give the groups time to make a start on the problem before drawing them together for a mini-plenary.

How is the problem-solving process supported by collaborative work and limiting the number of children recording the solution?

How is the collaborative group work helping particular children? Are the mixed-ability groups working?

  Ref: DfES 1386-2005 G

Plenary

Complete the table as a class on a blank copy of the grid.

Q. Which information can we put in first?
Q. Is there any part of the table that we can complete now?
Q. We know that there are 30 children in class 2 and 14 of them are girls, so how many boys are there in class 2? What calculation did you need to do? Did anyone use recording to make this clear?

Draw out: 14 + □ = 30

Give the opportunity for children to explain their reasoning to the class. They will have been able to rehearse this in their groups and so should be more confident in their explanations.

Q. Which clue can we use next?

Continue to ask children to help you to work through the problem, encouraging them to explain how one clue and piece of information affects other information.

Once the table has been completed ask questions to encourage children to solve 'what if …?' problems and to create their own.

Q. If three girls joined class 2 which clues would be changed?
Q. If five boys join class 3, then which clues would need to be altered?
Q. What clues could you create instead?

Ensure that children realise that the strategies used to solve this problem can be used to solve other similar problems.

Point out that one piece of information often affects others in this type of problem, and that the shape puzzle and this word problem are quite similar. In each case, we needed to prioritise clues/information rather than trying to work through them in order.

Lunches in Year 4

	Mon	Tues	Wed	Thurs	Fri
Packed lunch	14		20	14	
School dinner	16	17			10
Total		30	29	27	30

Activity sheet 2

A group of children are doing some data handling and they need to find out how many boys and girls there are in each class. They have asked 10 different people who did not know all of the answers but did give them some pieces of information. Can you help the group complete the table using the clues they have?

Numbers of boys and girls

	Class 1	Class 2	Class 3	Class 4	Total
Girls					
Boys					
Total					

Resource sheet 1

Numbers of boys and girls

Use these clues to find the number of boys and girls in each class.

There are a total of 114 children in the school.

There are 14 girls in Class 2.

Class 4 has twice as many girls as class 2.

No class has the same number of children.

There are 52 boys in the school in total.

In class 1 there are half as many boys as in class 2.

In class 2 there are a total of 30 children.

In class 3 there are an equal number of girls and boys.

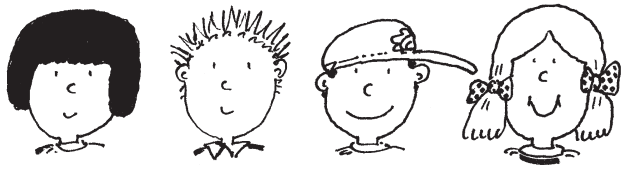
In class 4 there are 10 boys.

There are a different number of boys and girls in the school.

Logic problems — Year 5 — Lesson 1

Nicknames

Dawn, Mark, Josh and Tina are friends.



They each have a nickname.
Their nicknames are Spider, Curly, Ace and Fudgy, but not in that order.

What is the nickname of each of the friends?

Clues

- Josh plays tennis with Curly and goes swimming with Ace.
- Tina has been on holiday with Curly but travels to school with Fudgy.
- Spider, Curly and Dawn play in the football team.
- Spider sometimes goes to tea with Josh.

Resources

- OHT 1, from page 57 of *Mathematical challenges for able pupils in Key Stages 1 and 2* (ref. DfEE 0083/2000; NNS publication)
- Resource sheet 1
- Mini-whiteboards

Objectives

- Solve mathematical problems or puzzles, recognise and explain patterns and relationships, generalise and predict
- Suggest extensions by asking 'What if . . . ?'
- Identify the given facts and prioritise them

By the end of this lesson, children will be able to:

- use one piece of information in the problem and see what effect it has;
- use a recording system to organise the given information;
- check that the answer meets the criteria.

Vocabulary

prioritise relationships table

Necessary prior knowledge

Experience of checking a solution against the criteria
Experience of asking questions to clarify the problem
Understanding how one piece of information affects another in the problem

  Ref: DfES 1386-2005 G

The problem could be presented on the interactive whiteboard or on an OHT.

Organise the children so that they can move into groups of four.

Main teaching activity

Display OHT 1 to the class and read through the information given.

Check that children understand what the problem is asking them to do, i.e. to match the nicknames to the children.

Ask four children to come to the front and give them each a whiteboard. Ask them to each write one of the four children's names on the whiteboards and the four children's nicknames. Say that we will cross out nicknames on the whiteboards as we work out the clues.

Q. What does each statement tell us about the nicknames?

Statement 1 – we know that Josh cannot have the nickname Curly or Ace.
Statement 2 – we know that Tina cannot have the nickname Curly or Fudgy.
Statement 3 – we know that Dawn cannot have the nickname Spider or Curly.
Statement 4 – we know that Josh cannot have the nickname Spider.

Q. Which child do we have most information about?
Agree that we know most about Josh. Ask children to discuss in pairs what nickname he could have. Agree that the first statement tells us that Josh's nickname is not Curly or Ace, so we can cross these out. The last statement tells us that his nickname is not Spider, so we can cross out Spider. These clues together tell us that his nickname is Fudgy.

Ask children to look at the other clues and choose another child about whom we have quite a bit of information.

To develop children's thinking it may be necessary to encourage them to think about the 'not' elements that are implicit in the positive language of the statements, i.e. 'Josh plays tennis with Curly and goes out swimming with Ace', therefore Josh cannot have either of those two names as a nickname.

Continue working through the clues until only one nickname remains on each board. For example, the third statement tells us that Dawn cannot be Spider or Curly; as Josh is Fudgy, she must be Ace.

Check the solution against the criteria. (Dawn is Ace, Mark is Curly, Josh is Fudgy and Tina is Spider.)

Q. How else could we organise and record the information?
Ask children to discuss this in pairs and to use their whiteboards to show their suggestions.

Look for the children who are recording the information systematically, e.g. in a table, or look for different ways of working to use as exemplification.

Ask children to share some of their suggestions for recording and organising the information. Emphasise the systematic examples that you might have identified in your observations around the class.

This can provide an opportunity to model the language associated with thinking through a logic problem of this type, e.g. if Josh spends time with Curly and Ace then these cannot be his nicknames.

If no one has used a table, demonstrate how you could use one to organise the information. Draw the following grid. Discuss and question the children about how you would organise the information that you have.

The children may have used a table to organise the criteria in the problem. If not, begin to demonstrate how you would organise the criteria in a table so that a solution was clear and could be checked, and relationships between the criteria are represented visually.

	Spider	Curly	Ace	Fudgy
Josh	✗	✗	✗	✓
Tina				
Dawn				
Mark				

The table is an efficient way to represent a solution to this type of logic problem as it can illustrate both the negative and positive aspects of the criteria.

Share your thinking with the children as you insert the ✓and ✗.

  Ref: DfES 1386-2005 G

You may wish to give a prepared table to some children.

	Tuna	Salad	Cheese	Chicken
Jenny				
Sarah				
Ranjit				
Paul				

This activity can support the group discussion and interaction strand of *Speaking, listening, learning*. It could also highlight the children's abilities to work in a collaborative way, e.g. Do they share out the statements? How do they approach sharing the information they are working with?

Explain that they will have the chance to use the idea of a table in a similar problem to see if they find it helpful.

Give out Resource sheet 1.

Q. Which clues do you think would be good to use as a starting point for this problem?

Ask children to work in pairs to solve the problem and suggest they draw a table to help them.

Plenary

Agree the solution: Jenny chose salad, Sarah chose chicken, Ranjit chose cheese and Paul chose tuna.

Ask children to share how they solved the problem.
Q. Which clues did you work with first? Why?
Q. Which child did you not have any clues for? Did this matter? Why not?
Agree that although we had no clues about Paul, tuna was the only filling left.

Q. Did you find the table useful?
Suggest that some form of organised recording helps us to keep track of our thoughts.

Q. What advice would you give someone else who was trying to solve a similar problem?

Draw out prioritising information, looking at the effect of one clue on another, using a recording system and checking the solution against all the clues.

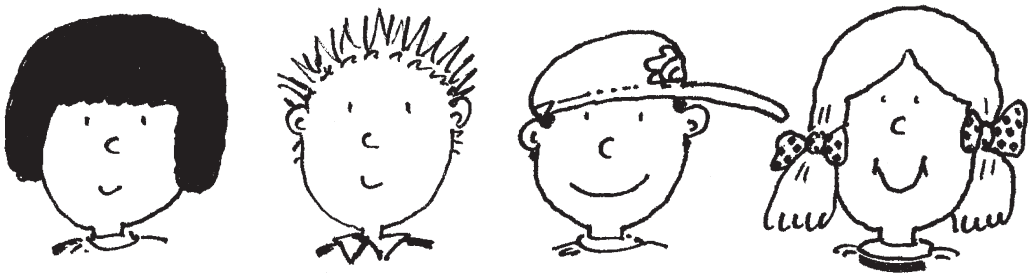
Giving a similar problem should give children an opportunity to put into practice what they have learned. Are they prioritising the criteria? Are they looking at the effect of one clue on another? Do they check their solutions against all the clues?

It is important that children recognise that the strategies they used to solve this problem can be used to solve other problems.

  Ref: DfES 1386-2005 G

Nicknames

Dawn, Mark, Josh and Tina are friends.



They each have a nickname.
Their nicknames are Spider, Curly, Ace and Fudgy, but not in that order.

What is the nickname of each of the friends?

Clues

- Josh plays tennis with Curly and goes swimming with Ace.
- Tina has been on holiday with Curly but travels to school with Fudgy.
- Spider, Curly and Dawn play in the football team.
- Spider sometimes goes to tea with Josh.

(from page 57 of *Mathematical challenges for able pupils in Key Stages 1 and 2.* Ref. DfEE 0083/2000; NNS publication)

Logic problems

Year 5 Lesson 1

Resource sheet 1

Sarah, Jenny, Ranjit and Paul each choose a sandwich filling. They can choose from:

- tuna,
- salad,
- cheese, or
- chicken.

Each child chooses a different filling.

Clues

- Sarah doesn't like fish.
- Jenny cannot eat dairy products.
- Ranjit does not eat meat or fish.
- Jenny doesn't like tuna or chicken.

Which sandwich filling does each child choose?

Logic problems Year 5 Lesson 2

Tea for two

Sally, Amy, Sita and Philippa plan to meet for lunch, but they have not been able to all meet on the same day.
Sally is unable to meet on Tuesdays, Wednesdays or Saturdays.
Amy is free to meet on Mondays, Wednesdays and Thursdays.
Sita has to go to work on Mondays and Thursdays.
Philippa can be available on Mondays, Tuesdays and Fridays.
They all want to spend time at home on Sundays.

Can each pair find a day on which to meet for tea?
Are there any days when none of them can meet?
Are there any days when more than one pair can meet up?

Resources

- OHT 2
- Resource sheet 2, cut up
- OHT 3

Objectives

- Solve mathematical problems or puzzles, recognise and explain patterns and relationships, generalise and predict
- Identify the given facts and prioritise them

By the end of this lesson, children will be able to:

- use one piece of information in the problem and see what effect it has;
- choose and use a recording system to organise the given information independently;
- check that the answer meets the criteria;
- use appropriate language that is associated with this type of logic problem, e.g. 'If this … then this will change …'.

Vocabulary

prioritise relationships

Necessary prior knowledge

Experience of checking a solution against the criteria
Experience of asking questions to clarify the problem
Understanding how one piece of information affects another in the problem

  Ref: DfES 1386-2005 G

Main teaching activity

The problem could be presented on the interactive whiteboard or using OHT 2.

Remind children about the lesson 'Nicknames'. In that lesson the focus was about organising and prioritising the information and trying to record it in a way that could exemplify our reasoning and thinking.

The aim of this part of the lesson is for children to be working more independently in order to interpret the statements, prioritise them and begin to create a recording system that will demonstrate their thinking about the information.

It would be helpful to display the key strategies that the children summarised in the plenary of lesson 1 to support some of them.

Introduce the new problem 'Tea for two'. Ask the children to read the problem. Ask them to discuss the problems in pairs, using the following questions as prompts.

Q. What is similar or different about this problem?
Q. What strategies will you use to start this problem?

Drawing together

Compare children's ideas to the strategies they focused on in the first lesson.

Share children's ideas about this problem.

This activity can support the group discussion and interaction strand of *Speaking, listening, learning*. It could also highlight the children's abilities to work in a collaborative way, e.g. Do they share out the statements? How do they approach sharing the information they are working with?

Check that children understand what the problem is asking them to do, i.e. find out which days the people can meet for tea.

Explain to children that they are going to think about this problem collaboratively. The group will need to have a set of the statements on separate pieces of paper that can be distributed around the group (prepared from Resource sheet 2). Each person needs to interpret their statement and reveal to the group what they think it is telling them. The group should then begin to decide what they could do to solve the problem, including what recording they might use.

Children could work in mixed-ability groups in order to develop the group interaction and encourage all of the children to be involved in the thinking, discussing and prioritising of information.

Ask children to begin work on the problem.

  Ref: DfES 1386-2005 G

Drawing together

This opportunity for sharing could be developed by asking a member of each group to move to another group to describe and discuss their group's recording methods.

Ask groups to describe their approaches to organising themselves and recording the criteria. For example, they may have taken one clue each, or the role of one of the characters.

The sharing of the recording approaches can help children to refine their own ideas and see examples of more efficient recording methods.

Q. What form of recording have you decided to use?
Emphasise the systematic examples that you might have identified in your observations around the class. Draw out that a table might be useful.

Q. How does the table help to organise the information?
Q. What are you going to record on the table?
Agree that it would be useful to record which days each person is free to meet. Warn the children to be careful as some of the clues say which days someone is **not** available.

A two-way table, in which information can be read across rows and down columns, is useful in the approach to this kind of problem.

Children should have met listing combinations before. If not, you may want to list the combinations as a whole class.

Q. When you have recorded who is free on which day, what will you need to do next to answer the question?
Agree that they need to list each pair.

Q. How might you do this systematically?
Ask children to discuss this in pairs. Draw out that they could list the pairs involving Sally, then Amy (excluding Sally who has already been listed), then Sita (excluding Sally and Amy). Ensure that the children understand they must not list repeats. (The six possibilities are: Sally and Amy, Sally and Sita, Sally and Philippa, Amy and Sita, Amy and Philippa, Sita and Philippa.)

Ask children to continue to solve the problem.

  Ref: DfES 1386-2005 G

Plenary

Ask a group to record the days the friends can meet on OHT 3.

Some extension questions

Q. How many meetings could be possible in a week?

Q. If another friend joined the group, what would you have to establish in order to adjust and then solve the problem?

	Mon	Tues	Wed	Thur	Fri	Sat	Sun
Sally	✓	✗	✗	✓	✓	✗	✗
Amy	✓	✗	✓	✓	✗	✗	✗
Sita	✗	✓	✓	✗	✓	✓	✗
Philippa	✓	✓	✗	✗	✓	✗	✗

Q. Can we answer the problem questions from this table?
Agree that further work needed to be done.

Q. How did you record the pairs?
Ask one group to show their recording in a table.

For example:

Pair	Days they both can meet
Sally and Amy	Mon, Thurs
Sally and Sita	Fri
Sally and Philippa	Mon, Fri
Amy and Sita	Wed
Amy and Philippa	Mon
Sita and Philippa	Tues, Fri

Do the children understand that the table is the translation of the word form of the problem to its pictorial representation?

  Ref: DfES 1386-2005 G

Say that each pair can find a day to meet, and sometimes three can meet. For example, Sally and Amy could meet with Philippa on Monday.

Q. Is there a day when all four can meet?

Agree that there isn't.

Q. Is there a day when no pairs can meet?

Agree that no one could meet on Sunday and only Sita could meet on Saturday, so no one could meet at the weekend.

Q. How did the recording help?

Agree that it helped us keep track of the information and put the information together. Suggest that tables are often useful if there is too much information to keep in our heads. Logic problems often have a list of statements which we need to put together and tables help us to do this. These clues are a combination of positive and negative statements.

Tea for two

Sally, Amy, Sita and Philippa plan to meet for lunch, but they have not been able to all meet on the same day.
Sally is unable to meet on Tuesdays, Wednesdays or Saturdays.
Amy is free to meet on Mondays, Wednesdays and Thursdays.
Sita has to go to work on Mondays and Thursdays.
Philippa can be available on Mondays, Tuesdays and Fridays.
They all want to spend time at home on Sundays.

Can each pair find a day on which to meet for tea?
Are there any days when none of them can meet?
Are there any days when more than one pair can meet up?

Logic problems

Year 5 Lesson 2

OHT 3

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Sally							
Amy							
Sita							
Philippa							

Logic problems

Year 5 Lesson 2

Resource sheet 2

Sally is unable to meet on Tuesdays, Wednesdays or Saturdays.

Amy is free to meet on Mondays, Wednesdays and Thursdays.

Sita has to go to work on Mondays and Thursdays.

Philippa can be available on Mondays, Tuesdays and Fridays.

They all want to spend time at home on Sundays.

Logic problems — Year 6 — Lesson 1

Albert Square

In Albert Square no house has the same number of people living in it as another.
The houses are different sizes.
In each line of three houses there is a total of 15 people.
Altogether 36 people live in the eight houses.
No house is empty.

How many people live in each house?

Objectives

- Solve mathematical problems or puzzles, recognise and explain relationships, generalise and predict
- Explain methods and reasoning, orally and in writing

By the end of this lesson, children will be able to:

- prioritise and use given facts to solve and check logic problems;
- ask 'What if . . . ?' questions.

Vocabulary

prioritise relationships

Necessary prior knowledge

Add several small numbers mentally

Resources

- Resource sheet 1 (based on problem 68 from *Mathematical challenges for able pupils in Key Stages 1 and 2*; DfEE 0083/2000; NNS publication)
- Resource sheet 2
- Resource sheet 3

Main teaching activity

It would be helpful to provide pupils with other examples of logic problems they have solved to draw out the similarities between logic problems.

Read the Albert Square problem to the children and explain that the focus of the lesson will be to look at how we solve this type of problem. Identify that this is one of a category of problems called logic problems. Say that one definition of logic problems is those where we use the relationships between criteria to reach a solution.

Explain that, by the end of the lesson, as well as solving the given problem we will reflect on the steps we took to solve the problem so that we can apply them to other problems.

Ask children to work in pairs to begin to identify what they need to find out and what information might be useful from the given facts. Children should be encouraged to eliminate the redundant information.

Drawing together

It may help some pupils to focus on the criteria if they are displayed on separate cards.

Use feedback from children to ensure that they have all focused on the given criteria. They should be clear about what we have to find out and that the answer has to meet a range of criteria.

Give a selection of incorrect possible solutions for children to discuss in pairs to check their understanding of the need to consider all the criteria.

This could be done using spreadsheet software such as Microsoft Excel. Use the 'sum' function to display the totals of each row and column.

34	15	36
17		20
19	40	41

How is working in pairs helping the children?

The children will be applying skills from solving word problems, highlighting, crossing out and annotating.

The teaching sequence follows the outline below, which will be used to help the development of the toolkit in the plenary.

- What do we have to find out?
- Decide where to start.
- Decide how we are going to solve the problem.
- Review work – where are we, where do we need to be?
- Check that the answer meets all the criteria.

The lower steps are repeated.

Q. Is this a valid solution?
Draw out that it meets one criterion but not the others. (The numbers are all different but the total is greater than 36 and the row totals are greater than 15.)

2	10	3
4		7
9	1	5

Q. Is this a valid solution?
Draw out that it meets two criteria but not the other one. The numbers are all different, the rows total 15 but the overall total is greater than 36.)

1	12	2
5		8
9	1	**5**

Q. Is this a valid solution?
Draw out that it meets one criterion but not the others. (The rows total 15 but the overall total is greater than 36 and the numbers are not all different.)

Use the last example and share your thinking out loud. For example, 'If I change the blue 5 (see above) to a 4, what effect does this have? Oh, I have to make one other in the row bigger because this is smaller, but that has changed column C …'

Pursue conversations with children: 'How do you know this answer is incorrect? Why do you think that?'

This part of the lesson is trying to move children on from using a trial and improvement approach and towards working through logic problems by systematically looking at the criteria given.

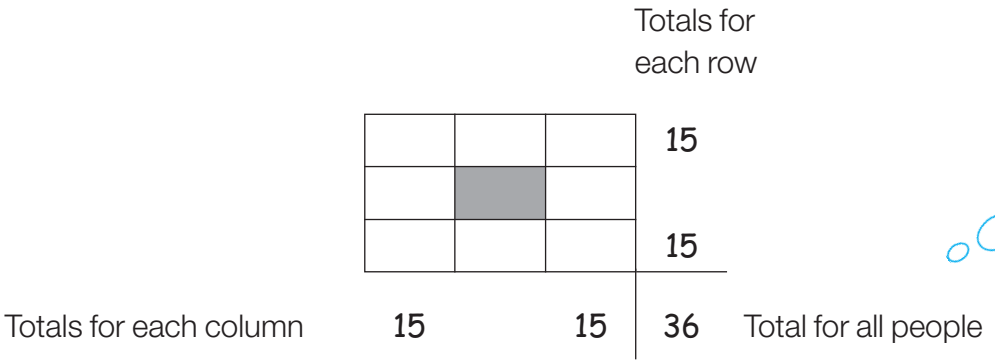
  Ref: DfES 1386-2005 G

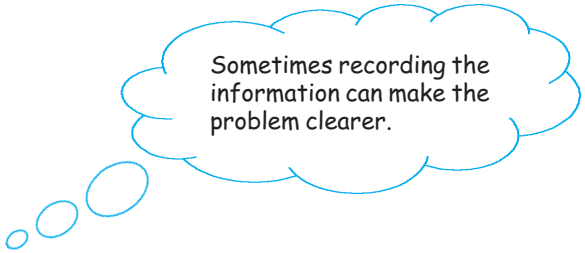
Scaffold the learning for the less able by providing a bead string with 36 beads for the 36 people.

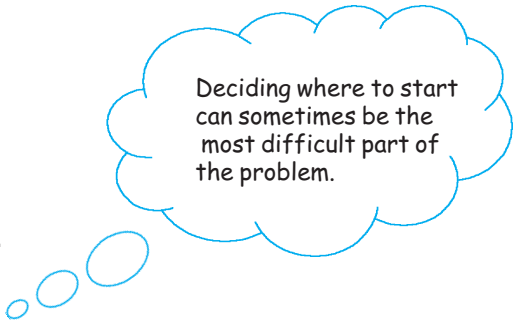
Agree that this approach would take a long time because it is not an efficient way of working. Remind children of other logic problems that they have solved and clarify that some information in the problem is more important and helpful to use as a starting point.

Ask children to discuss how we might record criteria together with the grid.

Agree that the following could be helpful.







Having recorded what we know, ask if we can now work out any other information. Ask children to discuss this in pairs. Agree that, as there are 36 people altogether and 30 living in two rows (or columns), the remaining row must have a total of 6, as must the remaining column. Record this on the grid.

Using a spreadsheet facility or digit cards will save the children from having to make lots of recordings or having to continually rub out their attempts.

Ask children to discuss which columns or rows it might be best to start with. Agree that finding the pairs with a total of 6 will give fewer possibilities than trios with a total of 15. Remind them that no house should have the same number of people, and ask them to continue to work on the problem in pairs.

Drawing together

After the children have had an opportunity to make a good start on the problem, draw them together to share strategies.

Q. Which numbers did you position first?
Q. Which total was easier to find? (6)
Q. Why was this total easier to find? (We are only combining two numbers to make this total.)
Q. How did you make this total? (5 + 1 and 2 + 4)

Ask a child to enter the four numbers which total 6.
Q. What did you do next?

	1		15
2		4	6
	5		15
			36

Q. What numbers combine with 1 to make the top row total 15?
Ask the children to list systematically: 1 and 13, 2 and 12, 3 and 11, 4 and 10, 5 and 9, 6 and 8, 7 and 7.

Q. Which of these can we not use? Why?
Cross out 1 and 13, 2 and 12, 4 and 10, 7 and 7 (repeated numbers).
Put 11 in the top left square.

If some children solve the problem quickly, ask them to try and find another solution.

Q. What effect does this have on other numbers in the grid?
Discuss that as 11 + 2 =13, the bottom left number would be 2, a repeat, so 11 can't be placed here. Ask the children to discuss in pairs if it could be placed in the top right square, and then go on to discuss which number rows are possible to try to solve the problem.
Q. Does your grid meet the original criteria in the question?
(The solution is on Resource sheet 3.)

This is to encourage children to ask 'What if . . . ?' before placing numbers.

Plenary

Ask neighbouring pairs of children to discuss their solutions and to discuss whether they are different. They will find that their solutions are rotations or reflections of each other.

Encourage children to go back to the question to check that their solution meets all the criteria.

Point out that, though we now know the number living in the eight houses and the relationship between them, there are several possibilities for the top left house, for example. Agree on one solution and ask children to think of additional clues which would distinguish this particular solution from the others, e.g. the first house has the most people living in it.

Help children to reflect on how they solved this type of problem by identifying the facts and prioritising them to find new information.

It may be helpful to display this for future lessons, incorporating different examples of work to exemplify the steps.

You could ask children to make their own posters or display Resource sheet 2.

Reflect on the steps they have worked through:
1. What do we have to find out?
2. Decide where to start.
3. Decide how we are going to solve the problem, including how recording might help us.
4. Review work: Where are we? Where do we need to be? Is this working?
5. Check that the answer meets all the criteria.

  Ref: DfES 1386-2005 G

Albert Square

In Albert Square no house has the same number of people living in it as another.
The houses are different sizes.
In each line of three houses there is a total of 15 people.
Altogether 36 people live in the eight houses.
No house is empty.

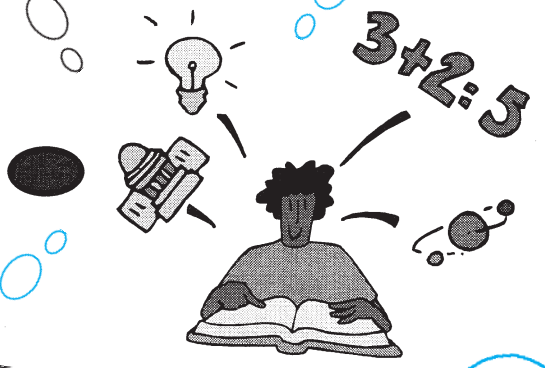
How many people live in each house?

(based on problem 68 from *Mathematical challenges for able pupils in Key Stages 1 and 2*. Ref: DfEE 0083/2000; NNS publication)

Steps to solve the problem

1. What do we have to find out?
Read the given information and identify the question.

2. Decide where to start
Identify the given facts and prioritise. Look for any relationships and patterns in the information given.



3. Decide how we are going to solve the problem
Identify resources or recording systems to help (pictures, using equipment, making lists and tables, trial and improvement, drawings, and so on).

4. Review and decide how to continue
Check that the answer meets the criteria being addressed. Consider the other criteria; look for any relationships and patterns. Apply the new criterion to the current work and see what effect it has. Return to step 2 or 3 as necessary.

5. We have an answer
Check the answer against all the criteria. Return to step 4 if necessary.

The solution

6	**1**	8
2		*4*
7	**5**	3

- Identify the numbers to position in the grid using the information that there are 8 different numbers and the total is 36.
- Use the criteria that the rows and columns each total 15, and the overall total = 36, to identify that the middle rows and columns each total 6.

a	**b**	c	= 15
d		*e*	= 6
f	**g**	h	= 15
			36

- Identify the pairs that total 6 and put them into the grid, e.g.

a	**1**	c	= 15
2		*4*	= 6
e	**5**	g	= 15

- Use trial and improvement to insert the other numbers into the grid.
- Explore the other possibilities for inserting the numbers (reflection and rotations of the given example) and identify an additional criterion to limit the number of solutions to one.

Logic problems — Year 6 — Lesson 2

House points

How many house points did each child in Grey House receive?

Usha	Sally	Tom
Anne	Sanjay	Jeremy
Sue	Bob	Pete

- At the end of the year the 9 children in Grey House all received some house points.
- The children's house points are consecutive numbers.
- The total house points for Grey House was 144 points.
- Each line of three children received the same total of points.
- No two children had the same number of house points.
- All children's house points were two-digit numbers.
- Jeremy had the least house points and sits in the same line as the girl who received more house points than anyone else.
- Jeremy did not have the same points as Sanjay.

Resources

- Activity sheet 1
- Resource sheet 2 from lesson 1
- Resource sheet 4

Objectives

- Solve mathematical problems or puzzles, recognise and explain relationships, generalise and predict
- Explain methods and reasoning, orally and in writing
- Suggest extensions such as 'What if…?'

By the end of this lesson, children will be able to:

- prioritise and use given facts to solve and check logic problems;
- recognise the effect of extensions such as 'What if …?' questions;
- create their own criteria for solving a logic problem in the context of a solved problem.

Vocabulary

prioritise relationships consecutive

Necessary prior knowledge

Add several small numbers mentally
Children who have experience of magic squares may find this activity easier

Main teaching activity

Read the problem on Activity sheet 1 together.

Remind children that logic problems are those where we use the relationships between given pieces of information, criteria, to reach a solution.

Remind children of the steps on Resource sheet 2. Draw children's attention to steps 1 and 2.

This could be a display, or each child could have a copy.

1. What do we have to find out? Read the given information and identify the question.
2. Decide where to start.

Ask children to discuss in pairs where they might start with this problem.

After several minutes, draw out that it would be useful to narrow down the range of numbers (from just two-digit numbers).

Q. Which clues can help us do this?
Q. Can the single statement be more easily interpreted using one or more of the other criteria to support it?

If children are struggling, suggest they find the total of numbers starting at 10 in order to get going, and then modify their start number according to what they find.

Draw out that the following clues will help.

- The total house points for Grey House was 144 points.
- The pupils' house points are consecutive numbers.

Ask children to try and find nine consecutive numbers with a total of 144.

Drawing together

Agree that the numbers are 12, 13, 14, 15, 16, 17, 18, 19 and 20.
Ask children to discuss in pairs what we might do next. Agree that we need to start placing numbers and ask them to identify clues to help us.
Agree that 'Jeremy had the least house points and sits in the same line as the girl who received more house points than anyone else' is a good start.
Ask children to discuss how they are going to record their work and then to carry on with the problem.

It's important that children see how a problem can be broken down to make it manageable.

Drawing together

Some children may need additional guidance to look at the further criteria as there are two stages to work through, using the statement about the total points for each line of pupils and the information about Jeremy.

Ask children to share how they decided Jeremy had 12 points and Anne (the only girl in the same line) had 20 points.

20	16	12

Has any group got a recording strategy that can be demonstrated to others to lead them to looking at an efficient recording strategy to help them record *'If this ... then this ...'*

Q. How do we know how many points Sanjay has? What do we need to know? Can we work this out?

Agree that as each line has the same total, and the total of three lines is 144, each line must have a total of 48 points.

'The only girl in the same line as Jeremy is Anne. Anne must have received the most points.
The line has to total 48. 20 + 12 = 32, 48 − 32 = 16, Sanjay must have 16 points.'

Encouraging children to ask 'What if ...?' questions will help to limit blind alleys.

  Ref: DfES 1386-2005 G

Ask children to work in pairs, completing the possibilities using a trial and improvement approach.

Encourage them to consider the effects on other rows of placing numbers, as they did in the previous lesson.

Plenary

Refer children to the last step in solving problems and to check that the answer meets the criteria.

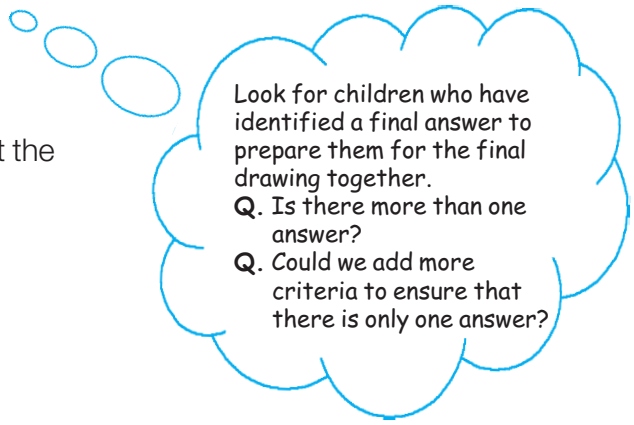
Q. Do we have a final answer?
Ask children to tick each clue (criterion) if the answer fits.

Q. Is there more than one answer?
Encourage children to compare their answers.
Q. What do you notice about the two answers that are possible?
Draw out that the top and bottom rows are swapped.
Q. Could we add more criteria to ensure that there is only one answer?

Q. Did you find the steps to solving logic problems useful?
Q. What was the same about the way we solved this problem and the house problem?

Q. What three top tips have you got to share with people about solving logic problems?
Make sure they include:

- prioritising information;
- the effects of one part of the solution on another.



House points

How many house points did each child in Grey House receive?

Usha	Sally	Tom
Anne	Sanjay	Jeremy
Sue	Bob	Pete

- At the end of the year the 9 children in Grey House all received some house points.
- The children's house points are consecutive numbers.
- The total house points for Grey House was 144 points.
- Each line of three children received the same total of points.
- No two children had the same number of house points.
- All children's house points were two-digit numbers.
- Jeremy had the least house points and sits in the same line as the girl who received more house points than anyone else.
- Jeremy did not have the same points as Sanjay.

Resource sheet 4

One solution

Usha 15	Sally 14	Tom 19
Anne 20	Sanjay 16	Jeremy 12
Sue 13	Bob 18	Pete 17