

Unit 5

Developing peer and self assessment in mathematics

Following the training in the generic unit *Peer and self assessment*, it is important to consider how the key messages of the training apply to mathematics. As part of the whole-school focus on this, the following subject development material is intended to help you consider the key messages of the training unit and identify any areas requiring development in your department.

The following is a brief summary of the training unit.

Objectives

- To provide the strategies that promote and develop peer and self assessment.
- To help participants to identify opportunities to introduce or extend these strategies when planning lessons.

Key messages

- To develop skills in peer and self assessment, learning objectives and intended learning outcomes must be made explicit and transparent to pupils. This will help to ensure that pupils are able to identify when they have met some or all of the success criteria.
- Sharing learning objectives and outcomes must be a regular feature of lessons and become an integral part of reviewing learning rather than a 'bolt-on' activity.
- Pupils develop their skills in self assessment after initially developing their skills in peer assessment and therefore pupils need to be taught the skills of collaboration in peer assessment. This will help pupils to assess their own progress objectively and become increasingly independent learners.
- To develop peer and self assessment in the classroom, teachers will need to:
 - plan peer and self assessment opportunities in lessons
 - train pupils over time to assess their own work and the work of others
 - explain the learning objectives and intended learning outcomes behind each task
 - frequently and consistently encourage pupils' self-reflection on their learning
 - guide pupils to identify their next steps.

The following material builds on the tasks outlined in the 'Ready for more?' section of the *Peer and self assessment* training unit and it is intended for all those who teach mathematics.

Reviewing existing practice in peer and self assessment

The table below provides a tool for a department to self-review current practice and to help identify an appropriate starting point.

As a department, agree and highlight the statements below that best reflect the practice of the whole department. At the bottom of each column is a reference to the tasks that will support your current practice and provide the appropriate material to develop from this point.

Having completed this review you should read 'Making effective use of the subject development material' on the next page.

	Focusing	Developing	Establishing	Enhancing
Teachers	<p>There is no whole-school approach that enhances and promotes the use of peer and self assessment to raise standards.</p> <p>The subject leader has identified where:</p> <ul style="list-style-type: none"> planning does not focus on learning objectives and does not identify expected outcomes so pupils lack the information they need to peer assess and self-assess their work teacher feedback does not relate directly to learning objectives and outcomes so peer and self assessment discussions tend to lack focus and are unproductive. 	<p>The department is beginning to collaboratively plan for peer and self assessment.</p> <p>Learning objectives and outcomes are made explicit and transparent to enable peer and self assessment.</p> <p>Practice is variable across the department. Some teachers lack the confidence to provide peer assessment opportunities.</p>	<p>Departments collaboratively and centrally plan for peer and self assessment opportunities.</p> <p>Teachers provide success criteria which enable pupils to assess their work and to recognise the standards they are aiming for in the subject.</p> <p>Teachers routinely select from a range of peer and self assessment strategies and use them with increasing confidence.</p> <p>Time is provided for pupils to reflect independently or collaboratively on what they have learned and how they have learned.</p> <p>Teachers train pupils to work effectively in group discussions and model how to give constructive and informative feedback.</p>	<p>There is an effective, coherent and manageable whole-school system for promoting self assessment and peer assessment. Whole-school collaborative planning enables success criteria for cross-curricular initiatives to be identified and used for peer and self assessment.</p> <p>Teachers work with pupils to identify success criteria related to progress in the key concepts and skills for the subject.</p> <p>Teachers orchestrate and maintain pupil dialogue with timely intervention to accelerate understanding and develop independent learning.</p> <p>Teachers continue to explore with pupils how they learn most effectively and how they can apply this.</p>
Pupils	<p>The subject leader has identified that:</p> <ul style="list-style-type: none"> pupils lack the skills and dispositions for peer and self assessment and struggle to provide constructive feedback to each other peer assessment discussions lack focus as pupils cannot judge the strengths and weaknesses of their work. 	<p>Pupils are beginning to assess their own work and that of their peers against the learning objectives and learning outcomes.</p> <p>They are gaining confidence in paired and group discussion and are beginning to provide constructive feedback.</p>	<p>Pupils can use success criteria to improve their own work and that of their peers and can recognise the standards they are aiming for in the subject.</p> <p>Pupils are increasingly confident in assessing their own work and provide informative and constructive feedback to others.</p>	<p>Pupils can independently identify how to move their learning forward.</p> <p>Pupils are able to relate success criteria to progression in the subject.</p> <p>Pupils are able to apply an understanding of how they learn to make better progress in different contexts.</p> <p>Pupils can engage in extended and focused dialogue about their learning.</p>
	Start with Task 5A	Start with Task 5B	Start with Task 5B or 5C	Start with Task 5C

Making effective use of the subject development material

The tasks you have been referred to are intended to support the development or extension of peer and self assessment in mathematics and provide guidance on how to embed this into regular practice in mathematics lessons.

The results of the self-review will have suggested the appropriate task(s) that will support your department's development needs.

To make best use of the supporting material the following sequence will be helpful.

1 Read the task and the supporting exemplification.

This describes how a department has approached the task and worked through each of its stages. It is given as an *example* of how the task might be addressed. It is not intended that you follow this approach, which is given as a guide to the process that will support improvements in your subject.

2 Identify what the department did and the impact it had on pupils.

Discuss as a team the example provided and establish the key areas that helped to develop this practice and the impact it had on pupils. It will be helpful to identify the changes in teachers' practice and how these impacted on pupils' learning.

3 Agree and plan the actions that will develop your practice.

As a department, agree how you intend to approach this task. Clarify what you are focusing on and why. The example given will act as a guide, but be specific about which classes, which lessons and which aspects of the curriculum will be your points of focus.

4 Identify when and how you will evaluate its impact on pupils.

The purpose of focusing on this is to improve pupils' achievement and attainment in mathematics. You will need to be clear on what has helped pupils to learn more effectively in your subject. Part of this will be how your practice has adapted to allow this. You should jointly identify what has worked well and which areas require further attention.

5 Having evaluated these strategies, consider what steps are required to embed this practice.

You will need to undertake an honest evaluation of what you have tried and the impact it has had on your teaching and on pupils' learning. One outcome might be that you need to spend longer on improving this area or you may be in a position to consider the next task.

Other departments in the school will have been focusing on this area and you should find out about the progress they have made.

You may find that some teachers in the department will require further time to develop and consolidate new practice, while others will be ready to progress further through the tasks in this area (while continuing to support their colleagues). Practice across a department will need to be consolidated before focusing on a new area of Assessment for learning.

The subject development tasks

Task 5A

With a colleague, plan and observe one of each other's lessons which has an agreed focus on peer and self assessment and uses one of the strategies on **handout 5.4** in the generic unit (see **appendix 5A.1**).

Jointly review your lessons and highlight the impact on pupils and your teaching.

Plan how and when this will be fed back to the department.

Task 5B

In your department, identify existing and potential peer and self assessment opportunities from the scheme of work for a year group or unit.

Within the next half term, plan opportunities and experiment with a variety of types of peer and self assessment using some of the techniques outlined in **appendix 5.1** in the generic unit.

Agree a review meeting that focuses on the gains made in pupils' learning.

Select some that had most impact on pupils and incorporate these into the medium-term plans.

Task 5C

Select a subject-specific task or activity that enables pupils to evaluate their own performance.

Agree the criteria for assessment with pupils, the principles for how they should assess and, initially, model how you would expect them to do it.

Observe them assessing their work, and provide feedback on how well they did and how they might improve in the future.

If peer and self assessment is well established, arrange to interview a small group of pupils to determine their response to those strategies (**handout 5.4** in the generic unit, see **appendix 5A.1**) and how they help them to learn more effectively.

The following pages provide exemplification of each task.

Task 5A

With a colleague, plan and observe one of each other's lessons which has an agreed focus on peer and self assessment and uses one of the strategies on handout 5.4 in the generic unit (see appendix 5A.1).

Jointly review your lessons and highlight the impact on pupils and your teaching.

Plan how and when this will be fed back to the department.

Context

During the whole-school training on peer and self assessment, the mathematics department gave highest priority to developing the following strategy.

- Use examples of work from anonymous pupils and ask their peers to suggest possible ways of improving their work and how they would meet the learning outcomes.

The department chose this strategy as they were working on the problem-solving phase of the *Year 8 multiplicative relationships mini-pack*. In this phase of the unit the teacher gives pupils some solutions to a problem and asks them to evaluate the efficiency of the strategies chosen, to identify errors and to make suggestions for improvements.

Process

The department decided to work in pairs to plan a lesson with a focus on developing this aspect of peer and self assessment. They used **appendix 5A.2 (handout PR6)** from the *Enhancing proportional reasoning* materials) to support them in planning the lesson.

The learning objectives for the lesson were as follows.

- To use the unitary method to solve simple word problems involving ratio and direct proportion.
- To solve complex problems by breaking them into smaller steps, choosing and using efficient techniques for calculation.

Appendix 5A.3 gives two pupils' solutions to a problem – 'Stacking CDs'. These, and others, are included as handout PR5 in the *Enhancing proportional reasoning* materials. The teachers in this department chose to use the same problem to generate a set of their own pupils' solutions.

Evaluation

After the lesson, each pair of teachers discussed the impact this approach had on pupils' learning. This formed the basis of a discussion at the next department meeting. The following gains were identified.

- In interpreting the methods of others, pupils became more aware of the rates they were calculating, i.e. choosing between CDs/1 cm and cm/1 CD. This helped many to recognise their own mistakes in solving the problem.
- Pupils recognised the importance of communicating the steps in their solution,
e.g. $5 \div 9 = 0.56$ (2 dp) so 1 CD is 0.56 cm wide.
- Pupils recognised that inefficient methods often led to mistakes being made.
- Pupils were keen to see examples of efficient, accurate methods.

Task 5B

In your department, identify existing and potential peer and self assessment opportunities from the scheme of work for a year group or unit.

Within the next half term, plan opportunities and experiment with a variety of types of peer and self assessment using some of the techniques outlined in appendix 5.1 in the generic unit.

Agree a review meeting that focuses on the gains made in pupils' learning.

Select some that had most impact on pupils and incorporate these into the medium-term plans.

Context

Departments that have worked with the *Interacting with mathematics* Key Stage 3 materials have identified good opportunities to promote peer and self assessment.

Process

One department used the Year 9 activity 'Revising explanations' from the materials *Securing progression in handling data* as an opportunity to work on strategy 3 on **handout 5.4**.

- Ask pupils to use the expected outcome to comment on strengths of each other's work and to identify areas for improvement.

In this activity, pairs of pupils compose a written explanation. In the materials, the explanation relates to their interpretation of data on teachers' ages given in a chart (see **appendix 5B.1**). This is followed by the whole class evaluating and refining one example of a written statement, highlighting good sections of the explanation and identifying sections that could be improved. Finally, the pupils go through the same process in groups of four. (Details of the full activity are given in **appendix 5B.2**.)

Another department used an opportunity in *the Year 8 Multiplicative relationships* and *Year 9 Proportional reasoning* mini-packs as a starting point to develop strategy 5.

- Ask pupils to write their own questions on a topic to match the expected outcomes and, in addition, provide answers to others' questions.

Phase 3 in both these unit plans focuses on problem solving. The learning objective for this work is 'Solve increasingly demanding problems and evaluate solutions; explore connections across a range of contexts'. Suggested activities include the following.

- Ask pupils to choose one problem.
 - In pairs, discuss alternative methods for solving the problem.
 - Change the numbers to make the problem more difficult and consider how the methods could be adapted.
 - Ask different or supplementary questions from the same context.
- Ask pupils to make up similar problems for a partner to solve.

After trialling this and feeding back to the department, the teachers experimented with developing this strategy for peer and self assessment with Year 8 classes using problems on percentages in the multiplicative relationships unit. Alongside this, the department introduced 'traffic lights' (see **appendix 5.1** of the generic unit) to get information on the extent to which individual pupils felt they had achieved the learning objective.

Evaluation

In reviewing this work, the department identified the following gains in pupil learning.

- Pupils extended their methods for solving problems involving percentages. In doing this they developed more of a feel for why different methods work, making links across percentages, decimals and fractions.
- Pupils increased their ability to explain their methods to someone else.
- Pupils devised more challenging questions than had been planned by the teacher.

Following the success of this work, the teachers looked for further opportunities in their schemes of work to use the same activities. They identified a range of mathematical topics with potential for this approach and chose to start with work on solving equations across Key Stage 3.

Task 5C

Select a subject-specific task or activity that enables pupils to evaluate their own performance.

Agree the criteria for assessment with pupils, the principles for how they should assess and, initially, model how you would expect them to do it.

Observe them assessing their work, and provide feedback on how well they did and how they might improve in the future.

If peer and self assessment is well established, arrange to interview a small group of pupils to determine their response to those strategies (handout 5.4 in the generic unit, see appendix 5A.1) and how they help them to learn more effectively.

Context

In response to the recent requirement for pupils to produce GCSE coursework on handling data, a group of schools got together to plan how to help pupils to build on their Key Stage 3 work.

Process

They wanted to devise an approach that would enable pupils to begin to evaluate their own performance against the GCSE criteria. They decided to use project 3 from *Bridging plans from Key Stage 3 to Key Stage 4* as the basis for planning two units of work – one taught towards the end of Year 9 and the other early in Year 10 with the peer and self assessment activity as part of the Year 10 work.

The main learning objectives for the units on handling data were to:

- discuss a problem that can be addressed by statistical methods and identify related questions to explore
- communicate interpretations of a statistical enquiry using tables, graphs and diagrams.

They planned to get pupils to use a given data set to identify a question or hypothesis to test, collect, process and represent data relevant to their chosen enquiry and to interpret the results. Pupils were to produce a written statistical report as a record of this work.

The teachers identified the following learning outcomes for the work to share with pupils.

We will have written a report that:

- identifies a question or hypothesis to test using a secondary data source
- draws on relevant raw data that is summarised using appropriate statistical methods (e.g. mean, median, mode and range) and represented on charts and graphs in ways that help identify the key features
- interprets the data and answers the question posed.

One of the schools gave the Year 9 classes a set of athletics data from the PE department. The learning outcomes were shared with pupils at the beginning of the paired work and recorded on task sheets for each pair of pupils to reference during the work. Pupils worked collaboratively in small groups to produce their written report.

On completion of this work, the teachers got together to prepare for the next stage of the work in Year 10. They selected two of the reports produced in Year 9. They duplicated both reports, cut each up into the different components (e.g. the question to answer, the plan for data collection, charts and graphs, interpretative statements) and placed these in envelopes for pairs of pupils to work with. In addition, and based on the same data, the teachers produced extra components that did not relate to the question/problem being explored.

In Year 10, pairs of pupils were given the envelopes and asked to select the relevant components to make a coherent report. After completing this task, they were asked to focus on the same learning outcomes as for the Year 9 activity to help assess the quality of the report. The teacher provided additional prompts based on the GCSE criteria for interpreting and discussing results (see **appendix 5C.1**). Pupils were asked to select the most appropriate statement in each box and to talk about how the report could be improved.

Before starting the task, each teacher established ground rules for the pupils in assessing each other's work. They also provided some principles for effective feedback. These included:

- being specific
- giving three positive points for every negative point.

The teacher was able to observe and listen to pupils while they engaged in this work. At the end of the lesson, the teacher provided feedback for the pupils on how well they had done. The following points were made.

- Pupils had looked closely at the data as presented and made helpful points about the comments within the report. Many pupils had made suggestions to improve the detail of comments in the reports. Examples of these were explored.
- The teacher emphasised the importance of looking for the difference between two consecutive criteria. Again, examples were explored.

Evaluation

Following completion of this work, two teachers in the department planned a follow-up lesson to get pupils' views on how the sharing of criteria for assessment had helped with learning. The teachers interviewed groups of pupils (four at a time) to ask them how they thought the peer assessment using the previous term's work had helped them to learn more effectively. Pupils' responses were collated and fed back to the department. These were very positive. The use of the GCSE criteria in pupil speak helped pupils to appreciate the standards of their work. Pupils commented on how helpful it had been to focus on one or two of the criteria, relating to the stages of the handling data cycle. This had helped them to improve their awareness of what they needed to do to improve their work and attain higher standards in the statistical report writing.

The rest of the department planned to trial the bridging project lessons and also undertook to use the same peer assessment strategy in another lesson that they would plan, teach and then share the outcomes with the rest of the department.

Subject-specific references

Referenced strategy materials

Framework for teaching mathematics: Years 7, 8 and 9 (DfEE 0020/2001)

Interacting with mathematics in Key Stage 3: Enhancing proportional reasoning (DfES 0093/2003)

Interacting with mathematics in Key Stage 3: Securing progression in handling data (DfES 0658/2003)

Interacting with mathematics in Key Stage 3: Year 8 multiplicative relationships mini-pack (DfES 0220/2002)

Interacting with mathematics in Key Stage 3: Year 9 proportional reasoning: mini-pack (DfES 0588/2002)

Bridging plans from Key Stage 3 to Key Stage 4: mathematics (DfES 0081 - 2004 G)

All the above materials can be found at www.standards.dfes.gov.uk/keystage3 by selecting 'mathematics' and then 'mathematics publications'.

QCA materials

Using assessment to raise achievement in mathematics, Section 1 (QCA, www.qca.org.uk)

Ofsted materials

Good assessment practice in mathematics (Ofsted, www.ofsted.gov.uk)

Handout 5.4 – Strategies for peer and self assessment

Strategies for peer or self assessment	Key benefit(s)	Example of how and where it could be used in a lesson
<p>1 Encourage pupils to listen to pupils' responses to questions and presentations made in class and to ask questions on points that they do not understand.</p>	<ul style="list-style-type: none"> Pupils think about what they have not understood Pupils publicly acknowledge that they can, and want to, learn from each other Promotes the idea of collaborative working – 'many brains better than just one' Can help establish 'working together' protocols 	<ul style="list-style-type: none"> Have whole-class discussion, making conjectures about comparison of data displayed in two pie charts. Pupils respond using whiteboards followed by episodes during which successive pupils add to or refute explanations. Pupils research different alternative energy resources and make short presentations to the rest of the class about how each one works and its advantages and disadvantages. The teacher acts as chair and takes questions from the rest of the class, feeding them to an appropriate pupil on the presentation team.
<p>2 Use examples of work from anonymous pupils and ask their peers to suggest possible ways of improving the work and how they would meet the learning outcomes.</p>	<ul style="list-style-type: none"> Pupils see what success looks like and explicitly identify the features that make for a good piece of work Helps moderate shared understanding of standards Sets benchmarks for target setting 	<ul style="list-style-type: none"> Pupils are given some solutions to a problem and asked to evaluate the efficiency of the strategies chosen, to identify errors and make suggestions for improvement. Pupils are given some background and results from a particular scientific enquiry and a set of results. Before writing their conclusion of the enquiry, pupils are shown examples written by other pupils and discuss which is the better conclusion and why. The teacher uses a piece of work that is not perfect but is about the standard that the pupils might achieve. Pupils work in groups, using the criteria to agree the level.
<p>3 Ask pupils to use the expected outcome to comment on strengths of each other's work and to identify areas for improvement.</p>	<ul style="list-style-type: none"> Pupils identify their own strengths and areas for development Pupils are sometimes more receptive to constructive criticism from peers than from the teacher Helps moderate shared understanding of standards 	<ul style="list-style-type: none"> The whole class evaluate and revise an anonymous written draft explanation interpreting the data given in a graph or chart. Pupils then work in pairs and fours to draft, evaluate and jointly revise similar explanations for other charts.
<p>4 Ask pupils to 'mark' each other's work but without giving them the answers. Instead, ask them to find the correct answers from available resources.</p>	<ul style="list-style-type: none"> Helps pupils distinguish between learning objectives and learning outcomes (and how to 'come up with the goods') Helps pupils recognise a range of alternative appropriate responses Promotes research and independent learning 	<ul style="list-style-type: none"> Pupils share their conclusions to an enquiry and discuss what might improve each other's work.

Strategies for peer or self assessment	Key benefit(s)	Example of how and where it could be used in a lesson
5 Ask pupils to write their own questions on a topic to match the expected learning outcomes and, in addition, provide answers to others' questions.	<ul style="list-style-type: none"> Helps pupils distinguish between learning objectives and learning outcomes (and how to 'come up with the goods') Helps pupils recognise a range of alternative appropriate responses 	<ul style="list-style-type: none"> At the end of a topic of work, the class generates its own end of topic 'test', with mark scheme using the expected outcomes for that topic and their own books and textbooks as a resource.
6 Ask pupils in groups to write five questions and, following whole-class discussion, identify the best two from each group (to generate 10–12 questions, e.g. for homework).	<ul style="list-style-type: none"> Pupils gain confidence as they create their own questions and answers Helps pupils recognise a range of alternative appropriate responses 	<ul style="list-style-type: none"> A 'checking progress activity' is provided at the end of an important section of work within a topic.
7 Ask pupils to analyse mark schemes and devise their own for a specified task.	<ul style="list-style-type: none"> Pupils are able to reflect on what the key aspects or ideas in a unit of work or task are, and refine their own interpretations of requirements and possible pitfalls Helps pupils recognise a range of alternative appropriate responses 	<ul style="list-style-type: none"> The whole class evaluate short responses to the 'explain' part of a test question interpreting the data given in a graph or chart. Pupils make a judgement as to which responses would gain the mark in the test. The teacher sets homework, then asks the class what the success criteria will be. Following completion, the work is peer-marked. The teacher constructs an exemplar copy of each topic test with model answers and shows this to pupils when returning their test papers, allowing time for pupils to compare their answers to the model ones.
8 Ask pupils to decide whether they think an answer is reasonable, whether they can add to the answer, or whether they would have given another answer.	<ul style="list-style-type: none"> Pupils can evaluate the validity of statements and generalisations and discuss common mistakes and misconceptions Helps moderate shared understanding of standards 	<ul style="list-style-type: none"> Pupils discuss the validity of general statements, and whether they are sometimes, always or never true, e.g. <i>multiplication makes numbers bigger, or if a square and a rectangle have the same perimeter, the square has the greater area, or $2n - 3 = 3 - 2n$.</i> Pupils are shown anonymous answers to particular test and exam questions and asked to improve or expand on the answer given.
9 Encourage pupils to develop assessment criteria for periodic assessment tasks.	<ul style="list-style-type: none"> Helps pupils focus on what they need to produce or demonstrate to have their achievement recognised 	<ul style="list-style-type: none"> As an extension to a starting point activity in a new topic, having found out what pupils already know, ask them to speculate about what they think they might need to learn about next.
10 Ask pupils for their level of confidence with a particular piece of work.	<ul style="list-style-type: none"> Pupils can identify productive areas on which to focus their efforts and develop mastery of particular concepts and skills 	<ul style="list-style-type: none"> The teacher asks pupils to 'traffic light' concepts for a particular piece of work. Green is 'happy'; amber is 'not quite sure'; and red is 'very unsure'. Greens can then support ambers and reds. Many red marks mean more in-depth teaching is required.

Planning a lesson using pupils' scripts

Selecting scripts before the lesson

- Choose a small selection of pupils' solutions, based on one or two problems – perhaps no more than four altogether for the group task.
- Ensure pupils are familiar with and reasonably successful at problems of the chosen kind, not just meeting them for the first time.

Modelling the task

Plan to model what will be a new task for the class, in a clear structured sequence, thinking aloud about what to do, so that pupils can imitate it.

- Choose one or two solutions to a problem to discuss as a class. Question pupils in order to elicit evaluative comments, refined to written statements.
- Ensure the class understands that they are commenting on the solutions and giving advice which could help the pupils improve their work, not just putting ticks, crosses and corrections.

Paired or small-group work

Organise well-focused small-group work, to give all pupils an opportunity to interpret the scripts, share thinking and refine ideas together.

- Ask pupils to begin by classifying the solutions as correct or incorrect.
- Pupils might write their comments on sticky notes.
 - Correct solutions should be checked for efficiency and a clear target for improvement noted, if appropriate.
 - Incorrect solutions should have the errors identified and a clear strategy for correction and improvement noted.

Plenary

Plan some key questions for the plenary, particularly to elicit:

- comments on the approaches used in the written solutions;
- views on what kinds of feedback or written comments would help the pupils to improve their work;
- reflections on what the class themselves can learn from the process of discussing other pupils' work.

Two pupils' solutions to a problem – 'Stacking CDs'

Anna's solution

9 CDs put side by side on a shelf measure 5 cm. How many centimetres would 14 CDs placed side by side measure?

Roughly
7.56 cm

$$\frac{5}{9} = 0.555$$

$$1.8 \times 9 = 16.2$$

$$0.544 \times 15 = 8.16$$

0.54 7.02
1.08 7.56
1.62
2.16
2.70
3.24
3.78
4.32
4.86
5.40
5.94
6.48

$$0.55 \times 10 = 5.5$$

$$2.75 \times 15 = 41.25$$

the length of 14 CD will be 7.75 cm.

$$2.75 + 5 = 7.75 \text{ cm}$$

Sam's solution

9 CDs put side by side on a shelf measure 5 cm. How many centimetres would 14 CDs placed side by side measure?

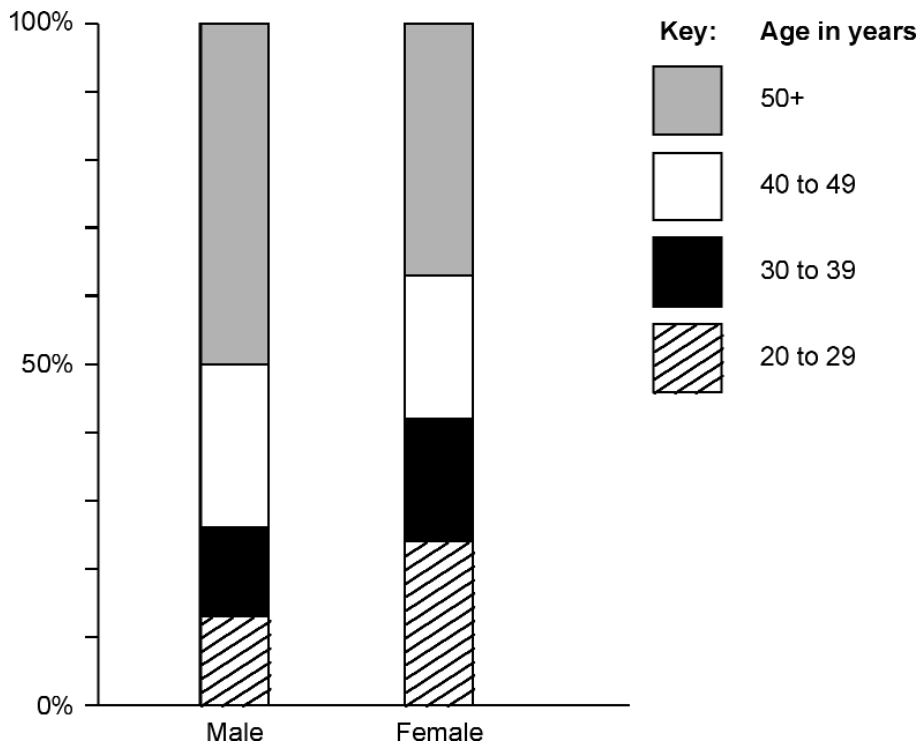
$$9 \div 5 = 1.8 = 1.8 \times 14 = 25.2 \text{ cm}$$

Key Stage 3 test question (2000 A2 17): Teachers


1. Teachers

A newspaper predicts what the ages of secondary school teachers will be in six years' time.

They print this chart.



- (a) The chart shows **24%** of male teachers will be aged 40 to 49
About what percentage of female teachers will be aged 40 to 49?



1 mark

- (b) About what percentage of **female** teachers will be aged **50+**?



1 mark

- (c) The newspaper predicts there will be about **20 000** male teachers aged 40 to 49
Estimate the number of male teachers that will be aged 50+



1 mark

(d) Assume the total number of male teachers will be about the same as the total number of female teachers.

Use the chart to decide which statement is correct.

Tick (✓) your answer.



Generally, male teachers will tend to be younger than female teachers.

Generally, female teachers will tend to be younger than male teachers.

Explain how you used the chart to decide.



Revising explanations (Year 9): prompts

These following tasks use resources available from the Year 9 folder on the Securing progression in handling data CD-ROM. Select from these according to the needs of your class.

- Handling data question bank provides a set of ten questions ranging from level 4 to level 7 drawn from previous Key Stage 3 tests.
- Responses gives examples of pupils' responses to the 'explaining' part of each question.

Task 1 (whole class): Developing explanations

The teacher leads the class through the process of composing an explanation to a selected question.

Preliminary step

In some questions the 'explain' part is presented towards the end. Where this is the case it would be useful to work through the preceding parts, dealing with any misunderstandings, before starting this activity on composing explanations. This might be done in an earlier lesson.

Explaining stage

Focus on the 'explain' part of the selected question. Emphasise that pupils should not think of this as a test question. They are to imagine that they are putting the chart and the requested explanation into a magazine article. The explanation should be about three or four sentences long.

The following steps may be ordered differently to suit a particular class.

- 1 Model how to compose a written explanation, explaining your thinking aloud and pointing out key features such as correct use of technical vocabulary or appropriate use of words such as *whereas*, *though*, *while*, *unless*, *however*, *equally* and *also*.¹
- 2 Ask pupils to work in pairs to compose one written explanation (perhaps on a whiteboard).
- 3 Select a response to the chosen question (either from your class or from the CD-ROM). Show it to the class and together with the pupils, analyse, annotate and perhaps revise the response. (Examples of annotated scripts are available on the CD-ROM to illustrate what this step might look like.)
- 4 Ask pairs to review their own explanation in light of the whole-class discussion.

¹ For more guidance on the use of connectives for contrast or comparison, see *Literacy across the curriculum* module 2, *Literacy in mathematics* (available on the Key Stage 3 website from January 2004).

Task 2 (groups): Discussing and revising

Pupils evaluate each others' explanations.

- Select an appropriate question. Ask pairs of pupils to write their joint explanation on whiteboards, then join with another pair to discuss and evaluate the two responses. Guidance on *The role of the review partner* (CD-ROM) will help here.
- Tell the four to agree a final form of the explanation in the light of their discussion.
- Select one or two examples, discuss the explanations with the class and ask pupils to explain how their discussions improved their writing.

Task 3 (whole class): Assessing explanations

Pupils assess other people's answers in test conditions.

- Select a question and six brief explanations written under test conditions (available on the CD-ROM). Display or distribute these to the class. Explain that three answers would gain full marks and three would not. One of each is already identified.
- Together with the pupils, 'mark' the remaining answers, showing why some are deficient and how they should be improved. Correct and incorrect responses are identified for teacher use on the *Test answer summary sheet* (CD-ROM).

How could the report be improved?

Learning outcome

The written report interprets the data and answers the question posed.

GCSE criteria
<ul style="list-style-type: none">• There are comments on patterns in the data.• There are comments on patterns in the data and any exceptions to these.• There are comments on patterns in the data and reasons are suggested for the exceptions.• There are comments on patterns in the data and plausible reasons are given for the exceptions.
<ul style="list-style-type: none">• Results are summarised but not related back to the question posed.• Results are summarised and related back to the question posed but some conclusions are incorrect or irrelevant.• Results are summarised and related back to the question posed and appropriate inferences are made.• Results are summarised and related back to the question posed and correct and detailed inferences are drawn from the data.