

Developing written feedback in mathematics

Following the training in the generic unit *Written feedback*, 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 recognise the types of written feedback that help pupils to improve.
- To focus written feedback on the learning objectives and planned learning outcomes of lessons so that pupils can see the immediate relevance of comments.
- To develop a strategy to provide written feedback that helps pupils to improve.
- To contribute to developing a whole-school policy clarifying the relationship between oral and written feedback.

Key messages

- The learning objectives and learning outcomes need to be the reference point for a teacher's written feedback. These need to be shared and made clear to pupils in advance of attempting the task.
- Effective feedback depends on the pupils being clear about what is expected of them. Pupils should have an expectation that the feedback they receive will explain what they have done well, with reasons, and where and how they can improve.
- Pupils should be given written feedback that provides clear evaluation of their strengths and weaknesses, prompts further thought and reasoning and identifies the next steps in their learning.
- To be able to identify the next steps in pupils' learning, a teacher needs to have a secure understanding of progression in the subject and be able to recognise pupils' misconceptions and challenges in the context of the subject.

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

To help you identify the appropriate starting point, the next section outlines a self-review that directs you to the material that will best support your departmental development.

Reviewing existing practice in written feedback

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>The departmental policy for providing written feedback does not relate to whole-school policy.</p> <p>The subject leader has identified:</p> <ul style="list-style-type: none"> a variety of disparate approaches to written feedback, e.g. a mixture of comments and different gradings within the department that written feedback often does not relate directly to the learning objectives and learning outcomes for the lesson in which the work was carried out that some teachers do not provide opportunities for pupils to act on their feedback. | <p>The departmental policy for providing written feedback relates to whole-school policy.</p> <p>There is a consistency of approach to written feedback developing across the department.</p> <p>Written feedback often directly relates to the learning objectives and outcomes but this is not consistent across the department and/or key stages.</p> <p>Written feedback increasingly clarifies for pupils precisely what they need to do to improve. Opportunities for pupils to act on teacher feedback are usually provided.</p> | <p>Whole-school and departmental policies emphasise the importance of referencing learning objectives in written feedback.</p> <p>The department has identified learning milestones and key tasks that will be marked in detail.</p> <p>Written feedback helps all pupils understand what they have done well and how they can improve.</p> <p>Teachers routinely provide time for pupils to reflect on, and respond to, written feedback.</p> | <p>Departmental policy and practice is consistent with whole-school policy in ensuring that written feedback is based on learning objectives and outcomes and focuses on improving standards in the subject.</p> <p>Departments across the school have a coherent and consistent approach to identifying learning milestones and key tasks to be marked in detail.</p> <p>Written feedback informs pupil target setting in the subject.</p> <p>Written feedback clearly identifies next steps for learning and regular opportunities are provided for pupils to consider and act on it.</p> |
| Pupils | <p>The subject leader has identified that:</p> <ul style="list-style-type: none"> pupils cannot connect the written feedback to the learning objectives for the lesson pupils typically do not understand the feedback given pupils tend not to act upon written feedback. | <p>Most pupils understand that written feedback is related to the learning objectives and outcomes of the lesson.</p> <p>Most pupils in lessons can explain what the written feedback means and can act upon it.</p> | <p>All pupils know that action is expected in relation to feedback.</p> <p>All pupils routinely use written feedback to improve their work.</p> <p>Pupil work shows evidence of a response to written feedback.</p> | <p>Pupils routinely use written feedback to reflect on the strengths and weaknesses of their work and to identify ways in which they can improve.</p> <p>Pupils understand how feedback relates to their longer-term goals and can set their own targets for improvement.</p> <p>Pupils are clear where in their work they have improved it in response to feedback.</p> |
| | Start with Task 4.2A | Start with Task 4.2A or 4.2B | Start with Task 4.2C | Start with Task 4.2C |

Making effective use of the subject development material

The tasks you have been referred to are intended to support the development or extension of written feedback 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 4.2A

In a department meeting, look at a sample of pupils' work from a year group alongside the relevant part of the scheme of work. How well does the observed work relate to the planned learning objectives? How effectively is the written feedback focused on the learning objectives?

Depending on the outcome of the sample, you may need to consider the following steps.

- 1 Select a series of lessons that you will be teaching in the near future.
- 2 Check and, where necessary, sharpen the learning objectives in your planning.
- 3 Share these objectives with pupils in accessible language.
- 4 Inform the pupils that written feedback will relate directly to the learning objectives.
- 5 Focus your written feedback on the objectives.

Further guidance is given in Unit 3, *Objective led lessons* and the related subject development materials.

Task 4.2B

Sample pupils' work in a year group or class to establish whether there is evidence that objective-based written comments are being acted on and that there are opportunities given for pupils to address the comments. (The pupils could usefully be the same as those in Task 4.2A.)

Over the next month, plan time in lessons for pupils to respond and act on their written comments.

As a department, or in pairs, look at the pupils' work and evaluate the impact of focusing on objectives.

Suggested steps:

- 1 Identify evidence of improved pupils' response to these comments.
- 2 Identify comments that prompt further thinking and indicate clearly the pupils' next steps.
- 3 Identify examples of good practice and agree to trial these over half a term in relation to one or more key units.
- 4 Ensure time in a department meeting to evaluate the impact on pupils.

Task 4.2C

In your department, agree key pieces of work for the next term that represent milestones in pupils' learning.

Establish the marking criteria and share them with pupils with explicit reference to standards in the subject.

Focus your feedback on these criteria and guide pupils on how they could improve.

The following pages provide exemplification of each task.

Task 4.2A

In a department meeting, look at a sample of pupils' work from a year group alongside the relevant part of the scheme of work. How well does the observed work relate to the planned learning objectives? How effectively is the written feedback focused on the learning objectives?

Depending on the outcome of the sample, you may need to consider the following steps.

- 1 Select a series of lessons that you will be teaching in the near future.
- 2 Check and, where necessary, sharpen the learning objectives in your planning.
- 3 Share these objectives with pupils in accessible language.
- 4 Inform the pupils that written feedback will relate directly to the learning objectives.
- 5 Focus your written feedback on the objectives.

Further guidance is given in Unit 3, *Objective led lessons* and the related subject development materials.

Context

Following the whole-school training on Assessment for learning, the mathematics department decided to review the approach to marking pupils' work. The whole school was focusing on providing effective written feedback to pupils. The mathematics department knew that they needed to address their current heavy marking load to make time for meaningful written feedback.

Process

The department set up a system to involve pupils with marking routine exercises, as this had the potential to encourage self-assessment and develop independence. The head of department explained the changes to parents through the school newsletter, and all teachers introduced the new ways of working to pupils. (**Appendix 4.2A.1** outlines the department's approach.)

Teachers found that the new approach gave more time for detailed written feedback on the questions pupils identified and on some extended pieces of work. They also found that, where teachers ensured adequate time for pupils to read the teacher's written comments, this had an impact on the quality of the pupils' later work (see Task 4.2B).

A month after introducing the new approach, the head of department sampled some pupils' exercise books to look at written feedback on a lesson on geometrical reasoning. The learning objectives for this lesson are given below.

| Teaching objective | Learning objectives | Learning outcomes |
|---|--|---|
| Understand a proof that the exterior angle of a triangle is equal to the sum of the two interior opposite angles. | To be able to: <ul style="list-style-type: none"> • identify interior and exterior angles on a triangle • label triangles accurately using agreed conventions • prove that the exterior angle at any vertex of a triangle is equal to the sum of the other two interior angles. | <p>All of you will label the diagram with some statements showing some angle facts.</p> <p>Most of you will label the diagram and text with statements that link together and lead to the correct conclusion, and be able to explain these.</p> <p>Some of you will present a coherent set of written statements explaining what fact has been used for each step leading to the conclusion.</p> |

The head of department found that few written comments were focused on the learning objectives. To demonstrate this, she produced a handout with representative written responses to the same piece of pupil work (see **appendix 4.2A.2**). She used this and the questions below to stimulate discussion.

- Which written feedback is most useful to the pupil?
- How could the written feedback be improved?

Evaluation

The teachers found the learning objectives helpful when working on improving the examples of the written feedback and decided to use this approach for the next term. They had been sharing objectives in most of their lessons for some time, and so agreed to communicate their intention to focus written feedback on the same objectives with pupils. They also felt that written feedback in the form of a question (as in example 2 of **appendix 4.2A.2**) had the potential to help the pupil to engage in using the feedback to improve the work (see Task 4.2B).

Task 4.2B

Sample pupils' work in a year group or class to establish whether there is evidence that objective-based written comments are being acted on and that there are opportunities given for pupils to address the comments. (The pupils could usefully be the same as those in Task 4.2A.)

Over the next month, plan time in lessons for pupils to respond and act on their written comments.

As a department, or in pairs, look at the pupils' work and evaluate the impact of focusing on objectives.

Suggested steps:

- 1 Identify evidence of improved pupils' response to these comments.**
- 2 Identify comments that prompt further thinking and indicate clearly the pupils' next steps.**
- 3 Identify examples of good practice and agree to trial these over half a term in relation to one or more key units.**
- 4 Ensure time in a department meeting to evaluate the impact on pupils.**

Context

Following the whole-school training on Assessment for learning, the mathematics department decided to review the approach to marking pupils' work. The whole school was focusing on providing effective written feedback to pupils.

Process

Having worked on using learning objectives to focus written comments for a term, the department came together to review progress. The head of department asked each teacher to bring three or four exercise books that contained examples of focused written feedback. Teachers worked in pairs, looking at the written feedback and looking for evidence of impact in the pupils' work.

They found inconsistencies, so they shared ideas for strategies to get pupils to act on written feedback. They agreed the following.

- When giving marked work back to pupils, teachers will allocate between five and ten minutes, usually at the start of the lesson, for pupils to read and respond.
- Where appropriate pupils should discuss their feedback in pairs.
- Pupils should be encouraged to write a written response to the feedback, so creating a written dialogue with the teacher.
- Pupils should be encouraged to go back to earlier written feedback to check they have acted on suggestions and resolved the problem.

Evaluation

Teachers agreed to experiment with these strategies over the next half term. They then repeated the process with the same exercise books to review progress.

Task 4.2C

In your department, agree key pieces of work for the next term that represent milestones in pupils' learning.

Establish the marking criteria and share them with pupils with explicit reference to standards in the subject.

Focus your feedback on these criteria and guide pupils on how they could improve.

Context

A department that had done extensive work on developing written feedback for pupils identified a weakness in pupils' written explanations through their analysis of the 2003 test papers and Key Stage 4 handling data coursework. This was viewed as critical in further raising pupils' standards of achievement, so the department explored a range of strategies to strengthen this area.

Process

The department used the 'Revising explanations' materials from *Securing progression in handling data* to extend their teaching approaches (see **appendices 4.2C.1** and **4.2C.2**). This work focuses on the Year 9 learning objective.

- Interpret graphs and diagrams and draw inferences to support or cast doubt on initial conjectures.

In order to focus pupils on the important qualities of written explanations, the department identified the marking criteria and produced the following as guidance for pupils while doing the work.

Guidance on writing explanations in interpreting charts

You will need to select key features from the chart to justify your reasoning. Your written explanation should include:

- a clear concise statement in response to the question
- **relevant** information, including either proportions (fractions, decimals or percentages) or totals to show you can read the charts
- comparisons between the two sets of data to support your statement.

The explanation should be about three or four sentences long.

Teachers used this guidance when marking the work. They did this in stages over the two-week unit so that pupils had the opportunity to improve their explanations using the feedback, redrafting their previous attempts. (Some examples from the *Securing progression in handling data* materials are provided in **appendix 4.2C.3**.)

Evaluation

Year 9 pupils' explanations in the context of handling data improved significantly, with evidence observed in written work that the guidance had helped pupils to devise clear concise explanations. The department then looked at the handling data units taught in Years 7 and 8 and decided to share the marking criteria with pupils and focus written feedback on these when teaching units in the spring term of each year.

Following the developments in your subject as a result of completing these tasks, you should evaluate its impact on teaching in the subject and how pupils have responded, particularly in relation to standards. The following questions may help to structure this.

- How has teaching been adapted to the key messages of effective written feedback?
- How has providing written feedback related to learning objectives impacted on pupils' learning?
- What more do we need to do to be more effective with written feedback?
- How do pupils respond to this approach to written feedback?
- How has it impacted on pupils' standards in your subject?

Subject-specific references

Referenced strategy materials

Securing progression in handling data (DfES 0658/2003). These materials can be found at www.standards.dfes.gov.uk/keystage3 by selecting 'mathematics' and then 'mathematics publications'.

Other strategy materials of interest

Interacting with mathematics in Key Stage 3: Year 9 geometrical reasoning mini-pack (DfES 0588/2002). These 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 3 explores the purposes of marking and feedback, and provides pointers to how they can be improved (QCA, www.qca.org.uk).

Ofsted materials

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

Involving pupils in marking their work

- Pupils** check all their own work initially. If appropriate, pupils 'mark' it as correct or incorrect.
- Any incorrect work is then clearly coded by the pupil using the 'traffic light' system.
 - A 'silly mistake' made through carelessness (this is something they really do understand), for example:

$$\begin{aligned} 5x + 3 &= 8 \\ 5x &= 8 + 3 && \text{coded green} \\ 5x &= 11 \\ x &= 2.2 \end{aligned}$$
 - An error that needs the teacher's attention (this is something they are struggling with), for example:

$$\begin{aligned} 5(a + 3) - 2(3 - a) &= 10 \\ 5a + 15 - 6 - 2a &= 10 && \text{coded red} \\ 3a + 9 &= 10 \\ 3a &= 1 \\ a &= 1/3 \end{aligned}$$
- Where the pupil uses the red code, the teacher then provides written feedback to help the pupil improve the work, for example:

$$\begin{aligned} 5(a + 3) - 2(3 - a) &= 10 \\ 5a + 15 - 6 - 2a &= 10 \\ 3a + 9 &= 10 \\ 3a &= 1 \\ a &= 1/3 \end{aligned}$$

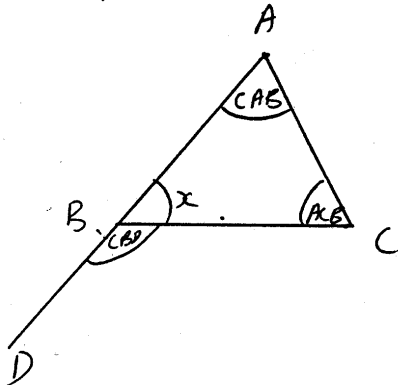
Your mistake is in this line because the second bracket is multiplied by negative 2, so: -2×3 and $-2 \times -a$
- Lessons are planned so that there is an opportunity for **pupils** to act on any such comments and again self-check. Any remaining errors will then be the subject of a conversation between teacher and pupil.

These examples relate to the following.

| Teaching objective | Learning objectives (for a sequence of lessons) | Learning outcomes (for a sequence of lessons) |
|--|--|---|
| Construct and solve linear equations with integer coefficients using appropriate methods | To be able to: <ul style="list-style-type: none"> form an equation from a given context appreciate other forms of the same equation solve the equation and check the solution relate the solution to the original context. | <p>All of you will be able to form and solve equations with the unknown on one side of the equation.</p> <p>Most of you will form and solve equations with the unknown on both sides and involving brackets.</p> <p>Some of you will solve equations involving negative signs anywhere in the equation and involving negative solutions.</p> |

Representative written responses to the same piece of pupil work

Example 1

Why call this x ?

$$CBD = ACB + CAB$$

$$ACB + CAB + x = 180^\circ$$

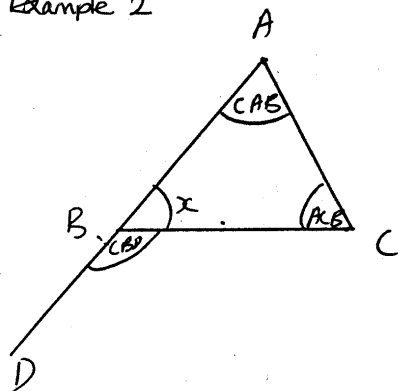
$$CBD + x = 180^\circ$$

$$\therefore ACB + CAB + x = CBD + x$$

$$ACB + CAB = CBD$$

Write again with reasons.

Example 2

How do you know that these add up to 180° ?

$$CBD = ACB + CAB$$

$$\rightarrow ACB + CAB + x = 180^\circ$$

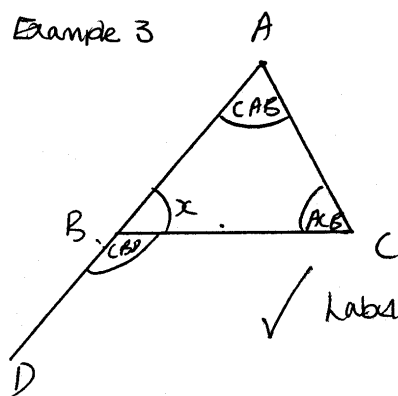
$$\rightarrow CBD + x = 180^\circ$$

$$\therefore ACB + CAB + x = CBD + x$$

$$ACB + CAB = CBD$$

What fact have you used here?

Example 3



$$CBD = ACB + CAB$$

$$ACB + CAB + x = 180^\circ$$

$$CBD + x = 180^\circ$$

$$\therefore ACB + CAB + x = CBD + x$$

$$ACB + CAB = CBD$$

✓ Labels good - no reasons given

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.

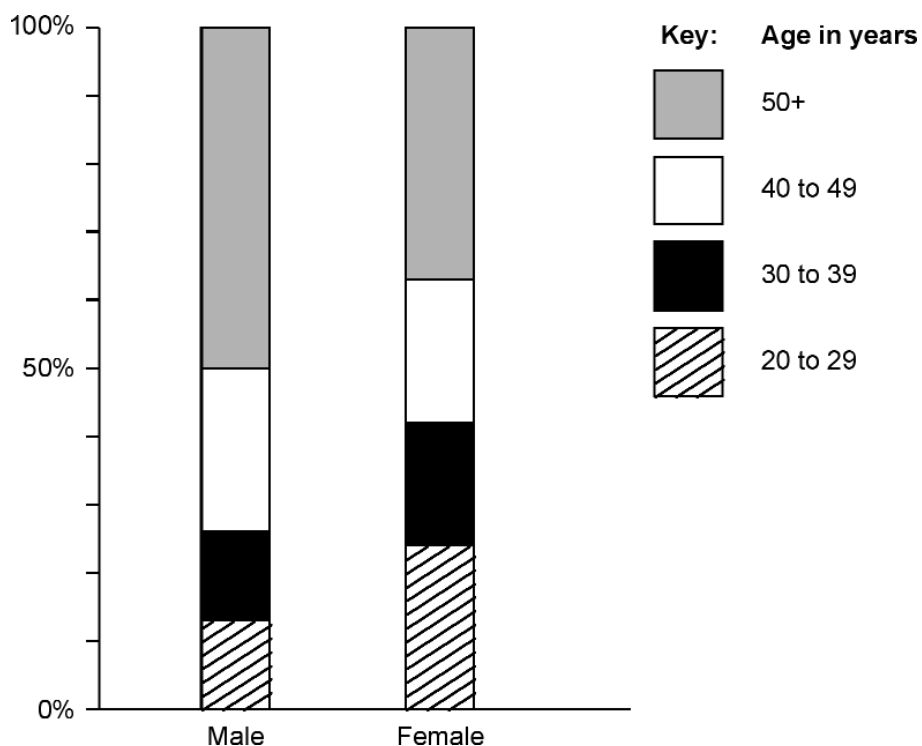
- Select a question and six brief explanations written under test conditions (available on the CD-ROM). Display or distribute these to the class. Explain that three answers would gain full marks and three would not. One of each is already identified.
- Together with the pupils, 'mark' the remaining answers, 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).

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.



1 mark

Total 4 marks

Revising explanations: Annotated pupils' scripts

Cycling

At point P Gary + Nesta were both at or
reaching Torbridge. Gary had got to Torbridge
+ had started his journey back to Ashbury.
He had also just overtaken Nesta.
Nesta was not far from Torbridge but had about
another quarter of a km to go.

Not true.

Inaccurate – Gary had already passed Torbridge.

True, but the answer would be improved with a statement like “at point P, Gary and Nesta pass each other travelling in opposite directions.”

The final sentence does not add anything important.

Teachers

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

This is because there is

37% of 50+ female teachers and
50% of 50+ male teachers

and then there is 24% of 40–49 male
teachers and 20% female teachers,
20% of 30–39 female teachers, 10%
of 30–39 male teachers.

Under 50 for females is round 62%
for males it is 50%.

A clear, concise statement

Key information

This does not add
anything important

Accurate but could be
better expressed, e.g.
“62% of females are under
50 whereas 50% of males
are under 50”