

# GCSE (9-1)

*Transition Guide*

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J560

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# ***MATHEMATICS***

Theme: Standard form

August 2015



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# Welcome

## Welcome to the KS3–KS4 transition guide for **Maths**.

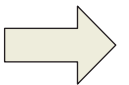
Key Stage 3 to 4 Transition Guides focus on how a particular topic is covered at the different key stages and provide information on:

- Differences in the demand and approach at the different levels;
- Useful ways to think about the content at Key Stage 3 which will help prepare students for progression to Key Stage 4;
- Common student misconceptions in this topic.

Transition guides also contain links to a range of teaching activities that can be used to deliver the content at Key Stage 3 and 4 and are designed to be of use to teachers of both key stages. Central to the transition guide is a Checkpoint task which is specifically designed to help teachers determine whether students have developed deep conceptual understanding of the topic at Key Stage 3 and assess their 'readiness for progression' to Key Stage 4 content on this topic. This checkpoint task can be used as a summative assessment at the end of Key Stage 3 teaching of the topic or by Key Stage 4 teachers to establish their students' conceptual starting point.

Key Stage 3 to 4 Transition Guides are written by experts with experience of teaching at both key stages.

[Go to topic comparison](#)



**Topic:** Standard form



## Key Stage 3 Content

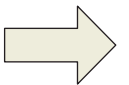
### Key Stage 3 National Curriculum Content

- Understand and use place value for decimals, measures and integers of any size
- Use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals
- Interpret and compare numbers in standard form  $A \times 10^n$ ,  $1 \leq A < 10$ , where  $n$  is a positive or negative integer or zero
- Use a calculator and other technologies to calculate results accurately and then interpret them appropriately



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Key Stage 4 Content



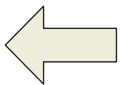
**Topic:** Standard form



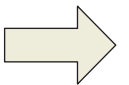
## Key Stage 4 Content

GCSE (9-1) Content Ref.	Subject content	Initial learning for this qualification will enable learners to..	Foundation tier learners should also be able to...	Higher tier learners should additionally be able to...	DfE Ref.
<b>1.04</b>	<b>Inverse operations</b>				
1.04a	Inverse operations	Know that addition and subtraction, multiplication and division, and powers and roots, are inverse operations and use this to simplify and check calculations, for example in reversing arithmetic in "I'm thinking of a number" or "missing digit" problems. e.g. $223 - 98 = 223 + 2 - 100 = 125$ $25 \times 12 = 50 \times 6 = 100 \times 3 = 300$ [see also Calculation and estimation of powers and roots 3.01b]			N3, N6
GCSE (9-1) Content Ref.	Subject content	Initial learning for this qualification will enable learners to..	Foundation tier learners should also be able to...	Higher tier learners should additionally be able to...	DfE Ref.
<b>3.02</b>	<b>Standard form</b>				
3.02a	Standard form	Interpret and order numbers expressed in standard form. Convert numbers to and from standard form. e.g. $1320 = 1.32 \times 10^3$ $0.00943 = 9.43 \times 10^{-3}$			N9
3.02b	Calculations with numbers in standard form	Use a calculator to perform calculations with numbers in standard form.	Add, subtract, multiply and divide numbers in standard form, without a calculator [see also Laws of Indices, 3.01c]		N9

Key Stage 3 Content



Explore the Guide



**Topic:** Standard form



Comment

Possible Teaching  
Activities (KS3 focus)

Checkpoint Tasks

Possible Teaching  
Activities (KS4 focus)

Possible Extension  
Activities (KS4 focus)

Resources, links and  
support

## Comment

### Difference between the level of demand and KS3 and KS4

The essential difference between Key Stage 3 and Key Stage 4 is the move from interpreting and ordering numbers in standard form and any calculations performed on a calculator, to the solving of problems involving the manipulation of numbers in standard form and solving without a calculator.

### Pre-requisite knowledge for Key Stage 4

At Key Stage 4 students will be expected to formulate more complex problems using numbers in standard form and to solve such problems without the use of a calculator. Students need to be competent in the four rules of number, the order of operations, the concept of cancelling and the use of the laws of indices. They should have a clear understanding of place value, be able to round to one (or more) significant figures for estimating and/or a check.

### Common misconceptions

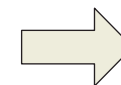
When given a problem formulated with numbers in standard form, students often think it easier to convert the number into ordinary form. Errors often occur when adding the number of zeroes, and if addition or subtraction of the numbers is required students often have problems lining up the zeroes, creating further error.

When multiplying or dividing, particularly with numbers less than one, students are under the misconception that converting the numbers to ordinary numbers makes the solution easier; they often lack confidence with the laws of indices.

Frequently a solution is obtained that is not in standard form and students are under the misconception that they have finished. For example an answer given as  $0.7 \times 10^{-3}$ ; writing 0.7 in standard form as  $7.0 \times 10^{-1}$  and substituting this to obtain  $7.0 \times 10^{-1} \times 10^{-3}$ , then using the laws of indices to obtain the final solution of  $7.0 \times 10^{-4}$ , is clear evidence of a good understanding of the problem.

Sometimes students do not fully appreciate that standard form comprises of a number between 1 and 10, multiplied by a multiple of 10. Often they do not move the decimal point, e.g. in converting the ordinary number 0.0007 into standard form they give  $0.0007 \times 10^{-4}$ , clearly misunderstanding the meaning of standard form.

Next



**Topic:** Standard form



Comment

Possible Teaching  
Activities (**KS3 focus**)

Checkpoint Tasks

Possible Teaching  
Activities (**KS4 focus**)

Possible Extension  
Activities (**KS4 focus**)

Resources, links and  
support

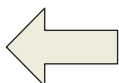
## Comment

### Ways of using activities and checkpoint tasks

The following activities are a mixture of PowerPoint presentations, whiteboard displays, activities and question sources. Together they form a series of alternative resources that teachers may choose to use when teaching this topic. The activities are listed under three sections, KS3 focus, GCSE focus and Challenge and Extension. Some activities provide suitable material for beginners, others could be used within the structure of a lesson.

The checkpoint tasks are designed to enable teachers to assess whether the students have reached a certain level of understanding. The tasks may be completed individually, in pairs or in groups, allowing discussion and interaction with the teacher; a series of suggested questions are provided in the teacher's notes.

Previous



**Topic:** Standard form



Comment

Possible Teaching  
Activities (KS3 focus)

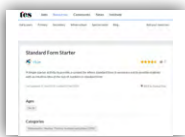
Checkpoint Tasks

Possible Teaching  
Activities (KS4 focus)

Possible Extension  
Activities (KS4 focus)

Resources, links and  
support

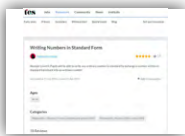
## Possible Teaching Activities (KS3 focus)



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view page

A simple starter activity to provide context for where standard form is a useful tool. Students are provided with a sheet of coloured pictures and a PowerPoint presentation, which gives numbers in standard form; students have to choose which picture the number represents. The PowerPoint presentation could be used as a starter; students could then be given all the answers (not provided) and working in groups or pairs match them up, arrange in order, or the resource could be used as a quiz.

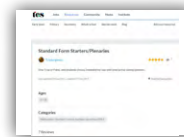
**Resources:** <http://www.tes.co.uk/ResourceDetail.aspx?storyCode=6322033>



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A PowerPoint document that shows how to write any large or small number in standard form, and vice versa, along with providing exercises that students can complete and later mark. The presentation is presented simply and very clear, though it is rather long and could be split into two or three lessons.

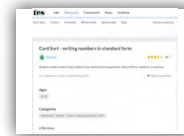
**Resources:** <http://www.tes.co.uk/teaching-resource/Writing-Numbers-in-Standard-Form-6041991/>



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view page

PowerPoint presentations of two similar activities, one true or false and another multiple choice. Both activities are concerned with changing standard index numbers into ordinary form and back again, with a total of ten questions for each.

**Resources:** <http://www.tes.co.uk/teaching-resource/Standard-Form-Starters-Plenaries-6159139/>



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view page

A simple Microsoft Word document that provides an idea for further development. The worksheet provides cards in standard form and other cards with their equivalent in ordinary numbers. The cards could be cut up so the students match and then arrange in order. A good starter activity.

**Resources:** <http://www.tes.co.uk/teaching-resource/Card-Sort-writing-numbers-in-standard-form-6429987/>



Comment

Possible Teaching  
Activities (**KS3 focus**)

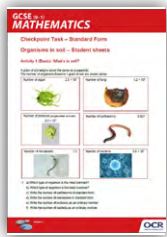
**Checkpoint Tasks**

Possible Teaching  
Activities (**KS4 focus**)

Possible Extension  
Activities (**KS4 focus**)

Resources, links and  
support

## Checkpoint Tasks



[Click here to view page](#)

The checkpoint task, Organisms in soil, is divided into 4 activities.

Activity 1 (Basic): What's in soil?

Activity 2 (Understanding indices): The farmer's field.

Activity 3 (Challenge): How small are bacteria?

Activity 4 (Research): Top soil and worm-casts

**Activity 1** involves converting numbers to and from standard form, checks understanding of positive, negative and zero indices and asks students to compare sizes and sort into order.

**Activity 2** checks student understanding of positive indices and how numbers written in standard form are dealt with during addition, subtraction and multiplication. Students are able to use a calculator to solve problems, but a level of understanding is expected when following through a given solution.

**Activity 3** checks the students understanding of negative indices and involves multiplication and division of numbers written in standard form. The activity involves substituting values in a formula; previous experience with the formula is not necessary. Students should be reminded to show the steps in their working when using a calculator.

**Activity 4** assesses students' ability to solve a problem and could be extended into an investigative section of work, with students researching data from the internet. Students would be required to show the steps in their working clearly, with attention paid to the detail, level of accuracy and units. Students should give a critical interpretation of their answer and check the validity of the information found by researching facts on the internet themselves. Websites from where the data has been collected is provided and could be used in addition to any websites found.

**Topic:** Standard form

Comment

Possible Teaching  
Activities (KS3 focus)

Checkpoint Tasks

Possible Teaching  
Activities (KS4 focus)

Possible Extension  
Activities (KS4 focus)

Resources, links and  
support

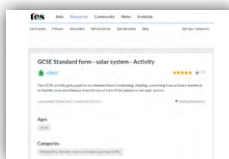
## Possible Teaching Activities (GCSE focus)



The video gives an explanation of how to add and subtract numbers that are in standard form without converting them into 'ordinary' numbers first. The examples include negative powers of ten. The video is 11 minutes long, but could be split into sections. Additional exercises would need to be provided.

Click here to  
see the clip

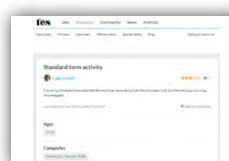
**Resources:** <https://www.youtube.com/watch?v=88ki39g5oRl>



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This activity provides two worksheets written in Microsoft Word. Pupils use standard form (multiplying, dividing, converting from ordinary numbers) to find mass and distance from the Sun of each of the planets in the solar system. It is an activity suitable for small groups, pairs or individuals; students are given a worksheet, which could be cut into different cards or made slightly easier by leaving them on the worksheet together with a table for the answers. A guide is given which provides the answers.

**Resources:** <http://www.tes.co.uk/ResourceDetail.aspx?storyCode=6126062>



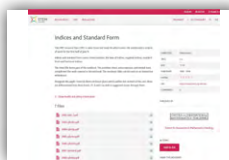
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This activity provides worksheets written in Microsoft Word and the resources for a starter, there is no explanation and teachers may use the worksheets as desired.

The 'Activity' document contains two worksheets. A starter could use the question worksheet as the base. The second worksheet containing the answers could be cut into cards and placed face down. One player picks a card and matches it with the question, earning those points if correct; the next player then repeats. Alternatively, students ask for a question of a given points value, then earn those points if they are able to select the correct answer.

The worksheet document provides an empty template in which pairs of students could make up their own questions and answers, then swap their sheets with another pair of students.

**Resources:** <http://www.tes.co.uk/teaching-resource/Standard-form-activity-6410397/>



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This resource provides many files, including worksheets, mental tests, and overhead slides, all of which could be adapted for starters, homework, tests etc.

**Resources:** <http://www.nationalstemcentre.org.uk/elibrary/resource/790/indices-and-standard-form>

**Topic:** Standard form

Comment

Possible Teaching  
Activities (KS3 focus)

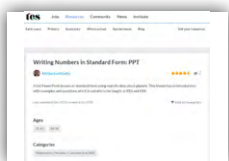
Checkpoint Tasks

Possible Teaching  
Activities (KS4 focus)

**Possible Extension  
Activities (KS4 focus)**

Resources, links and  
support

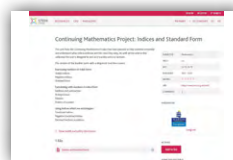
## Possible Challenge And Extension Tasks



A PowerPoint presentation that reviews writing very large and small numbers in standard form; exercises are provided on converting numbers to and from standard form and answers are not provided, so this could be a discussion within the class. Finally, a formula is introduced that involves students substituting numbers in standard form, before multiplying, dividing and square rooting. The last slide gives the final answers only in 'ordinary' form.

**Resources:** <http://www.tes.co.uk/teaching-resource/Writing-Numbers-in-Standard-Form-PPT-6046893/>

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This is essentially a diagnostic test, with questions on simple indices, negative indices and standard form, calculating with numbers in index form and using indices that are not integers. It focusses on understanding indices, which is also important for solving problems in standard form. Ensuring competence in handling indices would be an important step before problem solving with numbers in standard form.

**Resources:** <https://www.stem.org.uk/elibrary/resource/29985/continuing-mathematics-project-indices-and-standard-form>

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**Topic:** Standard form



Comment

Possible Teaching  
Activities (KS3 focus)

Checkpoint Tasks

Possible Teaching  
Activities (KS4 focus)

Possible Extension  
Activities (KS4 focus)

Resources, links and  
support

## Resources, links and support



**Additional  
Topic 1**



**Additional  
Topic 2**



**Additional  
Topic 3**

As we develop Transition Guides for further topics we'll update these links, making it easy for you to browse all the guides for your chosen subject.



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**Topic:** Standard form





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