NUMERACY

Y9 Reasoning sample materials

National Numeracy Tests

Llywodraeth Cymru
Welsh Government

Reasoning sample materials: Guidance for teachers

The reasoning tests will be first introduced in schools in 2014. It is therefore important that teachers and learners become increasingly familiar with the requirements in the framework to identify processes and connections, to represent and communicate, and to review.

Sample items have been produced for each year group to illustrate different question types and formats for response. Each year group contains one stimulus item, presented through PowerPoint, which requires information to be shown by the teacher immediately before the test begins.

The purpose of the stimulus material is to allow learners to engage with unfamiliar contexts. A teacher script is provided but teachers may use their own words provided no help is given with the numeracy that is to be assessed.

The sample items are representative of the anticipated level of demand. However, they are not complete papers: the number of marks within the live tests will be about 20 for each year group, with one stimulus item followed by between four and eight additional questions. In 2014 each reasoning test will last 30 minutes. The time taken to deliver the stimulus is in addition to this assessment time.

- ***How to use the sample items***

The sample items can be printed and used for practice before the tests. Strengths and areas for improvement can then be identified and used to provide additional classroom learning and teaching activities, where appropriate.

The reasoning sample items can also be used as a basis for classroom discussion, to illustrate good test techniques. These include the importance of reading the question carefully, where to write the answers, the importance of showing working to enable others to understand the reasoning applied, good time management and the benefits of checking answers.

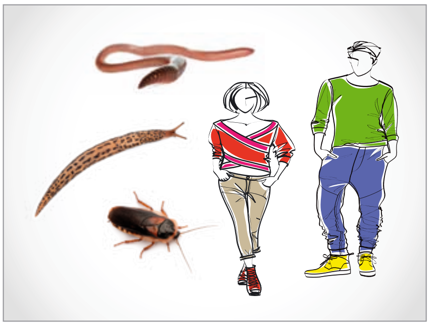
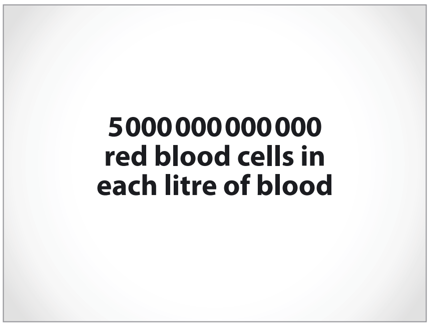
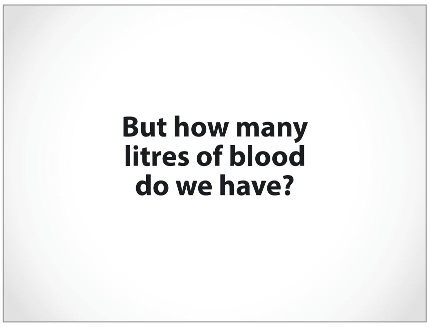
As importantly, the sample items can be used to promote understanding of good responses to open questions. For example, teachers could anonymise and photocopy a range of responses and ask learners to work in small groups to rank from 'best' to 'worst', identifying what is good about each and why.

- ***Marking of the sample items***

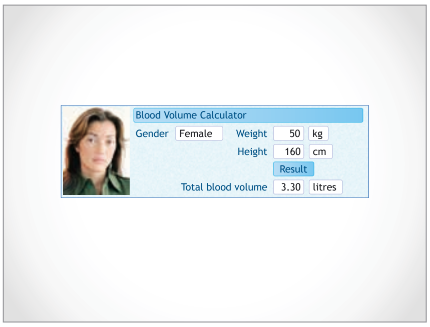
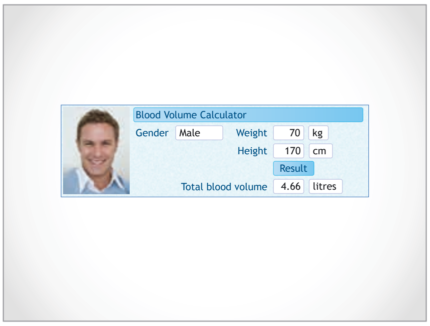
A markscheme is provided which is typical of those to be used alongside the live tests. It includes a range of likely responses with clear guidance on when and how partial credit should be applied. General marking guidance provides principles of marking to facilitate consistency across schools.

Presentation to be shown to learners before doing question 1

The text in the right-hand boxes should be read to learners. Teachers can use their own words, or provide additional explanation of contexts, if necessary. However, no help must be given with the numeracy that is to be assessed.

Slide 1		Two people, but what are the other images? *(slug, earthworm, cockroach)* All five are animals, but did you know that the colour of their blood is different? Slugs have blood that is almost blue, worms can have green blood and cockroaches' blood is colourless. We, of course, have red blood. The colour comes from red blood cells. Does anyone know about how many red blood cells you have in each litre of blood?
Slide 2		Five trillion … that's five million, million. And that is just within one litre of blood.
Slide 3		Of course we have more than one litre of blood. So how much do we have?

<table>
<tr><td>Slide 4</td><td></td><td>The answer to that depends on whether you are female or male …</td></tr>
<tr><td>Slide 5</td><td></td><td>It also depends on your body size.

There are several websites that allow you to type in your weight and height. Then the online calculator works out for you how much blood you are likely to have.</td></tr>
<tr><td>Slide 6</td><td>
</td><td>This is the output from one online calculator. There are three inputs: female or male, weight in kg and height in cm. This woman is estimated to have 3.30 litres of blood in her body.</td></tr>
<tr><td>Slide 7</td><td>
</td><td>And this man, who is heavier and taller than the woman, is estimated to have 4.66 litres of blood in his body.

For the online calculator to work someone has put in some simple formulae. Your task is to look at the data and work out what those simple formulae are.

All the information you need is in your booklet. When you have finished there are other questions to answer.

Remember that for some of the questions you will need to use your calculator, and it is very important to show your working so that someone else can understand what you are doing and why.</td></tr>
</table>

1

Blood Volume Calculator

Gender: Female — Weight: 50 kg

Height: 160 cm

Result

Total blood volume: 3.30 litres

Total volume of blood (litres)

weight (kg) \ height (cm)	160	170
FEMALES	**160**	**170**
0	1.65	1.94
10	1.98	2.27
20	2.31	2.60
30	2.64	2.93
40	2.97	3.26
50	3.30	3.59
60	3.63	3.92
70	3.96	4.25

For females of height **160cm**, the formula used by the calculator is:

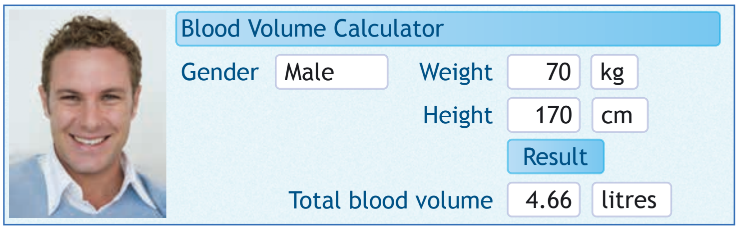
$$\textbf{Volume of blood in litres} = 0.33 \times \frac{\textbf{weight in kg}}{10} + 1.65$$

Show how you can work out the formula from the table.

2m

Write the formula for a female of height **170cm**.

1m



Total volume of blood (litres)

	MALES	height (cm) 160	height (cm) 170
weight (kg)	**40**	3.40	3.70
	50	3.72	4.02
	60	4.04	4.34
	70	4.36	4.66

For males of height **160cm**, the formula used by the calculator is:

$$\textbf{Volume of blood in litres} = 0.32 \times \frac{\textbf{weight in kg}}{10} + ?$$

Work out the missing value. [Hint: it is **not** 3.40]

2m

The table for females starts at 0kg. The table for males starts at 40kg.

Which is more realistic and why?

1m

2 Mount Snowdon is the tallest mountain in Wales. Many people climb it.

The graphs on the next page are published by Snowdonia National Park.

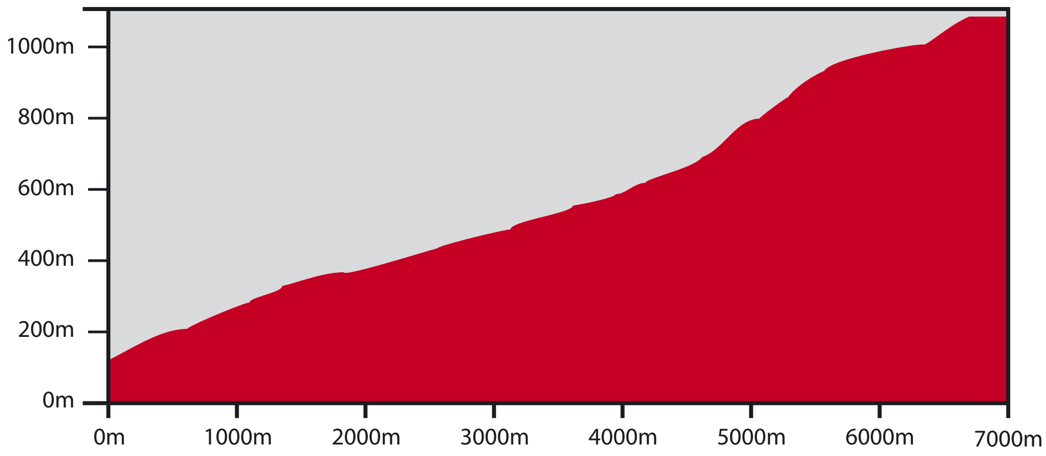
They allow walkers to compare climbing routes.

Match the graphs to the descriptions below.

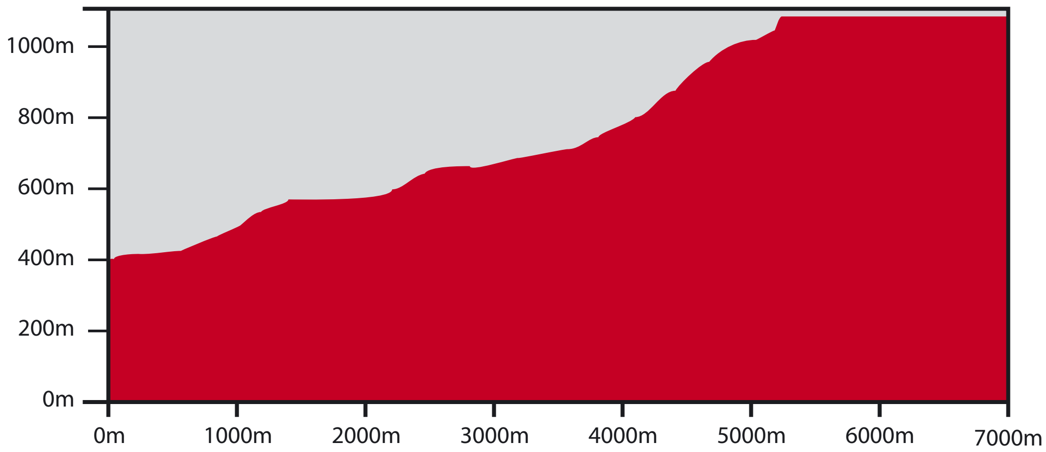
Pyg Track	The shortest distance to the top of the mountain but parts of it are very steep.	Graph ____________
Watkin Path	Starts at the lowest point but the ending is very difficult. Many people have accidents here.	Graph ____________
Llanberis Path	This path follows the track of the railway. It is the longest path; the gradient is about the same the whole way.	Graph ____________
Miner's Track	This path was built to serve a mine. It is almost flat for over a third of the way but becomes rough, steep and rocky.	Graph ____________

2m

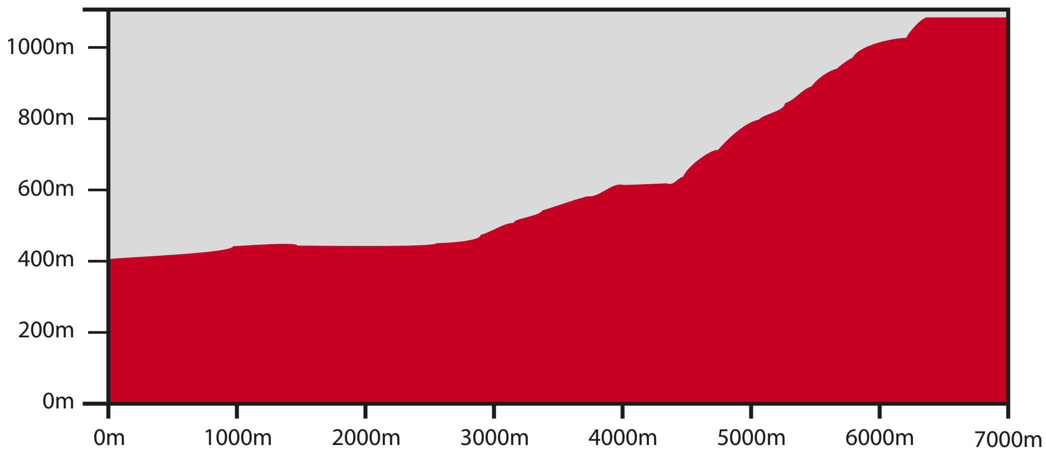
A


1000m
800m
600m
400m
200m
0m
0m
1000m
2000m
3000m
4000m
5000m
6000m
7000m

B


1000m
800m
600m
400m
200m
0m
0m
1000m
2000m
3000m
4000m
5000m
6000m
7000m

C


1000m
800m
600m
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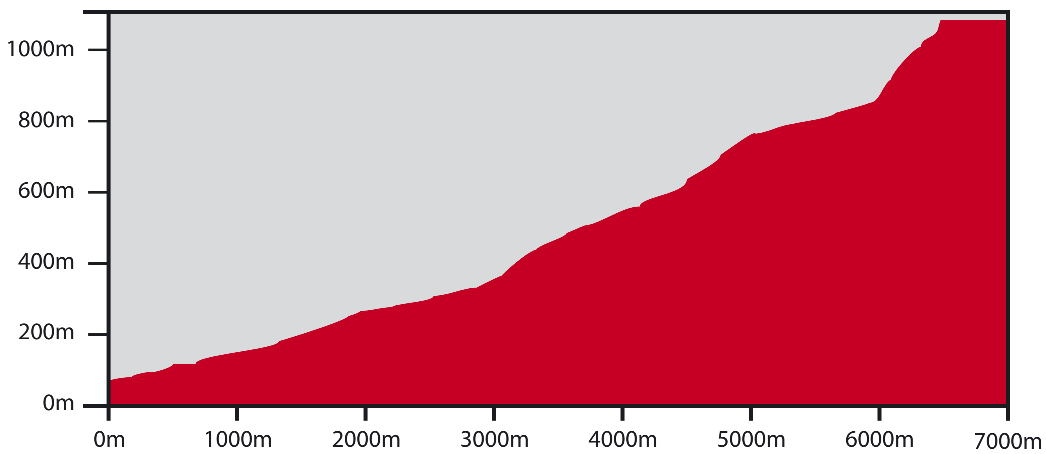
200m
0m
0m
1000m
2000m
3000m
4000m
5000m
6000m
7000m

D


1000m
800m
600m
400m
200m
0m
0m
1000m
2000m
3000m
4000m
5000m
6000m
7000m

3

Men's 100m 1912

Gold medal to
Ralph Craig (USA)

10.8 seconds

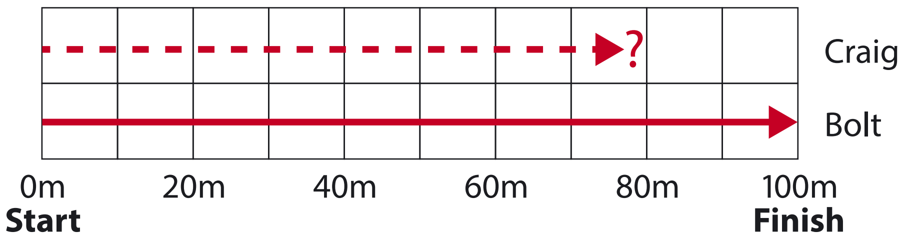
Men's 100m 2012

Gold medal to
Usain Bolt (Jamaica)

9.6 seconds

Imagine Craig and Bolt in the same 100m race, running in the times shown above.

Bolt would win, but after 9.6 seconds where would Craig be?



3m

To answer this question, what assumption have you had to make?

1m

Reasoning sample materials: Marking guidance

It is important that the tests are marked accurately. The questions and answers below help to develop a common understanding of how to mark fairly and consistently.

- ***Must learners use the answer boxes?***

Provided there is no ambiguity, learners can respond anywhere on the page. If there is more than one answer the one in the answer box must be marked, even if incorrect. However, if the incorrect answer is clearly because of a transcription error (e.g. 65 has been copied as 56), mark the answer shown in the working.

- ***What if learners use a method that is not shown within the markscheme?***

The markschemes show the most common methods, but alternative approaches may deserve credit – use your professional judgement. Any correct method, however idiosyncratic, is acceptable.

- ***Does it matter if the learner writes the answer differently from that shown in the markscheme?***

Numerically equivalent answers (e.g. eight for 8, or two quarters or 0.5 for half) should be marked as correct unless the markscheme states otherwise.

- ***How should I mark answers involving money?***

Money can be shown in pounds or pence, but a missing zero, e.g. £4.7, should be marked as incorrect.

- ***How should I mark answers involving time?***

In the real world, specific times are shown in a multiplicity of ways so accept, for example, 02:30, 2.30, half past 2, etc. Do not accept 2.3 as this is ambiguous. The same principle should be used for marking time intervals, e.g. for two and a half hours accept 2.5 but not 2.5pm.

- ***What if the method is wrong but the answer is correct?***

Unless the markscheme states otherwise, correct responses should be marked as correct even if the working is incorrect as learners may have started again without showing their revised approach.

- ***What if the learner has shown understanding but has misread information in the question?***

For a two (or more) mark item, if an incorrect answer arises from misreading information given in the question and the question has not become easier as a result then deduct one mark only. For example, if the 2 mark question is 86×67 and the learner records 96×67 then gives the answer 6432, one mark only should be given. In a one mark question, no marks can be given.

- ***What should I do about crossed out work?***

Working which has been crossed out and not replaced can be marked if it is still legible.

- ***What is the difference between a numerical error and a conceptual error?***

A numerical error is one in which a slip is made, e.g. within 86×67 the learner works out $6 \times 7 = 54$ within an otherwise correct response. A conceptual error is a more serious misunderstanding for which no method marks are available, for example if 86×60 is recorded as 516 rather than 5160

Year 9 Reasoning sample materials: Markscheme

Q	Marks	Answer	Comments
1i	2m	Links 0.33 to the difference between pairs of values and 1.65 to the weight of 0kg, e.g. • The equation is of the form y = mx + c The gradient is 0.033 because that is the difference between each pair of values divided by the difference in their weight. c is the y-intercept when weight is 0, so it is 1.65 • Successive values increase by 0.33 1.65 is the first value in the table • They change by 0.33 and 1.65 is the smallest value there	
	Or 1m	Recognises that the difference between each pair of values is 0.33 Or Recognises that 1.65 is the value when the weight is 0kg Or Shows the formula works for at least two pairs of values, e.g. • 0.33 × 0 + 1.65 = 1.65 0.33 × (10 ÷ 10) + 1.65 = 1.98	
1ii	1m	Gives a correct formula, e.g. • Volume of blood in litres = 0.33 × (weight in kg ÷ 10) + 1.94 • V = 0.033 × W + 1.94	

Q	Marks	Answer	Comments
1iii	2m	Gives the value 2.12	
	Or 1m	Shows $3.40 - 4 \times 0.32$, e.g. • $3.4 - 1.28$ Or Substitutes into the formula, e.g. • $3.4 = 0.32 \times 4 + ?$ • $3.72 = 0.32 \times 50 \div 10 + A$ • $4.04 = 0.32 \times 6 + ?$ • $4.36 = 0.32 \times 7 + ?$	
1iv	1m	Justifies why the table for males is more realistic, e.g. • You can't have people who are 0kg	
2	2m	All correct, i.e. B D A C	
	Or 1m	Any two or three correct	
3i	3m	89 or 88.(…) metres	*Note to teachers: this question is demanding and would be placed towards the end of the paper* Accept 88 followed by any decimal Accept 90 metres with correct working
	Or 2m	Shows or implies $9.6 \div 10.8$, e.g. • The digits 89 or 88 seen	
	Or 1m	Shows how far Craig would run in a unit of time other than 10.8 seconds, e.g. • He would run 10m in 1.08 seconds	
3ii	1m	Gives a valid assumption, e.g. • That they run at a constant speed • That the numbers are exact not rounded	Do not accept assumptions already made for them, e.g. • That they are both still alive • That Craig is fit and healthy