



Standards- Based Assessment Tools for Maths

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Assessment tools: Authoring

- To create these resources, I use
- **Uniquorate** - our free, open source, standards-compliant editor for
 - Packaging questions with media
 - Contextualising existing questions
 - Setting up and packaging tests
- Oxygen editor for
 - Using Maths extensions - Maxima CAS for manipulation
 - Organising marking and feedback logic
 - But **Uniquorate's** Expert Mode is good for this too, and free...
- Snuggletex for
 - Getting MathML from LaTeX
 - N.B. it's in **Uniquorate** already...

Uniqurate Questions 1: Friendly Mode

Question components

Text **Maths** Others

Feedback shown with components

+ ÷ A 1
- × B 2 Custom Maths

A
B C QuickMaths
A = B x C

? Click to find out about a component

Question Preview

Main Menu Save current question Test in QTIWorks Expert Mode

<< select for position >>

B I U ABC Font family Font size

What is the quadratic formula?

<< select for position >>

Answer/Feedback text (use toggle on the left to switch between answer and feedback) Score

+ X	answer	$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	π	0
+ X	answer	$ax^2 + bx + c$	π	0
+ X	answer	None of these	π	0

Quick feedback Max choices: 1 Min choices: 0 Random order: Show as pull-down:

<< select for position >>

Custom Maths component

Question Text = What is the value of the greater root of $ax^2 + bx + c = 0$ if b is [b], a is [a] and c is [c]?

Answer = $(-b + (b^2 - 4ac)^{1/2}) / (2a)$

<< select for position >>

One question can have several (different) inputs

Add more components if needed

Uniqurate Questions 2: Intermediate Mode

Click here to add MathML

Only HTML content is visible

Click on MathML to edit it

Use $\backslash qv\{\text{variable-name}\}$ in LaTeX to display variables in MathML

mX

You integrated!

to the e

he solut

fully diff

wer, but

You reduced the power by 1 but

You should multiply by the power

You multiplied by the power, but

You reduced the power by 1 but

You increased the power by 1 a

You have had three attempts at answering this question, so here is the solution:

To differentiate this expression, we "multiply by the power", so the coefficient becomes

$iA \times iB = iAB$

Then we "reduce the power by 1"

Uniqurate Questions 2: Expert Mode

The screenshot shows a software interface with a file explorer on the left and an XML editor on the right. The file explorer displays a package named 'Test03-trigGraphs-011600m' containing several files: 'images', 'desktop.ini', 'imsmanifest.xml', 'sin(2x).png', 'sin(3x).png', 'sin(4x).png', 'sin(5x).png', 'sin(6x).png', 'sin(x).png', 'imsmanifest.xml', and 'Test03-trigGraphs-011600m.xml'. The XML editor displays the content of 'Test03-trigGraphs-011600m.xml', which is a QTI XML document. The XML code includes a root element 'assessmentItem' with various attributes and child elements for 'responseDeclaration', 'outcomeDeclaration', and 'defaultValues'. A red vertical line is drawn next to the 'Test03-trigGraphs-011600m.xml' file in the file explorer, and a red diagonal line points from the XML editor to the 'ASKSOLUTION' element in the code.

```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <assessmentItem xmlns="http://www.imsglobal.org/xsd/imsqti_v2p1"
3   xmlns:m="http://www.w3.org/1998/Math/MathML"
4   xmlns:ma="http://mathassess.qtitools.org/xsd/mathassess"
5   xmlns:xi="http://www.w3.org/2001/XInclude" xmlns:xlink="http://www.w3.org/1999/xlink"
6   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" adaptive="false"
7   identifier="Test03-trigGraphs-011600m" timeDependent="false"
8   title="Identify sin(bx) from the graph" toolName="Mathqurate"
9   toolVersion="1.0" xml:lang=""
10  xsi:schemaLocation="http://www.imsglobal.org/xsd/imsqti_v2p1 imsqti_v2p1.xsd
11  http://mathassess.qtitools.org/xsd/mathassess mathassess.xsd">
12  <responseDeclaration cardinality="record" identifier="RESPONSE"/>
13  <responseDeclaration baseType="boolean" cardinality="single" identifier="HINTREQUEST"/>
14  <responseDeclaration baseType="boolean" cardinality="single" identifier="SOLREQUEST"/>
15  <outcomeDeclaration baseType="float" cardinality="single" identifier="SCORE"
16    normalMaximum="2.0"
17    normalMinimum="0.0">
18    <defaultValues>
19      <value>0.0</value>
20    </defaultValues>
21  </outcomeDeclaration>
22  <outcomeDeclaration baseType="boolean" cardinality="single" identifier="seenSolution">
23    <defaultValues>
24      <value>>false</value>
25    </defaultValues>
26  </outcomeDeclaration>
27  <outcomeDeclaration baseType="boolean" cardinality="single" identifier="seenHint">
28    <defaultValues>
29      <value>>false</value>
30    </defaultValues>
31  </outcomeDeclaration>
32  <outcomeDeclaration baseType="identifier" cardinality="single" identifier="ASKHINT">
33    <defaultValues>
34      <value>askhint</value>
35    </defaultValues>
36  </outcomeDeclaration>
37  <outcomeDeclaration baseType="identifier" cardinality="single"
38    identifier="ASKSOLUTION">
39    <defaultValues>
40      <value>asksolution</value>
41    </defaultValues>
42  </outcomeDeclaration>
43 </assessmentItem>
```

Files in package

QTI XML for this question

Packaging Tests (Uniquurate editor)

Test Details

Title

Time Limits (mins)

Post-test feedback

You have reached the end of the test. Your total score was [score] out of [total].

Test Sections

Main Menu Save current test

Section 1 ✕

Section rubric:

Answer all questions

Number of questions to choose from section:

Expand $(ax+b)(cx+d)$	(max score: 2.0)	
Solve simultaneous equations	(max score: 2.0)	
Solve a linear inequality with variable and constants on both sides	(max score: 3.0)	
Factorise a quadratic, $a=1$	(max score: 2.0)	
Solve a linear equation involving brackets	(max score: 2.0)	
Make x the subject of $f=x^2 h$	(max score: 2.0)	
Evaluate $x(y-p(x-qz))$	(max score: 2.0)	
Factorise ax^2-by^2	(max score: 2.0)	
Solve a quadratic equation	(max score: 2.0)	
Simplify a rational expression using the rules of indices	(max score: 2.0)	
Make s the subject of $r=(1/n)st$	(max score: 2.0)	
Solve a linear equation with the variable on both sides	(max score: 2.0)	
Use division rule, 2 variables, coeff in Z	(max score: 2.0)	
Simplify the square root of a number	(max score: 2.0)	

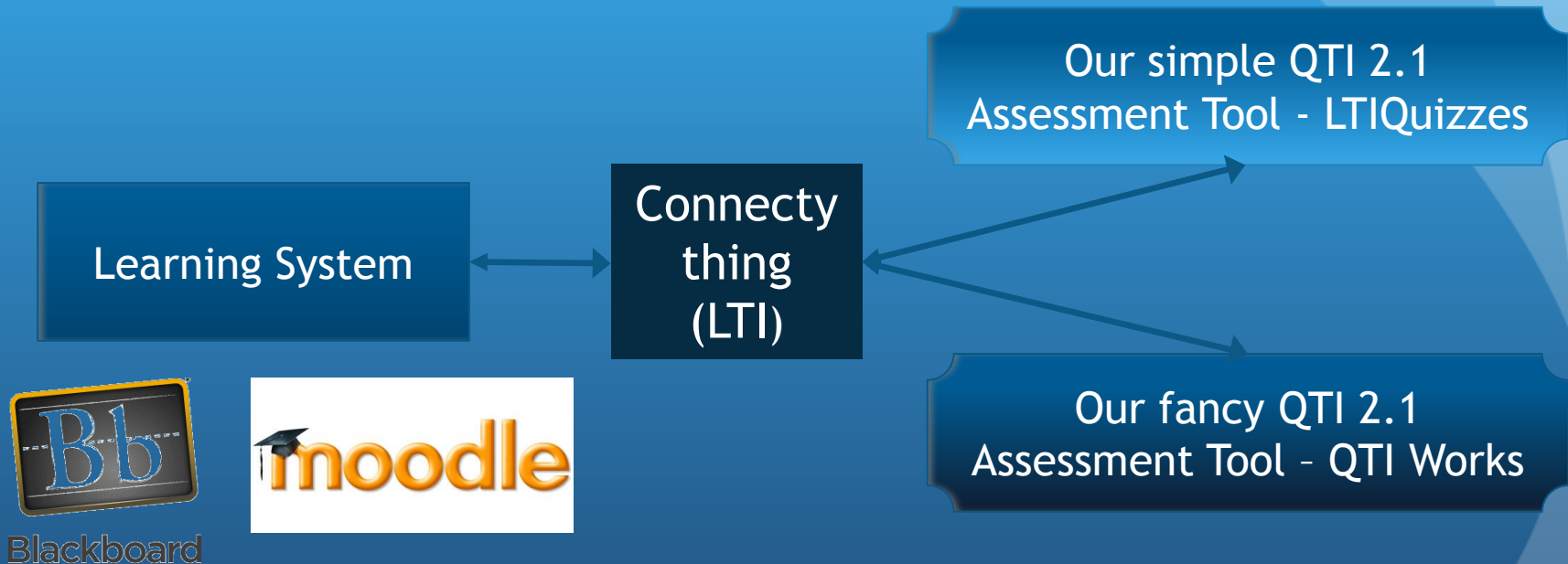
+ add question to section Shuffle question order Use questions once only

+ Add new section

Assessment tools: Delivery

- QTIWorks
 - All of QTIv2.1 (apart from a couple of obscure input types and more ornate test setups)
 - Maths extensions
 - Links to Moodle & Blackboard (and others) via LTI
- Learning Tools Interoperability: LTI
 - Standard for joining external software into VLEs, etc
 - Built into Moodle 2 and latest Blackboard versions
- Combination works for
 - Single questions - formative assessment, quick check,...
 - Tests - fairly basic designs as yet, but more coming...

LTI Connector for VLEs



QTI Works

QTI Works <https://www2.ph.ed.ac.uk/qtiworks/>

Use the Demo section to try out questions and tests

Log in to set up LTI delivery data



QTIWorks is a new open-source system for managing, verifying and delivering Question & Test Interoperability (QTI) v2.1 assessment items and tests. [Find out more about QTIWorks.](#)

About QTIWorks



Find out more about QTIWorks

Demos



Try some demos of QTIWorks' functionality

Log In



Sign into your QTIWorks account

Sign Up



Sign up for a free QTIWorks account

QTI Works - VLE Setup



QTIWorks Dashboard

This is where most of the "real" functionality of QTIWorks will build up. Things will be rather disorganised at first, so please be patient for a while!

Manage Assessments



Upload, manage and deliver your Assessments

Manage Delivery Settings



Manage your delivery settings

Upload questions
or tests to use in
VLEs

Generate LTI data
for setting up
questions and tests
in VLEs

ed Astronomy, The University of Edinburgh.
body, registered in Scotland, with registration number SC0053



Uploading an Assessment

- Content of uploaded assessments -question or test - can be changed (e.g. fix a bug)
- Date of last change is displayed

QTIWorks Dashboard » Your assessments »

Assessment 'Test05-011339-2dVector002-magnVect.xml'

Title Find the magnitude of a 2D vector	Assessment Type Item	Shared? No	Created Monday 12/11/12 at 21:35
Upload Version 5	Uploaded From Standalone Item XML	Valid? <u>Yes</u>	Last QTI Upload Thursday 03/01/13 at 12:50

Actions

- [Edit Assessment properties](#)
- [Replace Assessment Package Content](#)
- [Show validation status](#)
- Try out using:
 - [Default delivery settings](#)
 - [Item Delivery - Practice one randomised question](#)
- Delete Assignment (coming soon)
- [Manage deliveries of this Assessment](#)

Setting Up Assessment Launch Data

- Saving a delivery with LTI enabled creates launch data
- Data is pasted into Moodle 2 External Tool dialog or equivalent in other VLEs



QTIWorks Dashboard » Your assessments » Assessment 'Test05-011339-2dVector002-magnVect.xml' » Assessment Deliveries

Delivery 'Find the magnitude of a 2D vector'

Title
Find the magnitude of a 2D vector

Delivery Settings used
Item Delivery - Practice one randomised question

Created
Monday 12/11/12 at 21:39

Open to candidates?
Yes

LTI enabled?
Yes

LTI launch details

- **Launch URL:** <https://www2.ph.ed.ac.uk/qtiworks/lti/launch/1541>
- **Consumer Key:** 1541XXW0FSOMYNXOLW8Sn4cIrQQhSxmMW7rWS
- **Consumer Secret:** sjv1FGsEkjeiGNHatSkvFbF6aBwONGEX

Actions

- [Edit Delivery Properties](#)
-
- [Delete Delivery](#)
- [View Candidate Reports](#)

QTI in Moodle 2 - Question

Maths T1

My home / My courses / MathsT1 / Trigonometry 1 / Use Pythagoras to find a side in a right angle triangle

Use Pythagoras to find side in right triangle

In triangle ABC, angle B is 90° , the length of AC is 22 and the length of AB is 7.

Find the length of BC.

You may find it helpful to draw a diagram.

Give your answer correct to 2 decimal places.

Correct

Show Hint

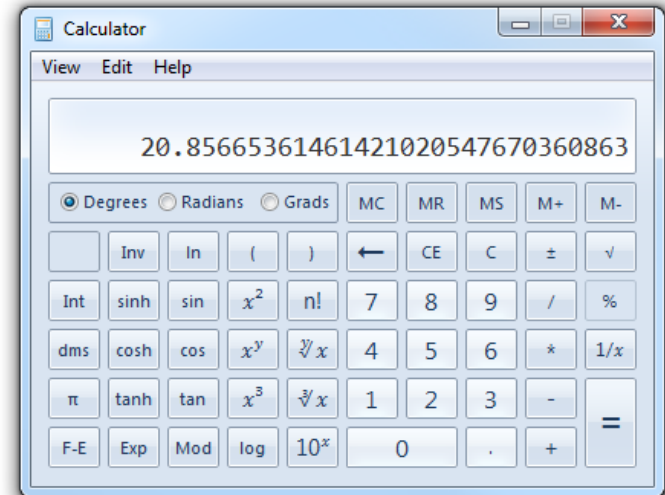
Show Solution

SUBMIT ANSWER

Reinitialise

Finish and review

Exit



QTI in Moodle 2 - Question with Solution

Maths T1

My home / My courses / MathsT1 / Trigonometry 1 / Find an angle in a scalene triangle, given the three sides

Find an angle in a scalene triangle, given the three sides

In triangle ABC, side $a=50\text{cm}$, side $b=36\text{cm}$ and side $c=38\text{cm}$. Find angle C in degrees.

Enter your answer to 2 decimal places.

C =

We apply the cosine rule

$$\begin{aligned}c^2 &= a^2 + b^2 - 2ab\cos(C) \\2ab\cos(C) &= a^2 + b^2 - c^2 \\ \cos(C) &= \frac{a^2 + b^2 - c^2}{2ab} \\ \cos(C) &= \frac{50^2 + 36^2 - 38^2}{2 \times 50 \times 36} \\ \cos(C) &= \frac{2500 + 1296 - 1444}{3600} \\ \cos(C) &= 0.653333 \\ C &= \cos^{-1}(0.653333) \\ C &= 84.97^\circ\end{aligned}$$

Reinitialise and play again

QTI in Moodle 2 - Maths Input

Maths T1

My home / My courses / MathsT1 / Differential Calculus / Differentiate ax^b expressed as a fraction

Differentiate ax^b , a integer, $b \neq 0$, as fraction

Differentiate

$$-\frac{6}{y^5}$$

✔ I have interpreted your input as:

$$\frac{30}{y^6}$$

Show Hint

Show Solution

SUBMIT ANSWER

Reinitialise

Finish and review

Exit

Test: Algebra 1

QT/ILT/ Test & demonstration course

My home / My courses / NB101 / Example Tests / Test - Algebra 1

- Expand $(ax+b)(cx+d)$ Answered
- Solve simultaneous equations Not Answered
- Solve a linear inequality with variable and constants on both sides Answered
- Factorise a quadratic, $a=1$ Not Seen
- Solve a linear equation involving brackets Not Seen
- Solve a linear equation with the variable on both sides Not Answered
- Evaluate $x(y-p(x-qz))$ Not Seen
- Factorise ax^2-by^2 Not Seen
- Solve a quadratic equation Not Seen
- Simplify a rational expression using the rules of indices Not Seen
- Use division rule, 2 variables, coeff in Z Not Seen
- Simplify the square root of a number Not Seen

This test is the one used in the Maths T1 topic Algebra 1. It is also in the demo course.

Question in a Test

My home / My courses / NB101 / Example Tests / Test - Algebra 1

Solve simultaneous equations

Answered

Use the substitution method to solve these simultaneous equations.

$$-x + y = -1 \quad \dots(1)$$

$$-4x - y = -19 \quad \dots(2)$$

The system of simultaneous equations shown above has

- One solution (x, y)
- No solutions
- An infinite number of solutions

If the equations have a single solution, enter the values of x and y below. Otherwise leave these input boxes empty.

$(x, y) = (4$, 3)

You may attempt this question up to 3 times during the test.

SUBMIT ANSWER

Test Question Menu

The indicator at top right shows the question status. No feedback is visible during the test - students have been using these randomised questions in formative mode for several weeks. Candidates return to the list of questions to select another question.

Test feedback & review

My home / My courses / NB101 / Example Tests / Test - Algebra 1

Feedback

You have reached the end of the test.

Your question scores are as follows:

Question 1:	2.0
Question 2:	2.0
Question 3:	3.0
Question 4:	2.0
Question 5:	0.0
Question 6:	2.0
Question 7:	0.0
Question 8:	1.0
Question 9:	2.0
Question 10:	2.0
Question 11:	2.0
Question 12:	2.0
Question 13:	2.0
Question 14:	2.0
Question 15:	2.0
Question 16:	2.0

Your total score was 28.0 out of 33, which is 84.8%.

My home / My courses / NB101 / Example Tests / Test - Algebra 1

Review your responses

Expand $(ax+b)(cx+d)$ [Review](#)

Solve simultaneous equations [Review](#)

Solve a linear inequality with variable and constants on both sides [Review](#)

Factorise a quadratic, $a=1$ [Review](#)

Solve a linear equation involving brackets [Review](#)

Solve a linear equation with the variable on both sides [Review](#)

Evaluate $x(y-p(x-qz))$ [Review](#)

Factorise ax^2-by^2 [Review](#)

Solve a quadratic equation [Review](#)

Simplify a rational expression using the rules of indices [Review](#)

Use division rule, 2 variables, coeff in Z [Review](#)

Simplify the square root of a number [Review](#)

Speed: time given speed and distance [Review](#)

These are the two parts of the feedback and review page; the scores for the questions are displayed and the candidate may return to see the questions and their input.

Links...

- Uniqurate question & test editor - web application - no installation, just go to <http://uniqurate.kingston.ac.uk/Uniqurate/startup>
- QTIWorks delivery & LTI preparation - online at <https://www2.ph.ed.ac.uk/qtiworks/>
- QTI Support Site (examples, tools, resources...) <http://qti-support.gla.ac.uk>
- QTI Moodle demo course <http://moodle2.gla.ac.uk/course/view.php?id=136>
- Emails:
 - sue.milne@glasgow.ac.uk
 - sarah.honeychurch@glasgow.ac.uk