Mathematics A (2008)
Sample assessment instrument and student responses

Supervised test
June 2010
**Purposes of assessment**

The purposes of assessment are to:

- promote, assist and improve student learning
- inform programs of teaching and learning
- provide information for those people — students, parents, teachers — who need to know about the progress and achievements of individual students to help them achieve to the best of their abilities
- provide information for the issuing of certificates of achievement
- provide information to those people who need to know how well groups of students are achieving (school authorities, the State Minister for Education and Training and the Arts, the Federal Minister for Education).

It is common practice to label assessment as being formative, diagnostic or summative, according to the major purpose of the assessment.

The major purpose of formative assessment is to help students attain higher levels of performance. The major purpose of diagnostic assessment is to determine the nature of students' learning, and then provide the appropriate feedback or intervention. The major purpose of summative assessment is to indicate the achievement status or standards achieved by students at a particular point in their schooling. It is geared towards reporting and certification.

**Syllabus requirements**

Teachers should ensure that assessment instruments are consistent with the requirements, techniques and conditions of the Mathematics A syllabus and the implementation year 2008.

**Assessment instruments**

High-quality assessment instruments:

- have construct validity (the instruments actually assess what they were designed to assess)
- have face validity (they appear to assess what you believe they are intended to assess)
- give students clear and definite instructions
- are written in language suited to the reading capabilities of the students for whom the instruments are intended
- are clearly presented through appropriate choice of layout, cues, visual design, format and choice of words
- are used under clear, definite and specified conditions that are appropriate for all the students whose achievements are being assessed
- have clear criteria for making judgments about achievements (these criteria are shared with students before they are assessed)
- are used under conditions that allow optimal participation for all
- are inclusive of students’ diverse backgrounds
- allow students to demonstrate the breadth and depth of their achievements
- only involve the reproduction of gender, socioeconomic, ethnic or other cultural factors if careful consideration has determined that such reproduction is necessary.

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2 Assessment instruments are the actual tools used by schools and the QSA to gather information about student achievement, for example, recorded observation of a game of volleyball, write-up of a field trip to the local water catchment and storage area, a test of number facts, the Senior External Examination in Chinese, the 2006 QCS Test, the 2008 Year 4 English comparable assessment task.

Mathematics A (2008)

Supervised assessment and student responses

Compiled by the Queensland Studies Authority
June 2010

About this assessment instrument

The purpose of this document is to inform assessment practices of teachers in schools. For this reason, the assessment instrument is not presented in a way that would allow its immediate application in a school context. In particular, the assessment technique is presented in isolation from other information relevant to the implementation of the assessment. For further information about those aspects of the assessment not explained in this document, please refer to the assessment section of the syllabus.

This sample provides opportunities for students to:

- access, select and apply rules and formulas
- recall, select and apply mathematical procedures to situations that are similar to situations already encountered
- apply a sequence of mathematical procedures in situations that are similar to situations already encountered
- interpret, clarify and analyse problems
- use strategies to model and solve problems
- make decisions informed by mathematical reasoning
- interpret and use appropriate mathematical terminology, symbols and conventions
- analyse information displayed in a variety of representations (such as written, symbolic, pictorial and graphical) and translate information from one representation to another
- develop logical sequences within a response expressed in everyday language, mathematical language, or a combination of both, as required, to justify conclusions, solutions or propositions

This sample assessment instrument is intended to be a guide to help teachers plan and develop assessment instruments for individual school settings.
Assessment instrument

The student work presented in this sample is in response to assessment items which are subsets or parts of an assessment instrument.

Question 1. (KP)
Calculate the distance between A (45°N, 105°W) and B (45°N, 10°E). Round your answer to the nearest km.

Question 2. (KP)
The scatter plot below graphs the ages of individuals and their income.
   a. What type of relationship is it?
   b. Describe the relationship in words.
   c. Use the line that best predicts the age of someone earning $55000.
Question 3. (KP)
The following two sets of data give the ages of 30 brides and 30 bridegrooms in a certain year. Complete the partially constructed back to back stem and leaf diagram below using the data provided. Compare the results between the brides and bridegrooms, giving relevant reasons for your answer.

<table>
<thead>
<tr>
<th>Brides</th>
<th>Bridegrooms</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 18 19 20 21 21</td>
<td>18 21 21 25 27 28</td>
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<tr>
<td>22 22 23 25 27 28</td>
<td>30 31 31 32 35 35</td>
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<td>30 30 31 32 35 36</td>
<td>36 37 37 38 40 42</td>
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<tr>
<td>39 41 41 43 47 55</td>
<td>42 44 46 49 51 55</td>
</tr>
<tr>
<td>56 63 67 74 77 82</td>
<td>56 59 59 61 67 68</td>
</tr>
</tbody>
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<tr>
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<th>Bridegrooms</th>
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</thead>
<tbody>
<tr>
<td>8 8 9</td>
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<tr>
<td>0 1 1 2 2 3 5 7 8</td>
<td>2</td>
</tr>
<tr>
<td>0 0 1 2 5 6</td>
<td>3</td>
</tr>
</tbody>
</table>

Question 4. (KP, MPS)
The total cost of some sporting equipment is $2844.50 including GST. Calculate the price of the equipment before GST was added.

Question 5. (KP, MPS)
A plane flying at 400km/h travelled directly north for 6 hours and 40 minutes before making an emergency landing. If the plane took off from Hobart (43°S 147°E), provide the coordinates of where the plane landed.
Question 6. (KP, MPS)
A flight leaves Perth on a 20-hour flight to Frankfurt at 3.00pm Wednesday. On what day and time (Frankfurt time) will the plane arrive in Frankfurt?

Question 7. (KP, MPS)
Marco earns $610.70 a week as a courier and $280.50 a week as a masseur. He claims the tax-free threshold for his major source of income and isn’t paid leave loading.

   a. How much tax does Marco pay a week?
   
   b. Would Marco earn the same net income if he earned the same gross income in a single job? Explain your answer with supporting mathematical evidence.

Question 8. (KP, MPS)
Dina gets $88573.68 per annum. She has union dues of $6.20 a week, car payments of $139.50 and medical insurance of $59.80 a week deducted from her pay. Find the tax she pays, her total deductions and net pay per fortnight.
Instrument-specific criteria and standards

Schools draw instrument-specific criteria and standards from the syllabus dimensions and exit standards. Schools will make judgments about the match of qualities of student responses with the standards descriptors that are specific to the particular assessment instrument. While all syllabus exit descriptors might not be assessed in a single assessment instrument, across the course of study, opportunities to demonstrate all the syllabus dimensions and standards descriptors must be provided.

The assessment instrument presented in this document provides opportunities for the demonstration of the following criteria:

- Knowledge and procedures
- Modelling and problem solving
- Communication and justification.

This document provides information about how the qualities of student work match the relevant instrument-specific criteria and standards at standards A and C. The standard A and C descriptors are presented below. The complete set of instrument-specific criteria and standards is in the appendix.

<table>
<thead>
<tr>
<th>Knowledge and procedures</th>
<th>Standard A</th>
<th>Standard C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The student’s work has the following characteristics:</td>
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<td></td>
<td>• Accurate use of rules and formulas in simple through to complex situations</td>
<td>• Use of rules and formulas in simple routine situations</td>
</tr>
<tr>
<td></td>
<td>• Application of simple through to complex sequences of mathematical procedures in routine and non-routine situations</td>
<td>• Application of simple sequences of mathematical procedures in routine situations</td>
</tr>
<tr>
<td>Modelling and problem solving</td>
<td>• Use of strategies to model and solve problems in complex routine through to simple non-routine situations</td>
<td>• Use of familiar strategies for problem solving in simple routine situations</td>
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<tr>
<td></td>
<td>• Informed decisions based on mathematical reasoning in complex routine through to simple non-routine situations</td>
<td>• Informed decisions based on mathematical reasoning in simple routine situations</td>
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<tr>
<td>Communication and justification</td>
<td>• Accurate and appropriate use of mathematical terminology and conventions in simple non-routine through to complex routine situations</td>
<td>• Appropriate use of mathematical terminology and conventions in simple routine situations</td>
</tr>
<tr>
<td></td>
<td>• Analysis and translation of information displayed from one representation to another in complex routine situations</td>
<td>• Translation of information displayed from one representation to another in simple routine situation</td>
</tr>
<tr>
<td></td>
<td>• Use of mathematical reasoning to develop logical sequences in simple non-routine through to complex routine situations using everyday and/or mathematical language</td>
<td>• Development of logical sequences in simple routine situations using everyday and/or mathematical language</td>
</tr>
</tbody>
</table>
## Sample student responses: Standard A

*Note: “[…]” indicates where the text has been abridged.*

<table>
<thead>
<tr>
<th>Standard descriptors</th>
<th>Student response A</th>
</tr>
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</table>
| Accurate use of rules and formulas in a complex situation | Question 1. (KP) * Calculate the distance between A (150°E, 105°W) and B (45°E, 10°E). Round your answer to the nearest km. 

\[
\text{Distance} = (\text{difference in longitude}) \times 111.2 \text{km} \times \cos \theta \\
= (105° + 10°) \times 111.2 \text{km} \times \cos 45° \\
= 9042.5 \text{km} \\
\approx 9043 \text{km}
\] |
| Application of complex sequences in a routine situation | |
| Use of mathematical reasoning to develop logical sequences in a complex routine situation using mathematical language | Question 2. (KP) The scatter plot below graphs the ages of individuals and their income. 

a) What type of relationship is it? 
b) Describe in the relationship in words. 
c) Use the line of best fit to predict
   1) The Age of someone earning $55000. 

   a) Positive relationship 
   b) As the age increases so does their yearly income. 
   c) 46 is the age of someone who earns $55000. |
Question 3. (KP)*

The following two sets of data give the ages of 30 brides and 30 bridegrooms in a certain year. Complete the partially constructed back to back stem and leaf diagram below using the data provided. Compare the results between the brides and bridegrooms, giving relevant reasons for your answer.

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<td>61</td>
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<tr>
<td>63</td>
<td>68</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Bride</th>
<th>Bridegrooms</th>
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</thead>
<tbody>
<tr>
<td>988</td>
<td>5</td>
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<tr>
<td>87532</td>
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<tr>
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<td>15699</td>
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<tr>
<td>73</td>
<td>178</td>
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<tr>
<td>74</td>
<td>7</td>
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<tr>
<td>2</td>
<td>8</td>
</tr>
</tbody>
</table>

The most common age group for both brides and grooms was 20–30. Although, women are more spread out, some reaching the 80’s while the men stop at 60. There is also a lot more women marrying younger. Reason?
Question 4. (KP, MPS)
The total cost of some sporting equipment is $2844.50 including GST. Calculate the price of the equipment before GST was added.

\[ \text{GST} = \text{price} \div 11 \]
\[ = \$2844.50 \div 11 \]
\[ = \$258.59 \]

Price of equipment before GST = $2844.50 - $258.59
\[ = \$2585.91 \]

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Question 5. (KP, MPS)
A plane flying at 400 km/h travelled directly north for 6.67 hours before making an emergency landing. If the plane took off from Hobart (South Australia), provide the coordinates of where the plane landed.

Distance = speed \times time
\[ = 400 \times 6.67 \]
\[ = 2668 \text{ km} \]

Distance = (difference in latitude) \times 111.2 \text{ km}
\[ = (43^\circ - x) \times 111.2 \text{ km} \]
\[ 2668 = (43^\circ - x) \times 111.2 \text{ km} \]

\[ 2668 \div 111.2 = 43^\circ - x \]

\[ 23.99 = 43^\circ - x \]

\[ 23.99 + x = 43^\circ \]
\[ x = 43^\circ - 23.99 \]
\[ x = 19^\circ \]

The coordinates of the plane's landing spot will be... 
\[ (19^\circ S, 147^\circ E) \]
**Standard A**

**Use of strategies for problem solving in a complex routine situation**

**Informed decisions based on mathematical reasoning in a complex routine situation**

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**Question 6. (KP, MPS)**
A flight leaves Perth on a 20 hour flight to Frankfurt 3:00 p.m. Wednesday. On what day and time (Frankfurt time) will the plane arrive in Frankfurt?

\[
\text{PERTH} \quad \text{FRANKFURT} \quad 20\text{hrs} \\
3\text{pm Wed} \\
\]

arrival time (Perth) = 3pm + 20hr \\
= 11am Thursday

Frankfurt is 7hrs behind Perth.

arrival time (Frankfurt) = 11am - 7hr \\
= 4am Thursday

Since Frankfurt is 7hrs behind Perth, they will gain time because in Perth they would arrive in Frankfurt at 11am but in Frankfurt time is 4am. However, both are on Thursday.
Question 7. (KP, MPS) *

Marco earns $610.70 a week as a courier and $280.50 a week as a masseur. He claims the tax-free threshold for his major source of income and isn’t paid leave loading.

a) How much tax does Marco pay a week?

b) Would Marco earn the same net income if he earned the same gross income in a single job? Explain your answer with supporting mathematical evidence.

\[ \text{courier tax} = \$89 \]
\[ \text{masseur tax} = \$49 \]
\[ \text{total tax} = \$138 \]

\[ \text{net income} = (610.70 + 280.50) - 138 \]
\[ \text{(for 2 jobs)} = 753.20 \]

For Marco’s major source of income (courier) he owns $610.70 a week—that is his gross, so not including any deductions. His net income for both jobs is still more than the gross income of one job. Therefore, Marco will benefit from working two jobs if he needs the money!

Also, the net income for separate jobs would still be more smaller...

\[ \text{courier: } \text{net income} = 610.70 - 89 \]
\[ = 521.70 \]

\[ \text{masseur: } \text{net income} = 280.50 - 25 \]
\[ = 255.50 \]
Question 8. (KP, MPS)*

Dina gets $88573.68 per annum. She has union dues of $620 a week, car payments of $695.50 and medical insurance of $59.80 a week deducted from her pay. Find the tax she pays, her total deductions and net pay per fortnight.

*Accurate and appropriate use of mathematical terminology and conventions in a complex routine situation

weekly income = \( \frac{88573.68}{52} \)
= $1703.34

tax = $462

total deductions = $462 + $6.20 + $139.50 + $59.80
= $667.50

deductions for a fortnight = \( \frac{667.50}{2} \)
= $1335

income for a fortnight = $1703.34 \times 2
= $3406.68

net pay per fortnight = gross income - deductions
= $3406.68 - $1335
= $2071.68

Use of mathematical reasoning to develop logical sequences in a complex situation using mathematical language.
### Standard C

**Note:** “[...]]” indicates where the text has been abridged.

<table>
<thead>
<tr>
<th>Standard descriptors</th>
<th>Student response C</th>
</tr>
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</table>
| Appropriate use of mathematical terminology and conventions in a simple routine situation | Question 1. (KP)*
Calculate the distance between A (45°N, 105°W) and B (45°N, 10°E). Round your answer to the nearest km.

\[
A) \quad (45°N, 105°W) = 105 - 45 = 60 \times \frac{111.2}{2} = 6672 \\
B) \quad (45°N, 10°E) = 45 - 10 = 35 \times \frac{111.2}{2} = 3892.
\]

\[
6672 - 3892 = 2780
\]

---

Question 2. (KP)
The scatter plot below, graphs the ages of individuals and their income.

![Scatter plot](chart.png)

- a) What type of relationship is it? **Positive relationship**
- b) Describe in the relationship in words.
- c) Use the line of best fit to predict
  1) The age of someone earning $55000.

b) The relationship has an even scatter of dots leading up the line which means it is therefore a **positive relationship**.

- c) The age of someone earning $55000 is roughly around 54 years old.
Translation of information displayed from one representation to another in simple routine situations

Informed decisions based on mathematical reasoning in a simple routine situation

Question 3. (KP) *

The following two sets of data give the ages of 30 brides and 30 bridegrooms in a certain year. Complete the partially constructed back to back stem and leaf diagram below using the data provided. Compare the results between the brides and bridegrooms, giving relevant reasons for your answer.

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<td>9 6 5 2 1 0 0</td>
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<td>7 4</td>
<td>1 7 8</td>
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</tbody>
</table>

The age range of Brides have a lot more younger Brides than Grooms however, a more vast age range with the Brides compared to the Grooms. The majority of Grooms are between the 20 - 50 year age group.

Why reason?
Question 4. (KP, MPS)
The total cost of some sporting equipment is $2844.50 including GST. Calculate the price of the equipment before GST was added.

\[
\begin{align*}
\$2844.50 & \div 1.11 \\
\$2588.59 &
\end{align*}
\]

The price before GST was added was $2588.59 for the equipment.

Question 5. (KP, MPS) *
A plane flying at 400km/h travelled directly north for 6 hours and 40 minutes before making an emergency landing. If the plane took off from Hobart (43°S 147°E), provide the coordinates of where the plane landed.

\[
\text{Distance} = \text{Speed} \times \text{Time}
\]

\[
\begin{align*}
400 \times 6.6 & \\
2560 &
\end{align*}
\]

\[
(43°S, 147°E)
\]

\[
147 - 43 = 104
\]

\[
104 \times 11.2 = 1164.8
\]
Question 6. (KP, MPS)
A flight leaves Perth on a 20 hour flight to Frankfurt at 3.00 p.m. Wednesday. On what day and time (Frankfurt time) will the plane arrive in Frankfurt?

20hrs.
3pm
11am
4hr
12am.

They would arrive in Frankfurt at 12am on the Monday.

Question 7. (KP, MPS) *
Marco earns $610.70 a week as a courier and $280.50 a week as a masseur. He claims the tax-free threshold for his major source of income and isn’t paid leave loading.

a) How much tax does Marco pay a week?

b) Would Marco earn the same net income if he earned the same gross income in a single job? Explain your answer with supporting mathematical evidence.

\[
\text{a) } 610.70 + 280.50 = 891.20 \\
\text{He pays } 178.00 \text{ over every week.}
\]

1 job not 2 jobs

b) Marco would be better off and earn a higher net income if he earn a total of $891.20 weekly in the single job because he would be taxed less. Compared to currently, he has a second job, the government takes 50% of everything you earn in your second job. 
Standard C

Applications of complex sequences of mathematical procedures in routine situations

Use of strategies to model and solve a problem in a routine situation

Question 8. (KP, MPS)

Dina gets $88573.68 per annum. She has union dues of $6.20 a week, car payments of $139.50 and medical insurance of $59.80 a week deducted from her pay. Find the tax she pays, her total deductions and net pay per fortnight.

\[
\frac{88573.68}{52} = \frac{1703.34}{52}
\]

\[
= 41.34 \text{ per fortnight}
\]

Total tax = $462

\[
= 9.24 \text{ per fortnight}
\]

She earns $1703.34 per fortnight.

her total deductions one $411.00

and tax she pays is $924. per fortnight.

Together she is left with

\[
\begin{align*}
& 1703.34 \\
& - 411.00 \\
& - 924.00 \\
\end{align*}
\]

\[
= 368.34
\]
### Instrument-specific criteria and standards

<table>
<thead>
<tr>
<th>Knowledge and procedures</th>
<th>Standard A</th>
<th>Standard B</th>
<th>Standard C</th>
<th>Standard D</th>
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<td>- Use of rules and formulas in simple routine situations</td>
<td>- Use of given rules and formulas in simple rehearsed situations</td>
<td>- Attempted use of given rules and formulas in simple rehearsed situations</td>
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<td>• Accurate and appropriate use of mathematical terminology and conventions in simple non-routine through to complex routine situations</td>
<td>• Accurate and appropriate use of mathematical terminology and conventions in simple non-routine and/or complex routine situations</td>
<td>• Appropriate use of mathematical terminology and conventions in simple routine situations</td>
<td>• Use of Mathematical terminology and conventions in simple rehearsed situations</td>
<td>• Use of mathematical terminology or conventions in simple rehearsed situations</td>
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<td></td>
<td>• Analysis and translation of information displayed from one representation to another in complex routine situations</td>
<td>• Analysis and translation of information displayed from one representation to another in simple routine situations</td>
<td>• Translation of information displayed from one representation to another in simple routine situations</td>
<td>• Development of logical sequences in simple routine situations using everyday and/or mathematical language</td>
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<td></td>
<td>• Use of mathematical reasoning to develop logical sequences in simple non-routine through to complex routine situations using everyday and/or mathematical language</td>
<td>• Use of mathematical reasoning to develop logical sequences in simple non-routine and/or complex routine situations using everyday and/or mathematical language</td>
<td>• Development of logical sequences in simple routine situations using everyday and/or mathematical language</td>
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