Mathematics B (2008)
Sample assessment instrument

Supervised assessment
March 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 B (2008) syllabus.

**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 B (2008)

Sample assessment instrument
Supervised assessment

Compiled by the Queensland Studies Authority
March 2010

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About this assessment instrument

This sample demonstrates:
- construction of a supervised assessment instrument
- construction of the associated instrument-specific criteria sheets

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

Question 1 (K&P)

Angelina invests $40,000 in an account that earns 7.5%pa simple interest. Determine the equation that represents Angelina’s account balance annually.

Question 2 (K&P)

In an experiment to study the relationship between age and vocabulary range for young children, 10 children of particular ages were selected and the vocabulary range was tested. The following results were obtained.

<table>
<thead>
<tr>
<th>Age in years</th>
<th>1.5</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
<th>4.0</th>
<th>4.5</th>
<th>5.0</th>
<th>5.5</th>
<th>6.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vocabulary range</td>
<td>100</td>
<td>250</td>
<td>890</td>
<td>1210</td>
<td>1530</td>
<td>1840</td>
<td>2060</td>
<td>2300</td>
<td>2500</td>
</tr>
</tbody>
</table>

Develop a relationship between the age of a child and its vocabulary range. Is it reasonable to assume that this relationship follows through to age 21?

Question 3 (K&P)

A wine manufacturer bottles wine in two types of casks, small and large. He can bottle 25litres of wine using 5 small and 2 large casks and he can bottle 80litres of wine using 15 small and 7 large casks. What is the capacity of each type of cask?

Question 4 (M&P)

Amelia is interested in a job as a waitress to earn money while she is at university. She has the choice of two jobs, both of which will allow her to work the 3 weekend dinner shifts.

- **Ristorante Ricardo** advises her that her wages consist of a fixed wage, plus tips (calculated per table served). The table below is a projected analysis of the total wage she would receive for the weekend.

<table>
<thead>
<tr>
<th>Number of tables served</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total weekend wage</td>
<td>58.5</td>
<td>81</td>
<td>103.5</td>
<td>126</td>
<td>148.5</td>
<td>171</td>
</tr>
</tbody>
</table>

- **Café Blue** advises her that wages consist of a fixed wage of $15 per shift plus an average of $3.60 per table served in tips.

Give advice to Amelia about which job she should choose.
<table>
<thead>
<tr>
<th>Standard A</th>
<th>Standard B</th>
<th>Standard C</th>
<th>Standard D</th>
<th>Standard E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge and procedures</td>
<td>Knowledge and procedures</td>
<td>Knowledge and procedures</td>
<td>Knowledge and procedures</td>
<td>Knowledge and procedures</td>
</tr>
<tr>
<td>The student work has the following characteristics:</td>
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<td>The student work has the following characteristics:</td>
<td>The student work has the following characteristics:</td>
<td>The student work has the following characteristics:</td>
</tr>
<tr>
<td>• application of mathematical definitions rules and procedures in routine complex tasks in life-related linear functions</td>
<td>• application of mathematical definitions rules and procedures in non-routine simple tasks in life-related linear functions</td>
<td>• application of mathematical definitions rules and procedures in routine simple life-related linear functions</td>
<td>• use of technology</td>
<td>• use of technology</td>
</tr>
<tr>
<td>• appropriate selection and accurate use if technology</td>
<td>• appropriate selection and accurate use of technology</td>
<td>• selection and use of technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modelling and problem solving</td>
<td>Modelling and problem solving</td>
<td>Modelling and problem solving</td>
<td>Modelling and problem solving</td>
<td>Modelling and problem solving</td>
</tr>
<tr>
<td>• use of problem-solving strategies to interpret, clarify and analyse problems to develop responses in routine complex life-related linear functions tasks</td>
<td>• use of problem-solving strategies to interpret, clarify and analyse problems to develop responses in non-routine simple life-related linear functions tasks</td>
<td>• use of problem-solving strategies to interpret, clarify and analyse problems to develop responses in routine simple life-related linear functions tasks</td>
<td>• evidence of simple problem-solving strategies in the context of problems</td>
<td>• evidence of simple mathematical procedures</td>
</tr>
<tr>
<td>Communication and justification</td>
<td>Communication and justification</td>
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<td>Communication and justification</td>
<td>Communication and justification</td>
</tr>
<tr>
<td>• appropriate interpretation and use of mathematical terminology, symbols and conventions in routine complex life-related linear functions</td>
<td>• appropriate interpretation and use of mathematical terminology, symbols and conventions in non-routine simple life-related linear functions</td>
<td>• appropriate interpretation and use of mathematical terminology, symbols and conventions in simple routine life-related linear functions</td>
<td>• use of mathematical terminology, symbols or conventions in routine life-related linear functions.</td>
<td>• use of mathematical terminology, symbols or conventions.</td>
</tr>
<tr>
<td>• use of mathematical reasoning to develop coherent, concise and logical sequences within a complex life-related response using mathematical and everyday language</td>
<td>• use of mathematical reasoning to develop coherent and logical sequences within a simple life-related response using everyday language</td>
<td>• use of mathematical reasoning to develop sequences within a simple routine life-related response using everyday language</td>
<td>• justification of decisions.</td>
<td></td>
</tr>
<tr>
<td>• coherent, concise and logical justification of procedures, decisions and results.</td>
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<td>• justification of decisions.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Part B

Question 5 (K&P)

Given the parabolic function \( y = 4x^2 + 5x - 6 \), determine

(a) the \( y \)-intercept
(b) the \( x \)-intercepts
(c) the line of symmetry
(d) the coordinates of the turning point.

Using the above, sketch the quadratic function \( y = 4x^2 + 5x - 6 \)

Question 6 (K&P)

Two positive numbers differ by 5. The product of these two numbers is 4 more than 40 times their difference. Find the two numbers.

Question 7 (K&P)

Describe ALL the transformations that have occurred when the parabola \( y = (x + 2)^2 \) is transformed to the parabola \( y = -2(x - 3)^2 + 4 \).

Question 8 (M&P)

A town council has decided to erect an archway over the highway entrance to the town. The arch will be in the shape of a parabolic curve. The highest point of the arch will be 60 metres above road level. 30 metres above the ground, the arch is 30 metres wide.

Will the council be able to construct this entrance to the town if they require that a 40 metre wide roadway pass under the arch?
<table>
<thead>
<tr>
<th>Knowledge and procedures</th>
<th>Modelling and problem solving</th>
<th>Communication and justification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard A</strong></td>
<td><strong>Standard B</strong></td>
<td><strong>Standard C</strong></td>
</tr>
<tr>
<td>The student work has the following characteristics: &lt;br&gt; - recall, access, selection of mathematical definitions, rules and procedures in routine complex abstract quadratic functions &lt;br&gt; - application of mathematical definitions rules and procedures in routine complex tasks in life-related quadratic functions</td>
<td>The student work has the following characteristics: &lt;br&gt; - recall, access, selection of mathematical definitions, rules and procedures in non-routine simple abstract quadratic functions &lt;br&gt; - application of mathematical definitions rules and procedures in non-routine simple tasks in life-related quadratic functions</td>
<td>The student work has the following characteristics: &lt;br&gt; - recall, access, selection of mathematical definitions, rules and procedures in non-routine simple abstract quadratic functions &lt;br&gt; - application of mathematical definitions rules and procedures in non-routine simple tasks in life-related quadratic functions</td>
</tr>
<tr>
<td><strong>Standard D</strong></td>
<td><strong>Standard E</strong></td>
<td></td>
</tr>
<tr>
<td>The student work has the following characteristics: &lt;br&gt; - use of stated rules and procedures in simple quadratic functions</td>
<td>The student work has the following characteristics: &lt;br&gt; - statements of relevant mathematical facts</td>
<td></td>
</tr>
</tbody>
</table>

- **Modelling and problem solving**<br>  - use of problem-solving strategies to interpret, clarify and analyse problems to develop responses in routine complex life-related quadratic functions tasks  
  - use of problem-solving strategies to interpret, clarify and analyse problems to develop responses in non-routine simple life-related quadratic functions tasks  
  - use of problem-solving strategies to interpret, clarify and analyse problems to develop responses in routine simple life-related quadratic functions tasks  
  - evidence of simple problem-solving strategies in the context of problems  
  - evidence of simple mathematical procedures  

- **Communication and justification**<br>  - appropriate interpretation and use of mathematical terminology, symbols and conventions in routine complex life-related quadratic functions  
  - coherent, concise and logical justification of procedures, decisions and results.  
  - appropriate interpretation and use of mathematical terminology, symbols and conventions in non-routine simple life-related quadratic functions  
  - coherent and logical justification of procedures, decisions and results.  
  - appropriate interpretation and use of mathematical terminology, symbols and conventions in simple routine life-related quadratic functions  
  - justification of decisions.  
  - use of mathematical terminology, symbols or conventions in routine life-related quadratic functions.  
  - use of mathematical terminology, symbols or conventions.
Part C

Question 9 (K&P)

Find the exact values for:

(a) $\sin 150^0$  
(b) $\cos \frac{3\pi}{4}$

Question 10 (K&P)

(a) If $\sin \alpha = -0.6$, where $0 \leq \alpha \leq 360^0$, find values for

(i) $\cos \alpha$  
(ii) $\tan \alpha$

(b) Determine the angle coterminal with $-548^0$ which lies in the range $0 \leq \theta \leq 360^0$.

Question 11 (K&P)

Determine the angle $\theta$, with $\pi \leq \theta \leq 2\pi$, for which:

(a) $\tan \theta = \sqrt{3}$  
(b) $\sin \theta = -\frac{1}{2}$

Question 12 (M&P)

Katie has just completed an experiment which involved observing and recording the displacement of an oscillating particle from an origin over regular time intervals. The following results were obtained over a 50 second interval.

<table>
<thead>
<tr>
<th>Observation Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement in metres</td>
<td>8</td>
<td>7.3</td>
<td>5.2</td>
<td>3.4</td>
<td>1.4</td>
<td>0.9</td>
<td>1.5</td>
<td>3.5</td>
<td>7.4</td>
<td>7.9</td>
</tr>
</tbody>
</table>

Katie believes that the particle oscillated in a periodic fashion.

By developing a mathematical model that relates displacement to time, either support or refute Katie’s belief.
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<tr>
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<td>evidence of simple problem-solving strategies in the context of problems</td>
</tr>
<tr>
<td>- investigation and evaluation of the validity of arguments including the analysis of results in the context of problems</td>
<td>- interpretation of results in the context of simple problems</td>
<td>- interpretation of results in the context of simple problems</td>
<td></td>
<td></td>
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