Mathematics A (2008)
Sample assessment instrument and indicative responses

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 A (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.

---

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)

Sample assessment instrument and indicative responses

Supervised assessment

Compiled by the Queensland Studies Authority
March 2010

The QSA acknowledges the contribution of Coomera Anglican College in the preparation of this
document.

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 instrument provides opportunities for students to:
• 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
• organise and present information for different purposes and audiences, in a variety of
  representations
• 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 an assessment task which is a type of assessment instrument involving students applying and using relevant knowledge and skills to create a response to a problem or issue.

**Question 1:** The weight of twenty people commencing a clinical weight loss trial testing the effectiveness of the 14-Day Weight Loss Program is given below:

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>62</td>
<td>65</td>
<td>68</td>
<td>73</td>
</tr>
<tr>
<td>75</td>
<td>75</td>
<td>77</td>
<td>79</td>
<td>82</td>
</tr>
<tr>
<td>85</td>
<td>86</td>
<td>87</td>
<td>89</td>
<td>90</td>
</tr>
<tr>
<td>91</td>
<td>93</td>
<td>93</td>
<td>93</td>
<td>95</td>
</tr>
</tbody>
</table>

a. Using the information given, construct a stem-and-leaf plot to represent the mass of the participants.

b. Using the information given, construct a box-and-whisker plot to represent the mass of the participants.

c. Discuss the strengths of displaying the data in a box-and-whisker plot over a stem-and-leaf plot.

d. Discuss the strengths of displaying the data in a stem-and-leaf plot over a box-and-whisker plot.
Question 2: You are the director of a company and you have given large salary increases to all your staff during 2008. However, profits have not been as spectacular as in 2007. The table below gives the figures for mean profits and salaries for each quarter (three months) of 2008.

<table>
<thead>
<tr>
<th></th>
<th>1st Quarter</th>
<th>2nd Quarter</th>
<th>3rd Quarter</th>
<th>4th Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profits $,000000</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Salaries $,000000</td>
<td>5</td>
<td>5.5</td>
<td>6</td>
<td>6.5</td>
</tr>
</tbody>
</table>

For the annual general meeting of shareholders, you are to draw two graphs, one showing profits and the other showing salaries, which will show you in the best possible way to shareholders.

On the grid below, draw the graphs and in the answer booklet, explain clearly why you have drawn them the way that you have.
**Question 3:** Below is the ground floor plan of the Smith family residence drawn to a scale of 1 : 150.

The Smith family residence is on a square block of land of side length 25 metres. The house is placed 5 metres from the front end of the block and 4 metres from the block on the eastern side of the property.

A garden shed with dimensions 3 metres by 4 metres is to be placed near the back of the house. If the property is facing due south, draw a plan of the block with the house and garden shed appropriately placed on it using a scale of 1 : 200.

Note: It is sufficient to represent the house as a suitably sized rectangle on the block; detail is not required.
**Question 4:** Fletcher has purchased himself a box kite so he can participate in the Byron Bay Kite Festival. The packaging on the kite states that the kite string will form an angle of 50° to the vertical when the kite is flying and the string is tight.

Fletcher wonders how high the kite will fly when he uses 50 metres of kite string. At noon, when the sun is directly overhead, Fletcher gets his friend Bartholomew to measure the distance along the ground between himself and the shadow of the kite.

Fletcher constructs the following diagram and uses Pythagoras Theorem, as shown, to find the height of the kite.

![Diagram showing kite and measurements](image)

\[ \text{base}^2 + \text{height}^2 = \text{hyp}^2 \]
\[ 38.3^2 + 50^2 = h^2 \]
\[ 3966.89 = h^2 \]
\[ h = 62.98 \text{ m} \]

\[ \text{overall height} = 62.98 \text{ m} + 1.6 \text{ m} = 64.58 \text{ m} \]

a. Explain why the height of the kite that Fletcher calculated is unrealistic.

b. Make the appropriate corrections to Fletchers’ working to find the correct height of the kite.

c. Verify the height of the kite using another method.
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. The standard A descriptors are presented below. The complete set of instrument-specific criteria and standards is in the appendix.

<table>
<thead>
<tr>
<th>Standard A</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Knowledge and procedures</strong></td>
</tr>
<tr>
<td>The student work has the following characteristics:</td>
</tr>
<tr>
<td>- application of simple through to complex sequences of mathematical procedures in routine and non-routine situations</td>
</tr>
<tr>
<td><strong>Modelling and problem solving</strong></td>
</tr>
<tr>
<td>- use of strategies to model and solve problems in complex routine through to simple non-routine situations</td>
</tr>
<tr>
<td>- informed decisions based on mathematical reasoning in complex routine through to simple non-routine situations</td>
</tr>
<tr>
<td>- reflection on the effectiveness of mathematical models including recognition of the strengths and limitations of the model</td>
</tr>
<tr>
<td><strong>Communication and justification</strong></td>
</tr>
<tr>
<td>- accurate and appropriate use of mathematical terminology and conventions in simple non-routine through to complex routine situations</td>
</tr>
<tr>
<td>- organisation and presentation of information in a variety of representations in simple non-routine through to complex routine situations</td>
</tr>
<tr>
<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>
</tr>
</tbody>
</table>
### Indicative response - Standard A

<table>
<thead>
<tr>
<th>Standard descriptors</th>
<th>Indicative response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisation and presentation of information in a variety of forms in complex routine situations</td>
<td></td>
</tr>
<tr>
<td>Reflection on the effectiveness of mathematical models including recognition of the strengths and limitations</td>
<td></td>
</tr>
</tbody>
</table>

#### Question 1

```
<table>
<thead>
<tr>
<th>Stem</th>
<th>Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0 2 5 8</td>
</tr>
<tr>
<td>7</td>
<td>3 5 5 7 9</td>
</tr>
<tr>
<td>8</td>
<td>2 5 6 7 9</td>
</tr>
<tr>
<td>9</td>
<td>0 1 3 3 3 5</td>
</tr>
</tbody>
</table>
```

Key: 610 represents 60 kg

#### b) Lower 60

```
<table>
<thead>
<tr>
<th>Quartile</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>25th</td>
<td>74</td>
</tr>
<tr>
<td>Median</td>
<td>83.5</td>
</tr>
<tr>
<td>75th</td>
<td>90.5</td>
</tr>
</tbody>
</table>
```

(c) Any valid strength of box-and-whisker plot. We see the spread of data visually, you see certain attributes of data e.g., half where 50% of data values appear.

(d) Any valid strength of stem-and-leaf plot. If you still see read actual data values.
Indicative response - Standard A

Organisation and presentation of information in a variety of forms in complex routine situations

Question 2

- The physical area of the profits is greater than salaries: profits appear larger.
- The vertical height of the profits is greater than the vertical height of salaries: profits look larger.

Profits graph must be drawn to be larger than salaries graph.

Look for good explanation as to why graphs are drawn.
Use of strategies to model and solve problems in simple non-routine situations

**Question 2.**
You are the director of a company and you have given large salary increases to all your staff during 2008. However, profits have not been as spectacular as in 2007. The table below gives the figures for mean profits and salaries for each quarter (three months) of 2008.

<table>
<thead>
<tr>
<th></th>
<th>1st Quarter</th>
<th>2nd Quarter</th>
<th>3rd Quarter</th>
<th>4th Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profits</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Salaries</td>
<td>5</td>
<td>5.5</td>
<td>6</td>
<td>6.5</td>
</tr>
</tbody>
</table>

For the annual general meeting of shareholders, you are to draw two graphs, one showing profits and the other showing salaries, which will show you in the best possible way to shareholders.

On the grid below, draw the graphs and in the answer booklet, explain clearly why you have drawn them the way that you have.
Question 3

Block of land

Drawing length: actual length

1:200

12.5 cm = 25 m
12.5 cm = 1250 cm

The dimensions of the property on the plan are 12.5 cm x 12.5 cm.

Position of house

Drawing length: actual length

1:200

2.5 cm = 5 m
2.5 cm = 500 cm

The house is placed 2.5 cm from the front of the block on the plan.

Drawing length: actual length

1:200

4 cm = 4 m
4 cm = 400 cm

The house is placed 2 cm from the eastern side of the block on the plan.
Application of complex sequences of mathematical procedures in non-routine situations

Garden Shed

<table>
<thead>
<tr>
<th>Drawing length</th>
<th>Actual length</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 cm</td>
<td>4 m</td>
</tr>
<tr>
<td>20 cm: 400 cm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drawing length</th>
<th>Actual length</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 cm</td>
<td>3 m</td>
</tr>
<tr>
<td>15 cm: 300 cm</td>
<td></td>
</tr>
</tbody>
</table>

The dimensions of the garden shed on the plan is 1.5 cm x 2.5 cm.

House

<table>
<thead>
<tr>
<th>Drawing length</th>
<th>Actual length</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td></td>
</tr>
<tr>
<td>8.5 cm: 8.5 cm x 150</td>
<td></td>
</tr>
<tr>
<td>8.5 cm: 127.5 cm</td>
<td></td>
</tr>
</tbody>
</table>

The house is 12.75 m across in real life.

<table>
<thead>
<tr>
<th>Drawing length</th>
<th>Actual length</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td></td>
</tr>
<tr>
<td>9 cm: 9 cm x 150</td>
<td></td>
</tr>
<tr>
<td>9 cm: 1350 cm</td>
<td></td>
</tr>
</tbody>
</table>

The house is 13.5 m deep in real life.
Indicative response - Standard A

Drawing length: actual length
1 : 200
6.75 cm : 1350 cm.

Drawing length: actual length
1 : 200
6.4 cm : 1275 cm

The dimensions of the base on the plan is
6.75 cm x 6.4 cm
Indicative response - Standard A

Question 4

a) The height of the kite is greater than the length of the kite string.

b) \[ \text{base}^2 + \text{height}^2 = \text{hyp}^2 \]
\[ 38.3^2 + h^2 = 60^2 \]
\[ h^2 = 50^2 - 38.3^2 \]
\[ h^2 = 1033.11 \]
\[ h = 32.14 \text{ m} \]

Overall height = 32.14 + 1.6
\[ = 33.74 \text{ m} \]

c) \[ \tan \theta = \frac{\text{opp}}{\text{adj}} \quad \cos \theta = \frac{\text{adj}}{\text{hyp}} \]
\[ \tan 50 = \frac{38.3}{h} \quad \cos 50 = \frac{h}{50} \]
\[ h = \frac{38.3}{\tan 50} \quad h = 50 \cos 50 \]
\[ \approx 32.14 \text{ m} \]

Overall height = 32.14 + 1.6
\[ = 33.74 \text{ m} \]

Informed decisions based on mathematical reasoning in a simple non-routine situation.

Use of mathematical reasoning to develop logical sequences in simple non-routine situations using mathematical language.
## Instrument-specific criteria and standards

<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><strong>Knowledge and procedures</strong></td>
<td><strong>Modelling and problem solving</strong></td>
<td><strong>Communication and justification</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| The student work has the following characteristics:  
  • application of simple through to complex sequences of mathematical procedures in routine and non-routine situations | The student work has the following characteristics:  
  • use of strategies to model and solve problems in complex routine through to simple non-routine situations  
  • informed decisions based on mathematical reasoning in complex through to simple non-routine situations  
  • reflection on the effectiveness of mathematical models including recognition of the strengths and limitations of the model | The student work has the following characteristics:  
  • accurate and appropriate use of mathematical terminology and conventions in simple non-routine through to complex routine situations  
  • organisation and presentation of information in a variety of representations in simple non-routine through to complex routine situations  
  • use of mathematical reasoning to develop logical sequences in simple non-routine through to complex routine situations using everyday and/or mathematical language. | The student work has the following characteristics:  
  • accurate and appropriate use of mathematical terminology and conventions in simple non-routine and/or complex routine situations  
  • organisation and presentation of information in a variety of representations in simple non-routine and/or complex routine situations  
  • use of mathematical reasoning to develop logical sequences in simple non-routine and/or complex routine situations using everyday and/or mathematical language. | The student work has the following characteristics:  
  • use of strategies to model and solve problems in routine through to simple non-routine situations  
  • informed decisions based on mathematical reasoning in routine situations  
  • recognition of the strengths and limitations of the model in simple situations | The student work has the following characteristics:  
  • use of familiar strategies for problem solving in routine through to simple non-routine situations  
  • informed decisions based on mathematical reasoning in simple situations  
  • recognition of the strengths and limitations of the model in simple situations | The student work has the following characteristics:  
  • use of given strategies for problem solving in simple rehearsed situations | The student work has the following characteristics:  
  • attempted use of given strategies for problem solving in well-rehearsed situations | The student work has the following characteristics:  
  • attempted use of simple mathematical procedures in simple rehearsed situations | The student work has the following characteristics:  
  • attempted use of simple mathematical procedures in simple rehearsed situations |