Free-Standing Mathematics Qualification
June 2008
Intermediate Level

**USING ALGEBRA, FUNCTIONS AND GRAPHS   6988/2
Unit 8**

AQA
ASSESSMENT and
QUALIFICATIONS
ALLIANCE

Tuesday 13 May 2008   9.00 am to 10.15 am

Time allowed: 1 hour 15 minutes

Instructions
- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- You may **not** refer to the copy of the Data Sheet that was available prior to this examination. A clean copy is enclosed for your use.

Information
- The maximum mark for this paper is 50.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

SECTION A

Answer **all** questions in the spaces provided.

Use **Volcanoes** *on page 2 of the Data Sheet.*

1 A volcano erupts and lava flows towards a village 5 kilometres away.

The distances of the lava flow from the village, at various times after the eruption, are given in the table below.

Time (*t* days)	5	10	15	20	25	30
Distance from the village (*d* km)	4.6	3.9	3.5	3.1	2.6	1.9

1 (a) On the axes below, plot the data in the table.
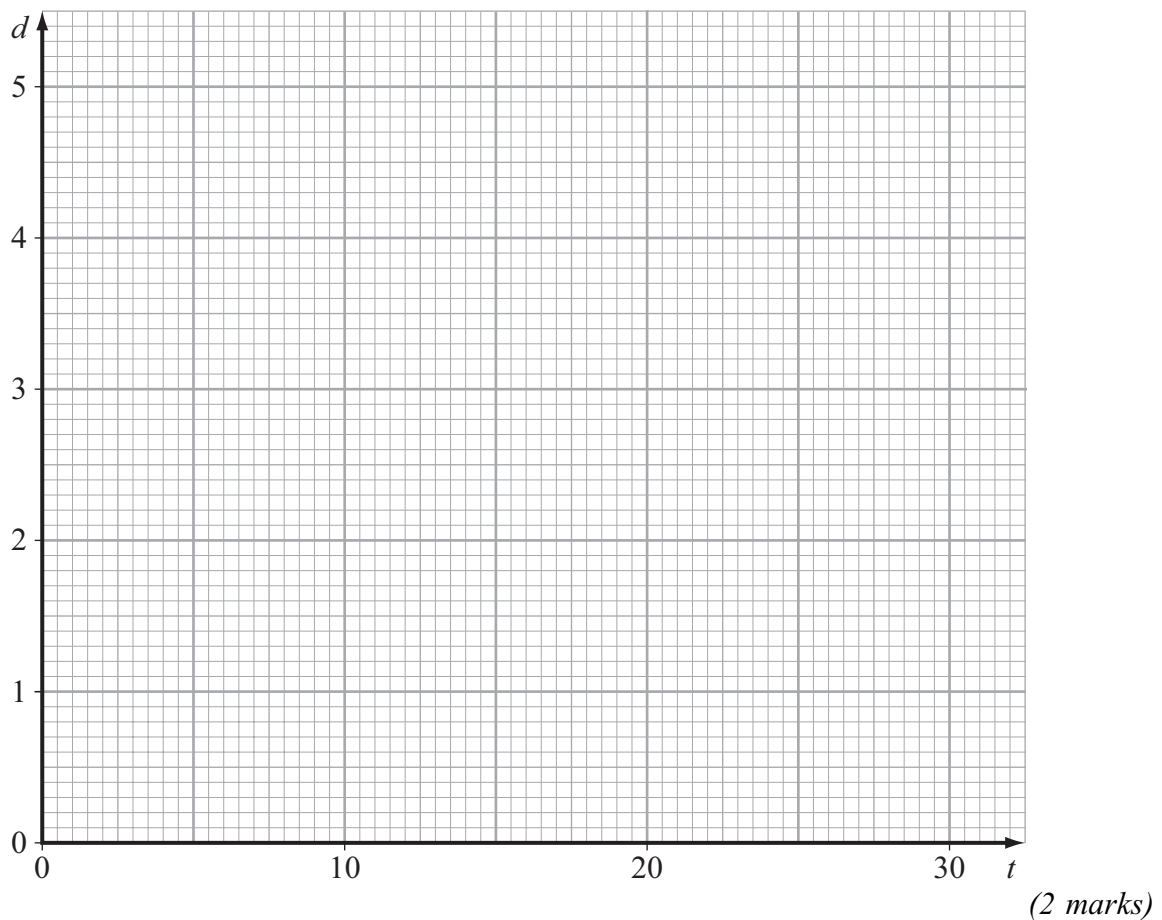
(2 marks)

1 (b) Draw a line of best fit on your graph.

(1 mark)

1 (c) Use the graph to find a formula for *d* in terms of *t*.

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Answer..

(3 marks)

1 (d) How many days after the eruption will the lava reach the village?
(You may assume that the lava continues to flow at the same rate.)

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Answer..

(2 marks)

1 (e) Estimate the speed of the lava in kilometres per day.

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Answer..

(2 marks)

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Areas outside
the box will
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for marking

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SECTION B

Answer **all** questions in the spaces provided.

*Use **Air bubbles** on page 2 of the Data Sheet.*

2 As an air bubble travels upwards through water, its volume increases.
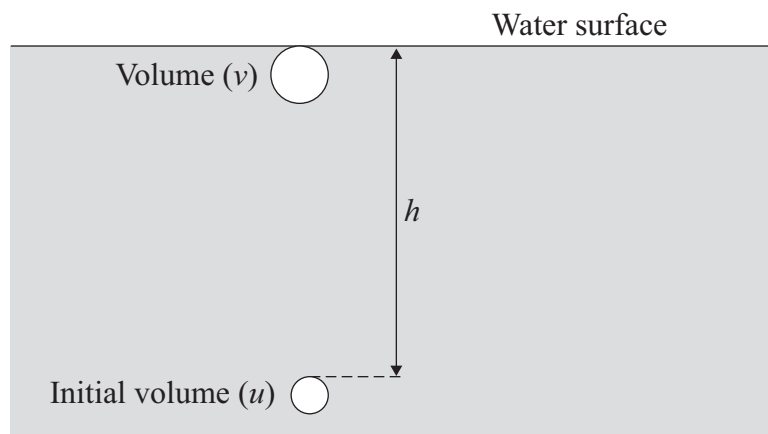
The formula for finding the initial volume, $u \, \text{cm}^3$, of an air bubble from its volume, $v \, \text{cm}^3$, at the water surface when it has risen h metres is

$$u = \frac{10.3v}{h + 10.3}$$

2 (a) At the water surface, an air bubble has a volume of $2.75 \times 10^{-2} \, \text{cm}^3$.

What was the initial volume of the air bubble when it was 25 metres below the water surface?
Give your answer in standard form.

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Answer..

(3 marks)

2 (b) (i) Rearrange the formula to give v in terms of h and u.

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Answer..

(2 marks)

2 (b) (ii) An air bubble 30 metres below the water surface has a volume of $8.5 \times 10^{-4}\,\text{cm}^3$.

Calculate the volume of the air bubble at the water surface.

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Answer..

(2 marks)

2 (c) Find h when $u = 2 \times 10^{-3}$ and $v = 6 \times 10^{-3}$.

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Answer..
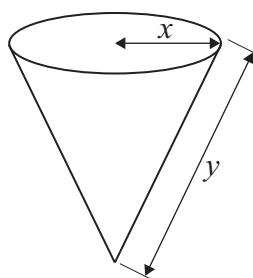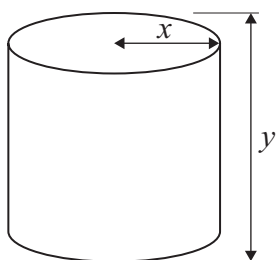
(3 marks)

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SECTION C

Answer **all** questions in the spaces provided.

Use **Ice cream containers** *on page 3 of the Data Sheet.*

3 An ice cream manufacturer sells ice cream in two types of container.
One container is a cylinder with radius x cm and perpendicular height y cm.
The other container is a cone with radius x cm and slant height y cm.

3 (a) Find the curved surface area of the cylinder when $x = 4$ and $y = 6$.

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Answer...

(3 marks)

3 (b) Show that the formula for the total surface area, S cm^2, of the closed cylinder can be expressed as

$$S = 2\pi x^2 + 2\pi xy$$

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(2 marks)

3 (c) Factorise fully the expression $2\pi x^2 + 2\pi xy$.

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Answer..

(2 marks)

3 (d) Find an expression, in terms of π, x and y, for the total surface area of the closed cone.

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Answer..

(3 marks)

3 (e) How many times bigger is the total surface area of the closed cylinder compared to the total surface area of the closed cone?

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(1 mark)

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SECTION D

Answer **all** questions in the spaces provided.

Use **Containers** *on page 3 of the Data Sheet.*

4 Each of *n* small containers holds *x* litres of liquid.
The total volume of the liquid is 500 litres.

4 (a) Find *n* when $x = 20$ litres.

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Answer...
(1 mark)

4 (b) The equation connecting *n* and *x* is

$$n = \frac{k}{x} \qquad \text{where } k \text{ is a constant}$$

What is the value of *k*?

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Answer...
(1 mark)

4 (c) Which of the following graphs shows the relationship between *n* and *x*?

Answer...
(1 mark)

3
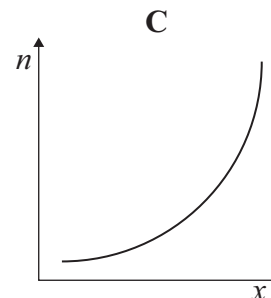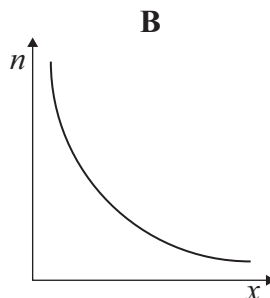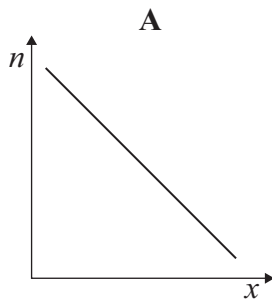
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SECTION E

Answer **all** questions in the spaces provided.

Use **Bus journey** *on page 4 of the Data Sheet.*

5   The diagram shows the velocity–time graph of a bus on a journey between two bus stops.
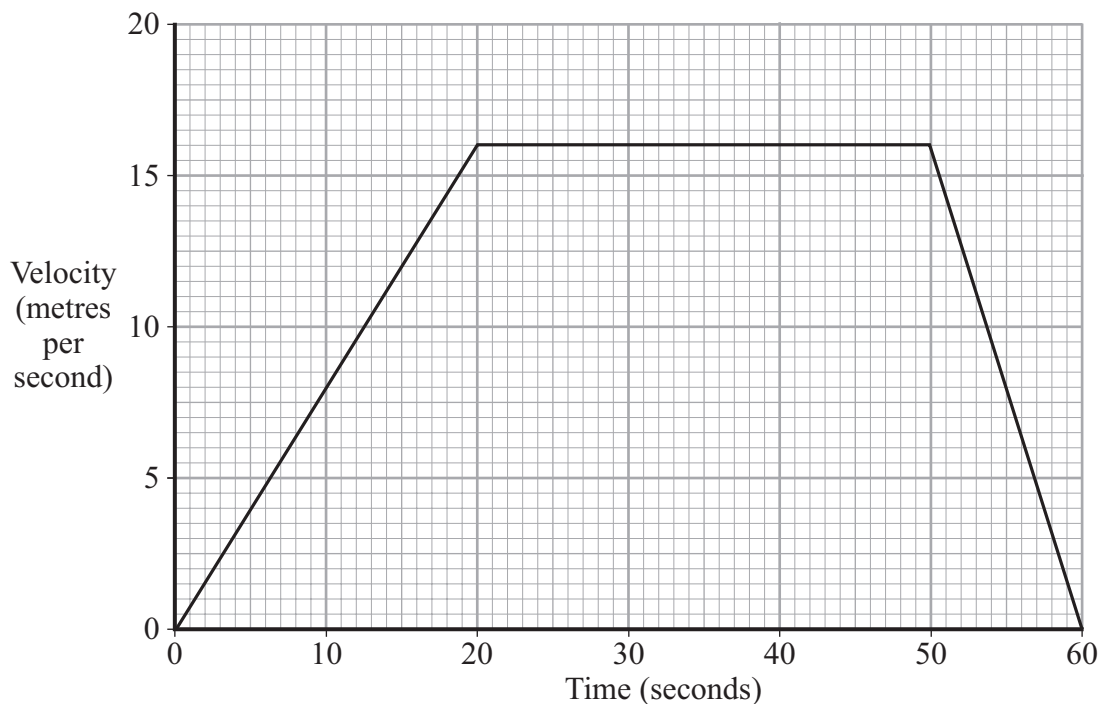
5   (a)   The area under the graph represents the distance travelled by the bus.

How far does the bus travel between the two bus stops?

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Answer...

(2 marks)

5 (b) Calculate the time it takes to travel half the distance between the two bus stops.

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Answer..

(4 marks)

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SECTION F

Answer **all** questions in the spaces provided.

Use **Postcard** *on page 4 of the Data Sheet.*

6 A rectangular postcard measures 20 centimetres by 8 centimetres.

A border of uniform width is drawn inside the rectangle.
A small square is drawn, as shown on the diagram below.

The width of the border, x cm, is the same as the side of the square.
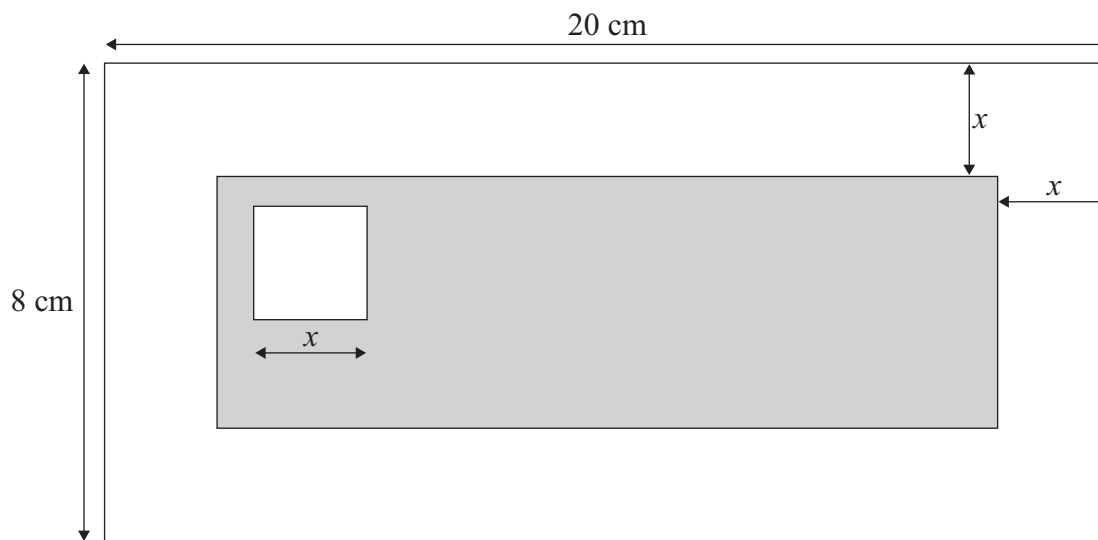
6 (a) Write an expression, in terms of x, for the length and width of the shaded section.

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Answers: Length...

Width ....

(2 marks)

6 **(b)** **(i)** The shaded section has an area of $124 \, \text{cm}^2$.

Show that $3x^2 - 56x + 36 = 0$.

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(3 marks)

6 **(b)** **(ii)** By factorising or otherwise, solve the equation $3x^2 - 56x + 36 = 0$ to find the values of x.

The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$.

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Answers: $x =$........................ or $x =$ ....

(3 marks)

Question 6 continues on the next page

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6 (b) (iii) Calculate the area of the small square.

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Answer..

(2 marks)

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END OF QUESTIONS

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