Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

For Examiner's Use

Free-Standing Mathematics Qualification
June 2007
Intermediate Level

USING ALGEBRA, FUNCTIONS AND GRAPHS 6988/2
Unit 8

Wednesday 16 May 2007 9.00 am to 10.15 am

For this paper you must have:
- a clean copy of the Data Sheet (enclosed)
- a calculator
- a ruler.

Time allowed: 1 hour 15 minutes

Instructions
- Use blue or black ink or ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- 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.

For Examiner's Use			
Question	Mark	Question	Mark
1		5	
2		6	
3			
4			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

SECTION A

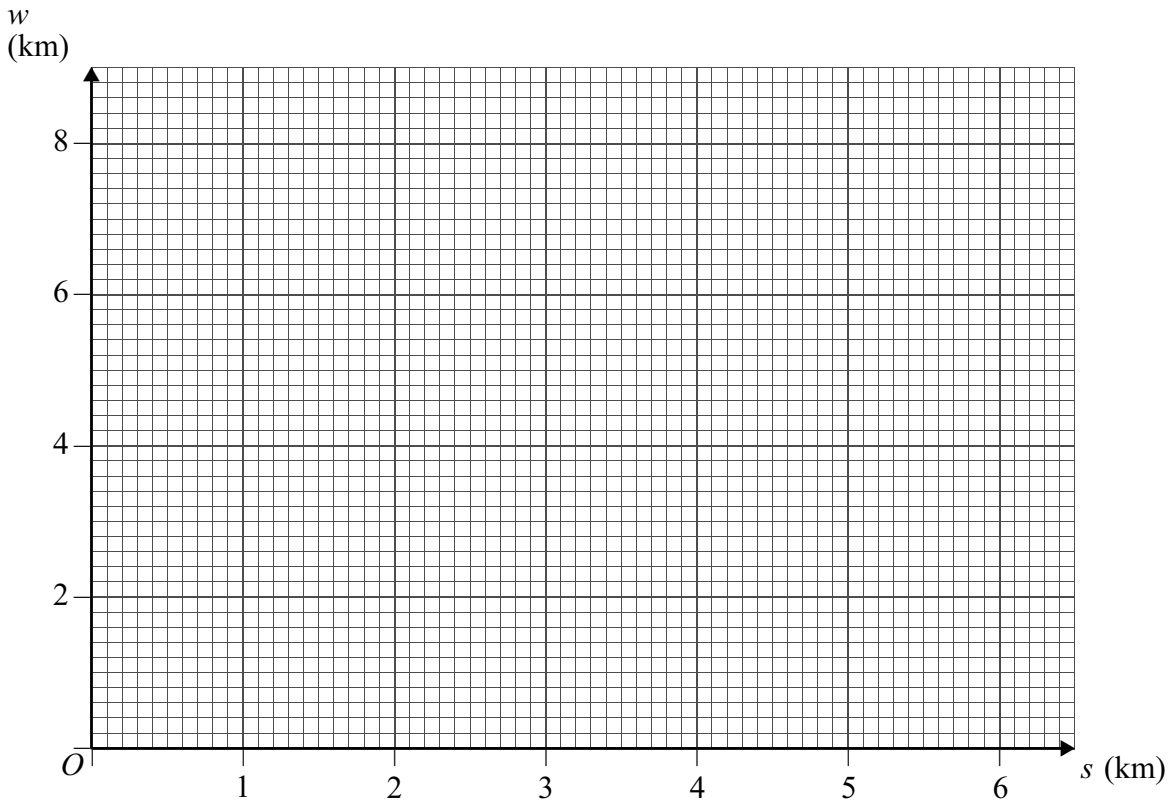
Answer **all** questions in the spaces provided.

Use **Walking distances** *on page 2 of the Data Sheet.*

1 The table gives the distances of a number of housing areas from a local school.

Housing area	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Straight-line distance (*s* kilometres)	0.9	2	2.5	3	4	5	6
Walking distance (*w* kilometres)	1.2	2.6	3.3	4	5.1	6.6	7.7

(a) On the graph below, plot the points for the data given in the table.



(2 marks)

(b) On the graph, draw the straight line that best fits the data.

(1 mark)

(c) Write down a formula expressing w in terms of s.

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Answer.....

(2 marks)

(d) Use your formula to estimate the walking distance when the straight-line distance is 4.25 kilometres.

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Answer.....

(2 marks)

(e) Explain why the formula should not be used to estimate walking distances when s is greater than 6 .

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(1 mark)

8

Turn over for the next question

SECTION B

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

Use **Earth and Mercury** *on page 2 of the Data Sheet.*

2 (a) How many times greater is the atmospheric pressure on Earth than it is on Mercury?

Give your answer in standard form.

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Answer.....

(3 marks)

(b) Calculate the ratio of the mass of Earth to the mass of Mercury.

Write your answer in the form $n : 1$.

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Answer.....

(2 marks)

(c) The approximate volume, V, of a planet with radius r is given by the formula

$$V = \frac{4\pi r^3}{3}$$

Calculate the volume of Mercury.

Give your answer in standard form, correct to two decimal places.

State the **units** of your answer.

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Answer.....

(4 marks)

(d) A student calculated that Mercury's distance from the Sun was 37.8% of the Earth's distance from the Sun.

Was she correct?

Show the calculation that you made to support your answer.

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Answer.....

(2 marks)

11

SECTION C

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

Use **Farm sale** *on page 3 of the Data Sheet.*

3 At a farm sale, a farmer can buy

6 gates and 5 barn doors for £ 580, or

4 gates and 10 barn doors for £ 720 .

(a) Each gate costs £ x and each barn door costs £ y .

Write down the above information as a pair of equations.

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Answers .....

and .....

(2 marks)

(b) Solve your equations to calculate the cost of one gate.

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Answer £ .....

(3 marks)

5

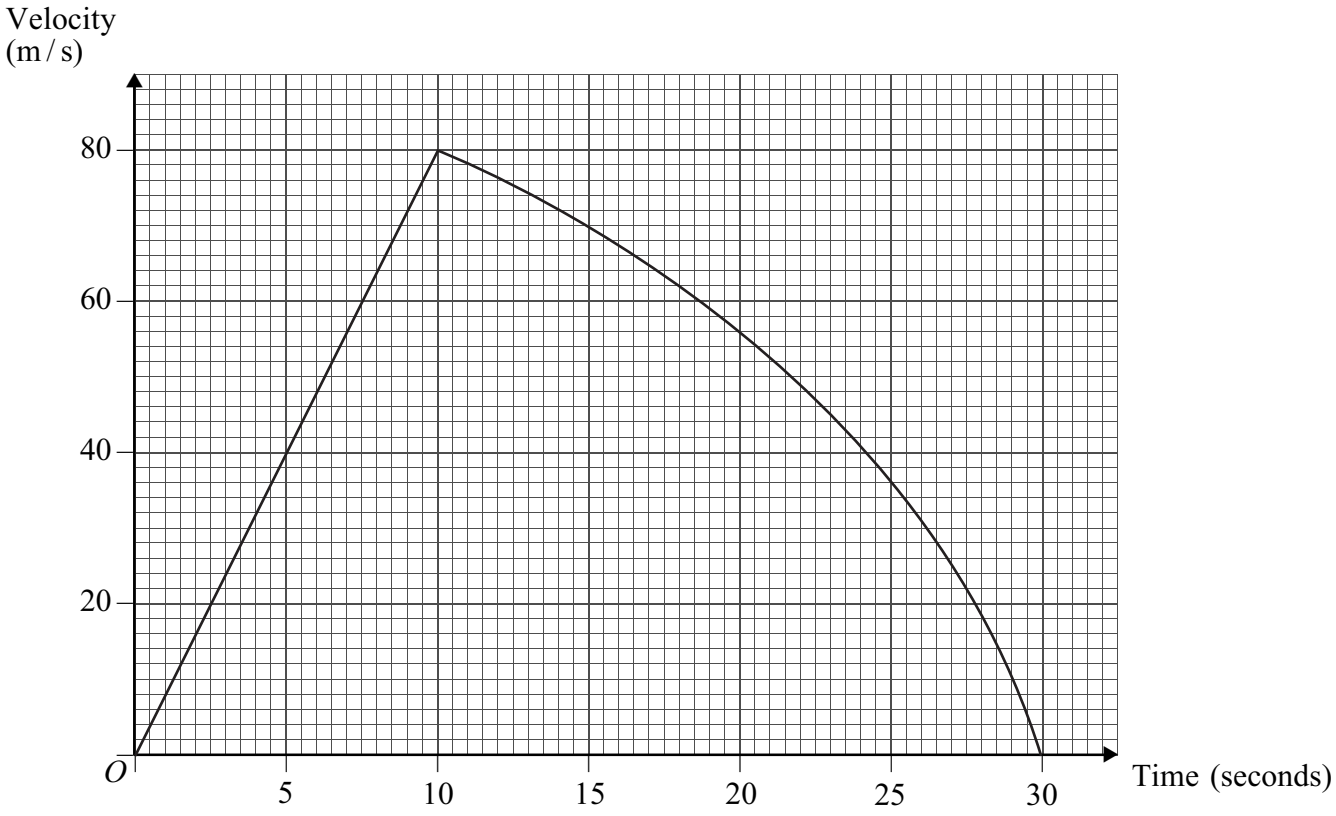
Turn over for the next question

SECTION D

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

Use **Racing car** *on page 3 of the Data Sheet.*

4 The graph is repeated below.



(a) (i) Draw a tangent at the point where the time is 20 seconds.

(1 mark)

(ii) Calculate the gradient of the graph at this point.

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Answer.....

(2 marks)

(iii) State the units of the answer.

Answer.....

(1 mark)

(b) The area under the graph represents the distance travelled by the car.

Calculate an estimate of the distance travelled during the last 20 seconds of the car's journey.

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Answer.....

(3 marks)

7

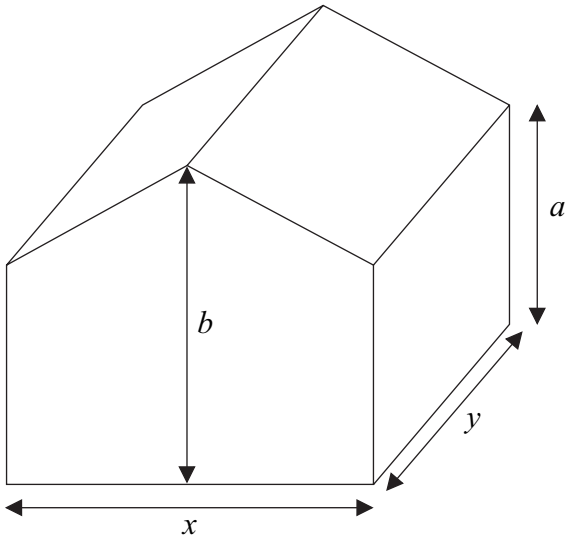
Turn over for the next question

SECTION E

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

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

5 This diagram represents a greenhouse. All measurements are in metres.



The volume, V, of the greenhouse is given by the formula

$$V = \frac{1}{2}xy(a + b)$$

(a) Rearrange this formula to give x in terms of a, b, V and y.

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Answer.....

(2 marks)

(b) Calculate x when $V = 125$, $y = 8$, $a = 2$ and $b = 3$.

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Answer.....

(2 marks)

(c) In another greenhouse, $x = 3n$, $y = 2n + 4$, $a = 2$ and $b = 3$.

(i) Show that the formula for the volume of this greenhouse can be expressed as

$$V = 15n^2 + 30n$$

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(2 marks)

(ii) The volume of this greenhouse is also $125\,\text{m}^3$.

Using $V = 125$ and the formula in part (c)(i), show that

$$3n^2 + 6n - 25 = 0$$

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(2 marks)

Question 5 continues on the next page

(iii) Solve the equation $3n^2 + 6n - 25 = 0$.

The solutions of $an^2 + bn + c = 0$, where $a \neq 0$, are given by

$$n = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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Answer.....

(3 marks)

(iv) Write down the dimensions of the base of the greenhouse.

Answers ..... and .....

(1 mark)

12

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SECTION F

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

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

6 The formula $n = 250 \times 2.95^{0.3t}$ can be used to calculate the approximate number of tadpoles, n, in a pond at time t days after observations began.

(a) Calculate the value of n when $t = 0$.

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Answer.....
(2 marks)

(b) (i) Calculate the value of n when $t = -2$.

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Answer.....
(2 marks)

(ii) Explain what your answer in part (b)(i) means.

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(1 mark)

(c) On what day did the tadpole population go above 2000 for the first time?

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Answer.....
(2 marks)

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END OF QUESTIONS

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