For Supervisor's use only

2

90285

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Level 2 Mathematics, 2003

90285 Sketch and interpret non-linear graphs

Credits: Three
9.30 am Wednesday 19 November 2003

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should answer ALL the questions in this booklet.

Show ALL working.

If you need more space for any answer, use the pages provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–11 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

For Assessor's use only

Achievement Criteria		
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Sketch non-linear graphs from equations and identify relevant features of graphs. ☐	Plot graphs of equations and interpret their features. ☐	Determine and apply an appropriate graphical model for a situation. ☐
	Write equations of graphs. ☐	
Overall Level of Performance (all criteria within a column are met) ☐		

You are advised to spend 35 minutes answering the questions in this booklet.

Assessor's use only

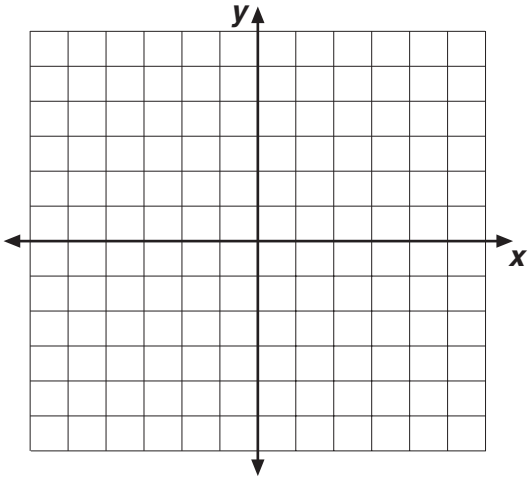
GRAPHS AND FLOODS

Show **ALL** working.

QUESTION ONE

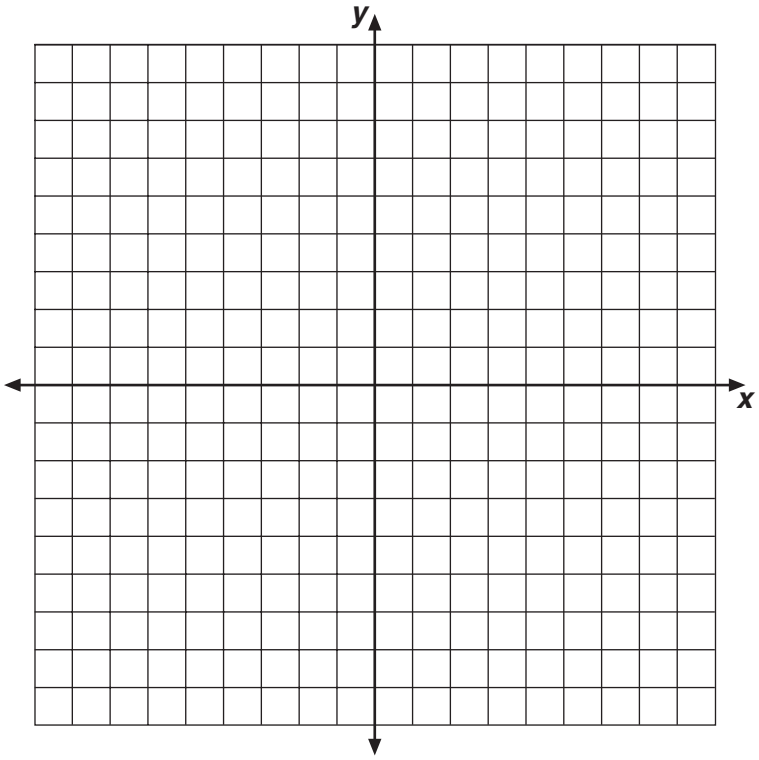
Draw the graphs of the three equations below.

(a) $y = x^2 - 2x - 3$

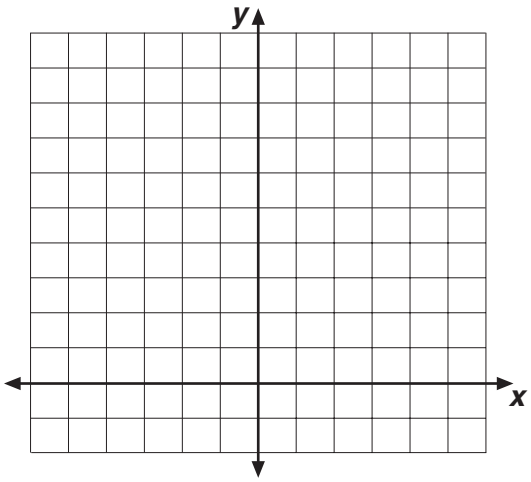


If you need to redraw either of these graphs, use page 10.

(b) $y = \frac{6}{x}$



(c) $y = 3^x$

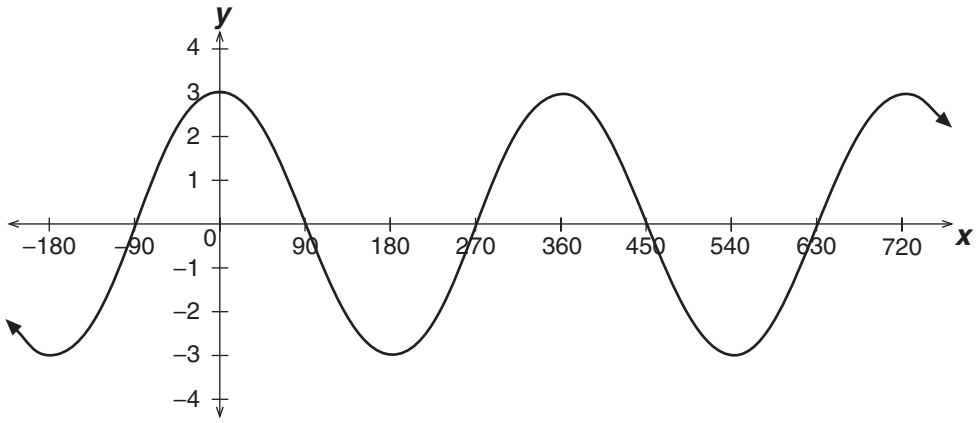


If you need to redraw this graph, use page 10.

Assessor's use only

QUESTION TWO

Identify THREE features of the following graph of $y = 3 \cos x$.



(1) _____

(2) _____

(3) _____

QUESTION THREE

Assessor's use only

Kate is studying the floods that occurred in Europe last winter.

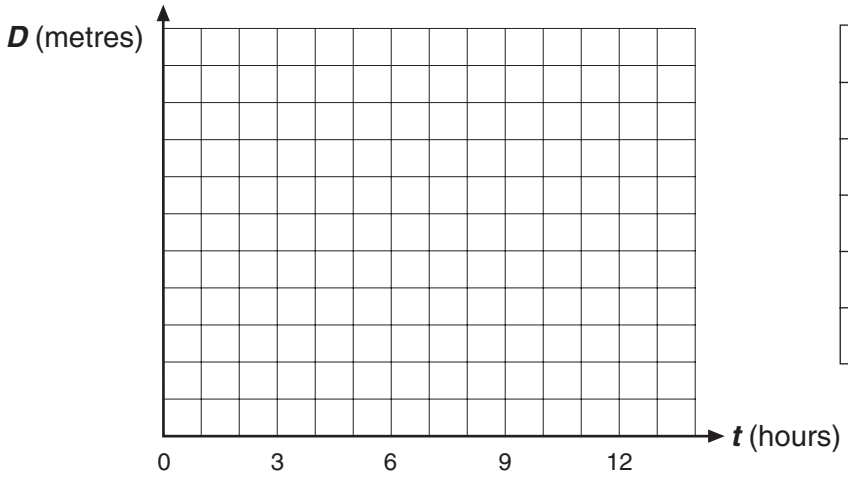
She discovered that the depth of the Vltava River in Prague changed very rapidly during the first 12 hours of the flood.

Kate found that these depths could be modelled by the equation:

$$D = 2.7(1.1)^t$$

where D is the depth of the river in metres
and t is the number of hours since the rain began.

Plot the graph of the equation for the depth of the river for the first 12 hours of the flood.



t	D

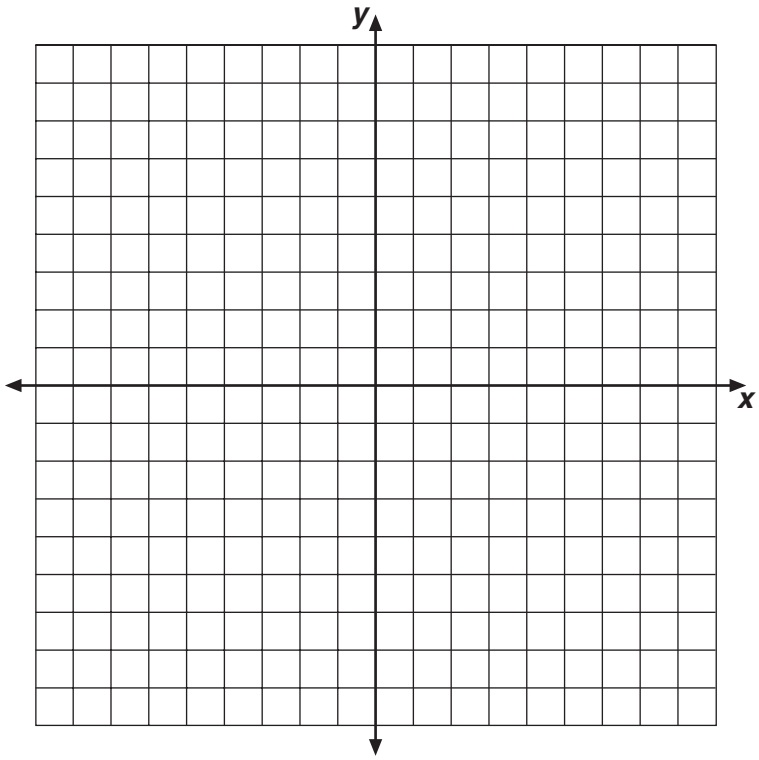
If you need to redraw this graph, use page 10.

QUESTION FOUR

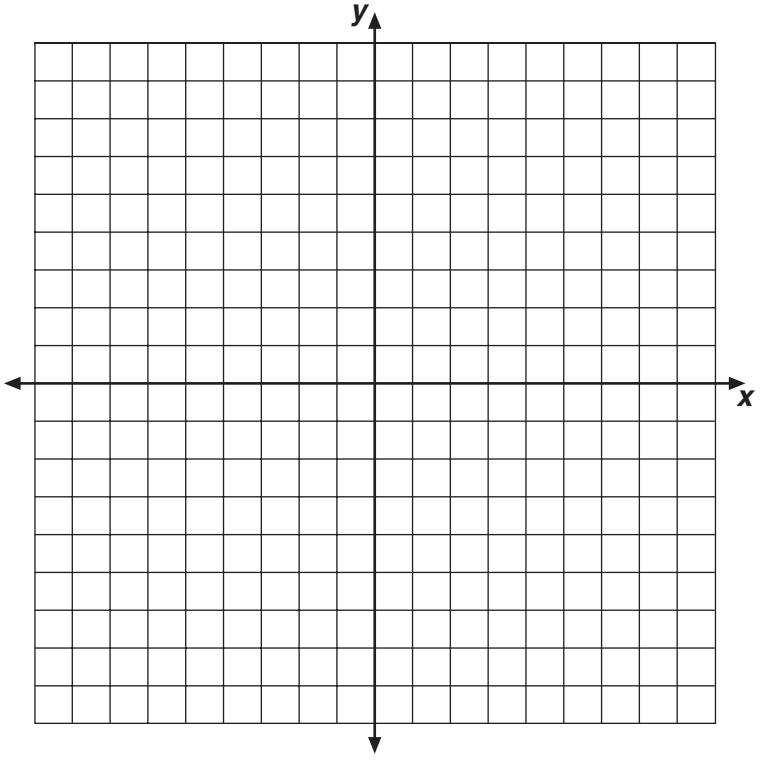
Assessor's use only

Draw the graphs of the following equations:

(a) $(x-3)^2 + (y+2)^2 = 9$



(b) $y = \dfrac{2x+3}{x-1}$



If you need to redraw either of these graphs, use page 10.

QUESTION FIVE

Assessor's use only

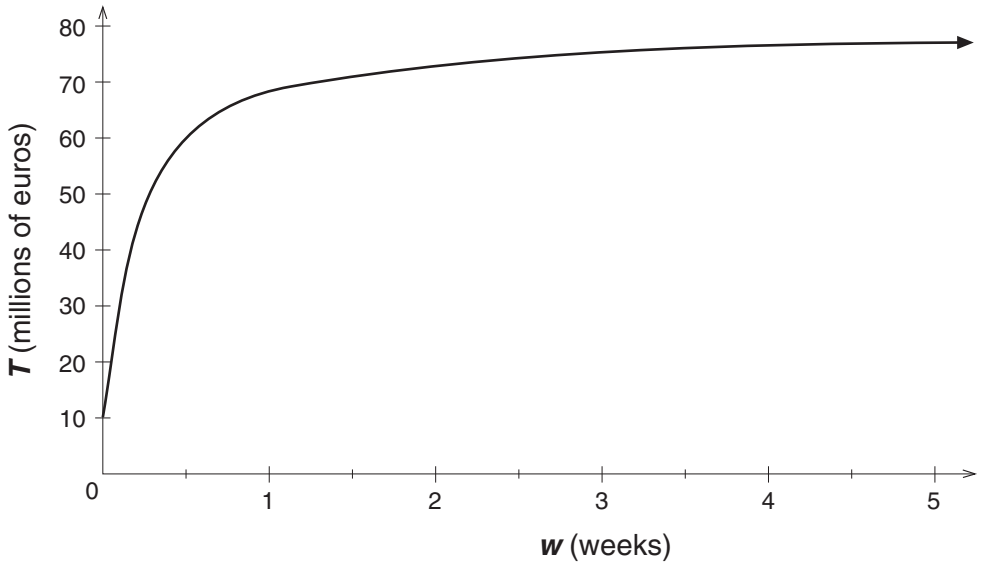
The Czech Government has an aid fund to help the clean-up operation after the flood.

The total money the Czech Government has in the aid fund can be modelled by the equation:

$$T = \frac{400w + 10}{5w + 1}$$

where T is the total amount of money in the aid fund in millions of euros
and w is the number of weeks since the rain began.

The graph of the equation for the total amount of money in the aid fund is shown below:



(a) What does the graph tell us about the rate at which the money in the aid fund grew?

(b) What does the graph tell us about the total amount of aid money received after many weeks?

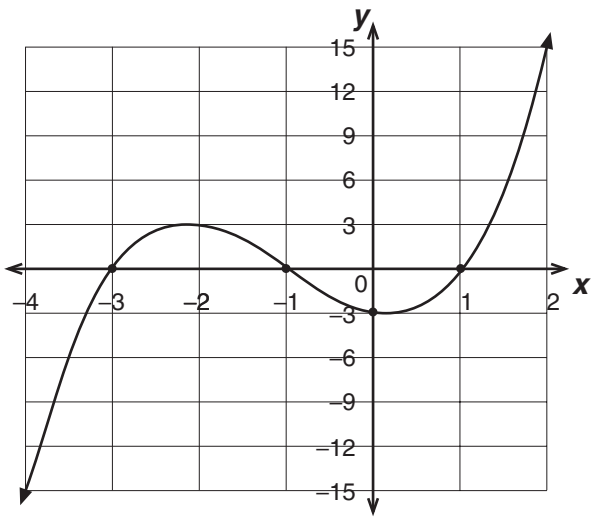
(c) What does the axis intercept tell us about the aid money situation?

QUESTION SIX

Assessor's use only

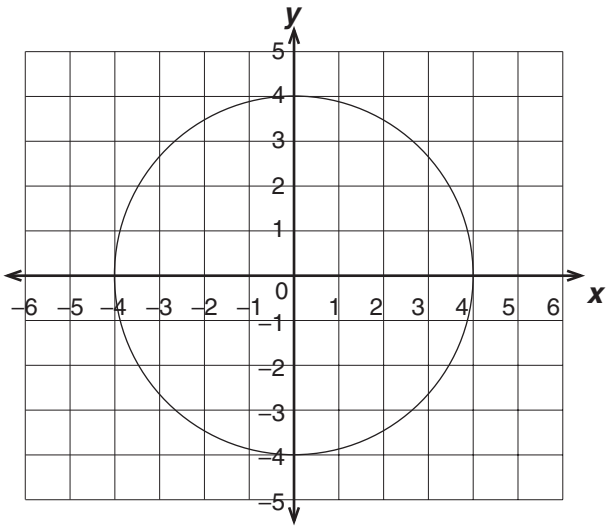
For EACH of the graphs below, write the equation.

(a)



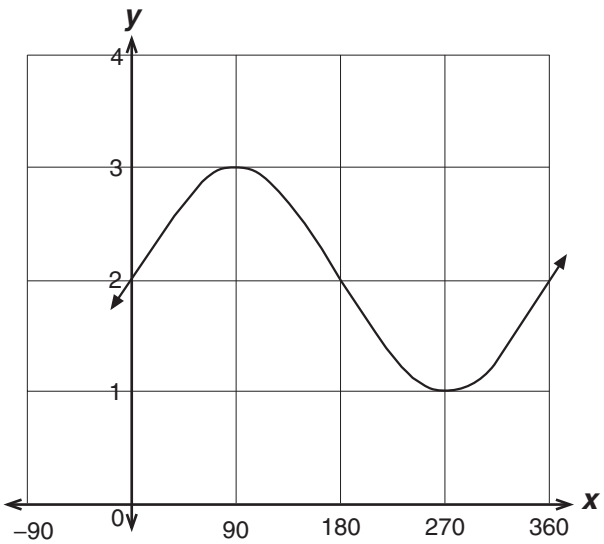
Equation:

(b)



Equation:

(c)



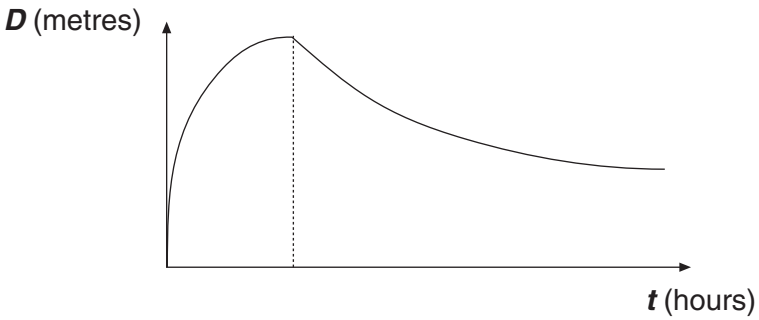
Equation:

QUESTION SEVEN

Assessor's use only

Jake is also studying the floods in Prague and has found that:

- the initial depth of the river was 2.7 m at 6 pm on 13 August when the rain started
- the maximum depth of the river was 8.5 m at 6 am on 14 August (after 12 hours)
- the depth of the river had dropped to 3.9 m by 6 am on 17 August (after 84 hours).



After 12 hours, the depth of the river could be modelled by a hyperbola of the form:

$$D = \frac{a}{t - b}$$

where D is the depth of the river in metres
and t is the time in hours since the rain began.

(a) Write the equation for the hyperbola that could model the depth of the river after it had been raining for 12 hours.

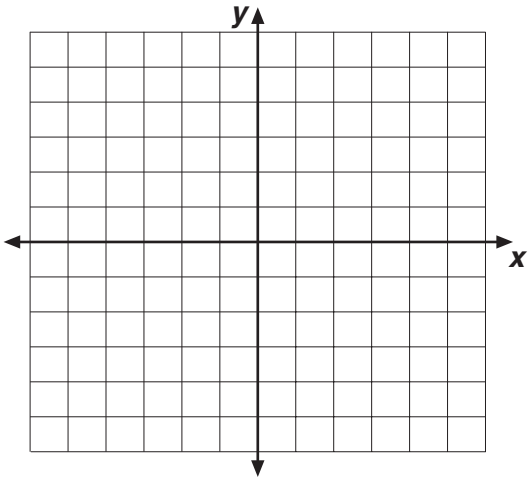
(Round your values of a and b to the nearest integer.)

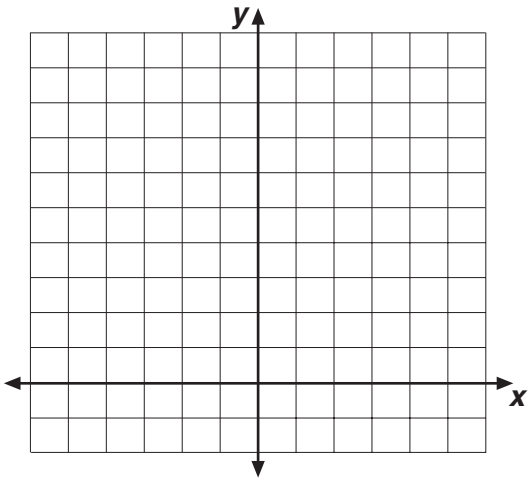
(b) Use your model from (a) to estimate the time and date when the river returned to its original depth of 2.7 m.

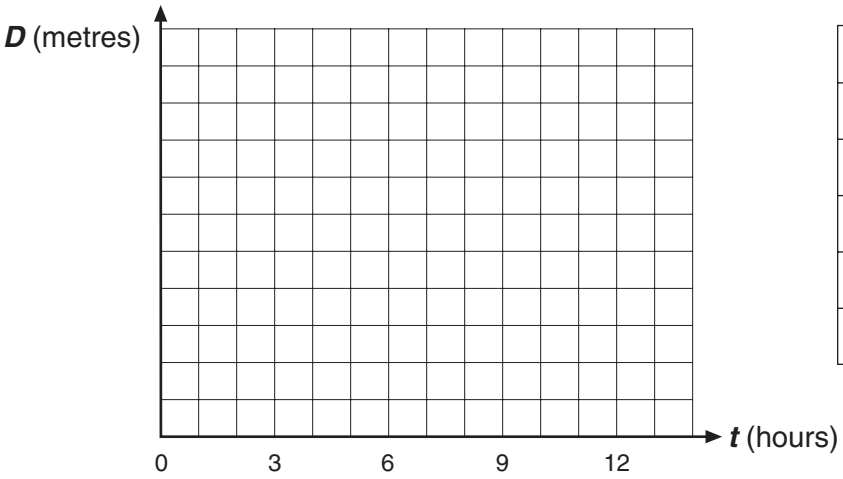
Assessor's use only

If you have made a mistake and need to redraw a graph, use the appropriate copy printed here.

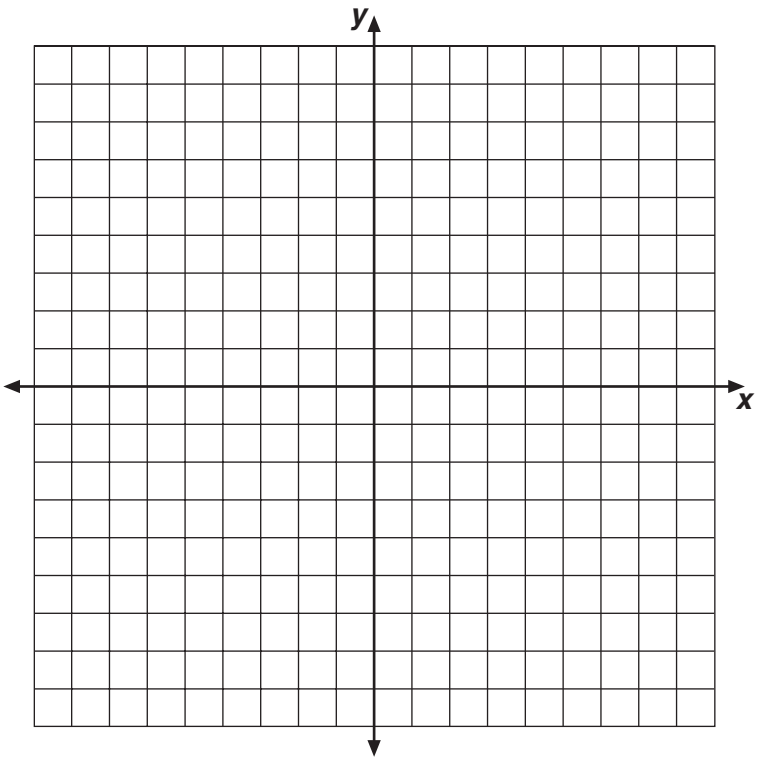
Assessor's use only







t	*D*



Extra paper for continuation of answers if required.
Clearly number the question.

Assessor's use only

Question Number