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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

For Supervisor's use only

Level 1 Mathematics, 2009

90800 Demonstrate an understanding of the features of graphs

Credits: Three
9.30 am Friday 20 November 2009

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.

The questions in this paper are NOT in order of difficulty. Attempt all questions or you may not provide enough evidence to achieve the required standard.

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

You should show ALL working.

Check that this booklet has pages 2–8 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**	
Demonstrate an understanding of the features of graphs.	Demonstrate an understanding of the relationship between functions and the features of their graphs.	Determine and apply appropriate model(s) to solve graphical problem(s).	
Overall Level of Performance			

You are advised to spend 30 minutes answering the questions in this booklet.

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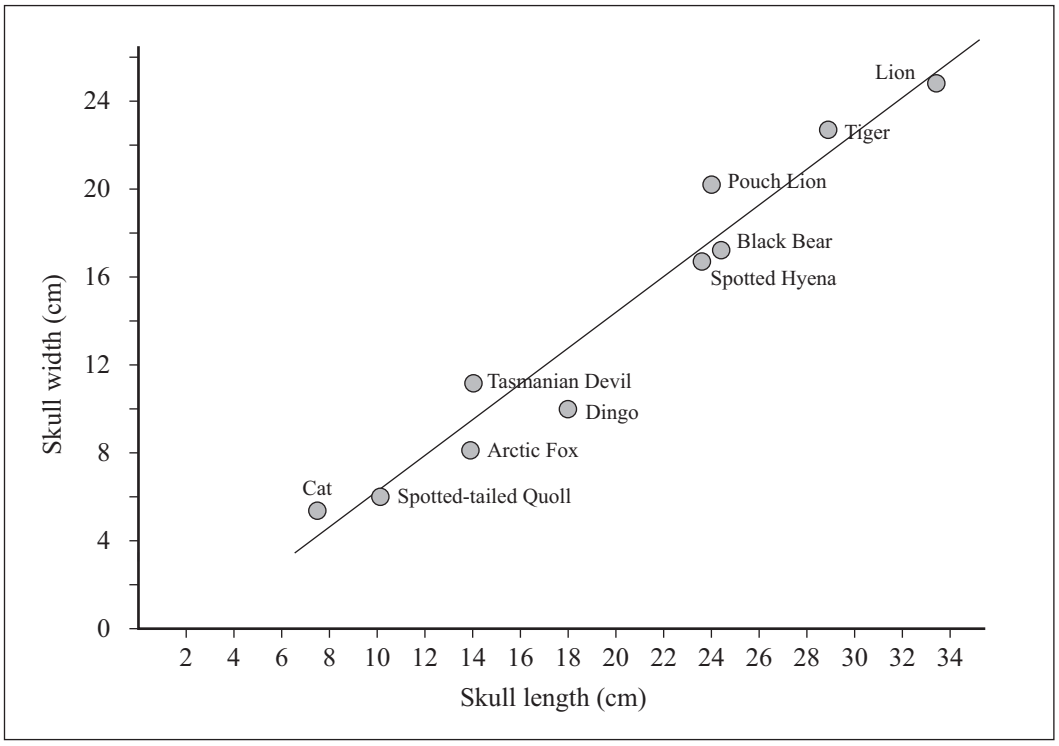
QUESTION ONE

Skull of the extinct Australian Pouch Lion – a carnivorous animal

http://en.wikipedia.org/wiki/File:Thylacoleo.jpg

A scientist predicts that there is a linear relationship between a carnivore's skull width and its skull length. This is shown in the graph below.



(a) (i) From the graph, name three animals that have skull widths greater than expected for their skull length.

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(ii) If the points on the graph for two carnivores are separate, but are joined by a vertical line, what can you say about their skull length **and** skull width?

(b) Some data have been collected about four modern predators.

(i) Use the data from the table below to determine a quadratic model for the relationship between skull width *sw*, and bite-force index *bf*.

Predator	***sw* (cm)**	***bf***
wolf	13.2	163
black bear	17.2	64
tiger	22.7	127
lion	24.6	159

(ii) Some scientists claim that the extinct Australian Pouch Lion would be one of the most dangerous predators in the world if it was alive today.

An Australian Pouch Lion had a 20.2 cm skull width, and an actual bite-force index of 194.

Use calculations to show whether your model supports the scientists' claim or not.

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QUESTION TWO

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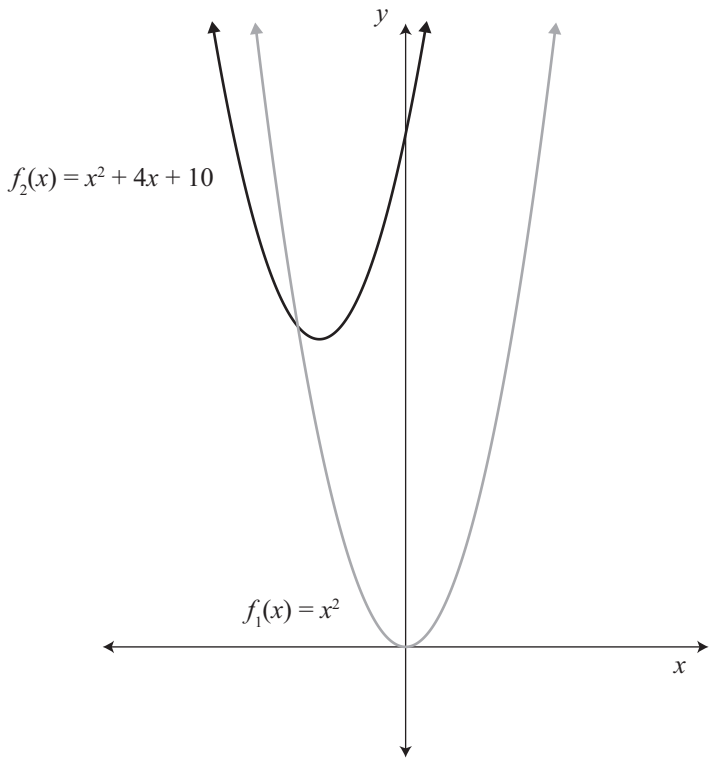
(a) Zac starts dragging the graph of $f_1(x) = x^2$ across his calculator screen towards the graph of $f_2(x) = x^2 + 4x + 10$ until they are on top of each other.

The equation of $f_1(x)$ changes on his screen as he does this.

Write the equation of $f_1(x)$, in the form $y = (x + a)^2 + b$, when the graphs of $f_1(x)$ and $f_2(x)$ are on top of each other.



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(b) Brendan is a BMX rider.

He is jumping from one ramp to another.

The flight path of a point on the seat of Brendan's bike above the floor is modelled by the equation,

$y = -0.20x^2 + 0.73x + 3.40$

where y = the height of the point on the bike's seat in metres above the floor, and x = the horizontal distance in metres travelled from the top of the ramp.

(i) Calculate the maximum height of the BMX bike seat above the floor.

(ii) The coefficients of x^2 and of x are affected only by the speed and angle of takeoff.

What is the equation of the family of parabolas where the speed and angle of takeoff are the same as they are for Brendan?

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(iii) To land safely, a rider must land on the top or far side of the next ramp.

If the next ramp is 1.4 m above the ground and 5.7 m horizontally from the top of the first ramp, show whether Brendan can land safely or not.

(iv) Form the family of equations describing BMX jumps whose flight paths have turning points translated $\begin{pmatrix} -a \\ b \end{pmatrix}$ from Brendan's flight path.

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

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Question number

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