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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

For Supervisor's use only

Level 2 CAS Mathematics, 2009

90807 Demonstrate an understanding of calculus methods

Credits: Four
9.30 am Monday 16 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.

Make sure you have the Formulae Sheet L2-MATHF.

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.

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 calculus methods.	Demonstrate an understanding of a range of calculus methods.	Demonstrate an understanding of a range of calculus methods in solving problems.
Overall Level of Performance		

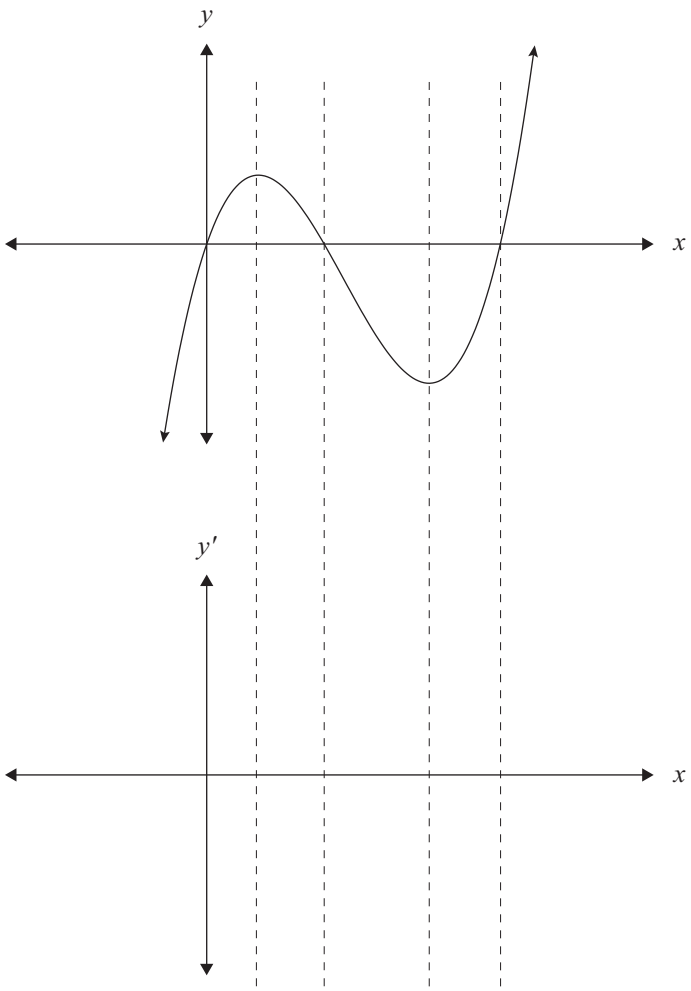
You are advised to spend 55 minutes answering the questions in this booklet.

Assessor's use only

QUESTION 1

(a) The diagram below shows the graph of a function $y = f(x)$.

On the axes provided, clearly sketch the graph of the gradient function $y = f'(x)$.



If you need to redraw this graph, use the grid on page 7.

(b) Another function f is given by $f(x) = x^3 - 6x^2 + 3x - 2$.

Find the gradient of f at the point where $x = 2$.

(c) The entrance to the Italian Gardens in Hamilton has a curved trellis on top of two vertical side-sections of equal height.

The curved section can be modelled by the parabola

$$y = 3x - \frac{3}{4}x^2$$

where x is the horizontal distance in metres from the left side of the trellis and y is the height in metres of the curved parabolic section of the trellis above the top of the vertical sides.
The maximum height of the entrance from the floor level is 5.4 m.

Use calculus to find the height of the vertical side-sections.
Show the derivative of the function.

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(d) An object is moving in a straight line.
P is a point on the line.
Its acceleration, a m s^{-2} at a time t seconds after it leaves P, is given by:

$$a(t) = 2 - 6t.$$

When $t = 0$, the object is at point P and has a velocity of 4 m s^{-1}.

How far is the object from P when $t = 3$?

QUESTION TWO

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(a) Find $f(x)$ if $f'(x) = 2x - 7$
and $f(x) = 20$ when $x = -2$.

(b) The gradient of a parabola at any point (x,y) on the parabola is given by $3x + 4$.
The point (1,2) lies on the parabola.

Find the equation of the parabola.

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(c) A wall of a building is 5 m long.
The wall has a mural painted on it.
The mural contains a line.
The line can be represented by the function $y = (x - 1)(x - 3)$
where y is the height of the line above the ground
and x is the distance from the left side of the building.
The area below the line is painted green.

Find the area that is painted green.

(d) The cross section of a canal can be modelled by a parabola.
The canal is 80 m wide at ground level and it is 20 m deep at its lowest point.
The canal is 0.8 km long.

Find the volume of water in the canal when it is full to ground level.

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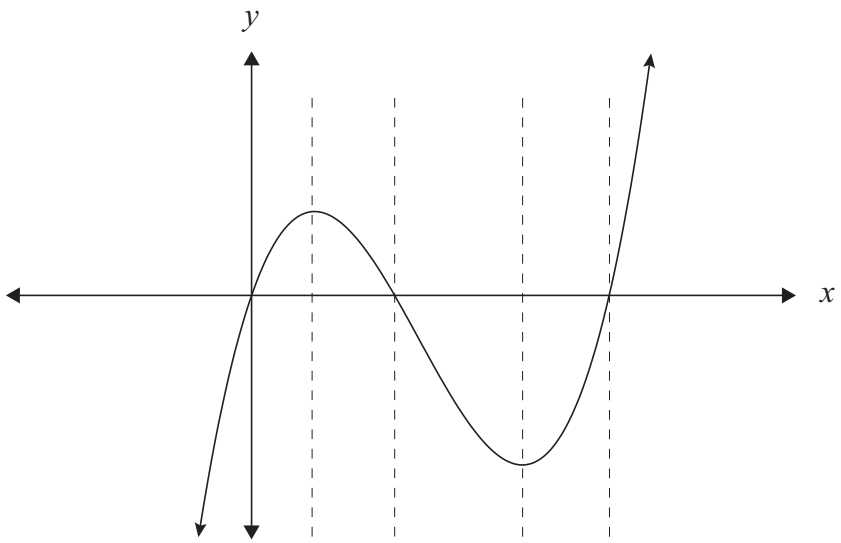
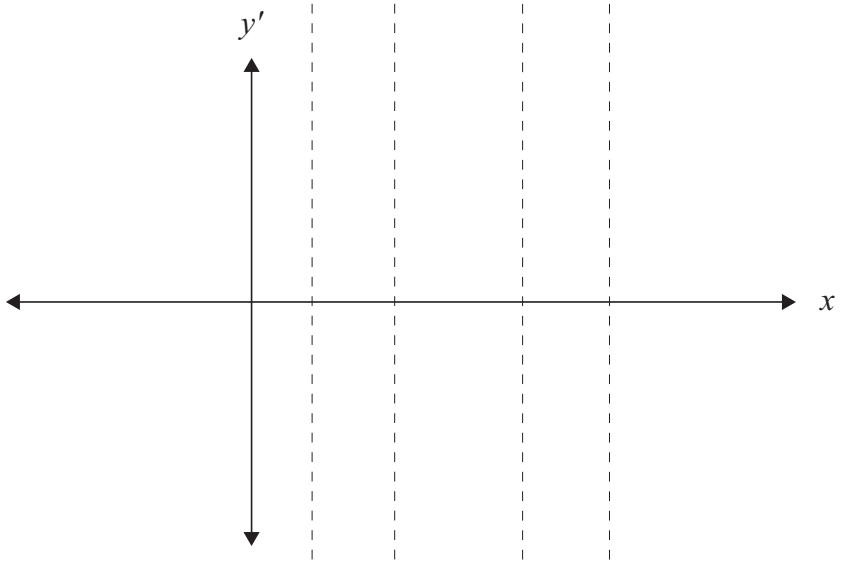
If you need to redraw the graph from page 2, draw it on the grid below and carefully number the question. Make sure it is clear which graph you want marked.





Question _____

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

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Question number

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