For Supervisor's use only

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90286

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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

Level 2 Mathematics, 2004

90286 Find and use straightforward derivatives and integrals

Credits: Four
2.00 pm Tuesday 23 November 2004

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 a copy of Formulae Sheet L2–MATHF.

You should answer ALL the questions in this booklet.

Give any derivatives or integrals that are used when answering the questions.

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 2–8 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.

Achievement Criteria	*For Assessor's use only*	
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Find and use straightforward derivatives and integrals. ☐	Apply calculus techniques to solve problems. ☐	Apply differentiation techniques to solve optimisation problems. ☐
Overall Level of Performance ☐		

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

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Show working.

You **must** give any derivatives or integrals that are used when answering the questions.

QUESTION ONE

(a) Find the gradient of the curve $y = 2x^4 - x + 3$ at the point where $x = 1$.

(b) Find the equation of the function that passes through (2,15) and whose gradient function is

$\frac{dy}{dx} = 8x^3 + 2x - 4$.

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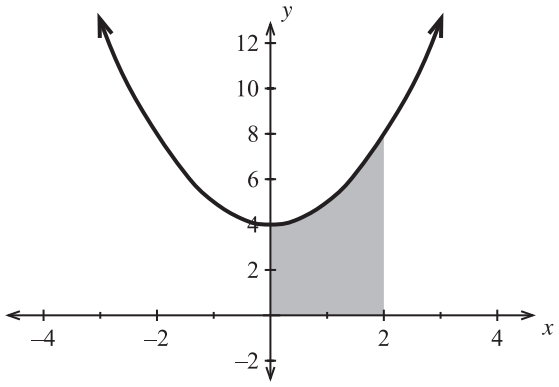
(c) Find the area under the curve $y = x^2 + 4$ for values of x between 0 and 2.
(The area shaded on the diagram.)



(d) Find the coordinates of the point on the curve $y = \frac{4}{x^2}$ where the gradient is 1.

QUESTION TWO

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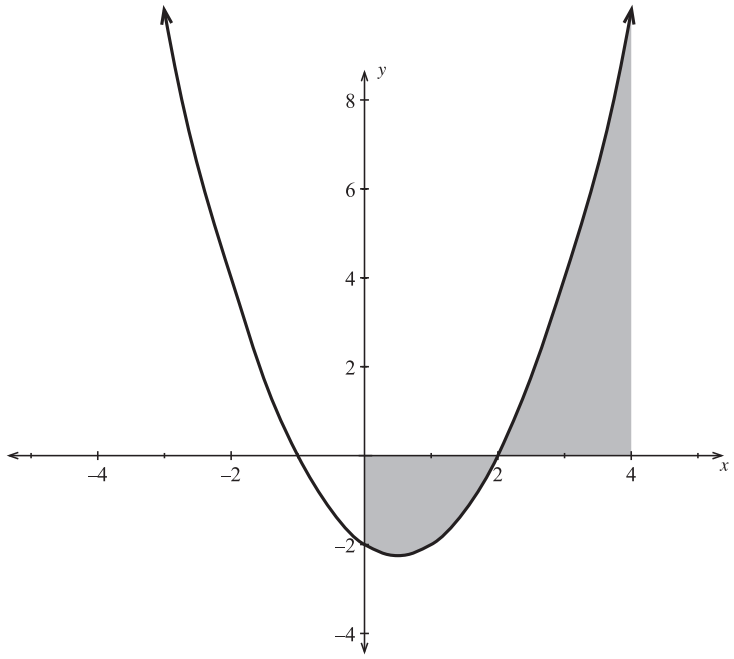
Find the area between the x-axis and the curve $y = (x+1)(x-2)$

$$= x^2 - x - 2$$

for values of x between 0 and 4.



QUESTION THREE

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Meg and her mother are playing with a wind-up toy train.
The velocity v cm/sec of the train is given by

$$v = 60 - 3t^2 \quad \text{for } 0 \le t \le 4$$

where t is the time in seconds after the train starts.

(a) After 10 sec the train is 15 cm from Meg.

How far was the train from Meg at the start?

(b) Use calculus to calculate the maximum velocity of the toy train.

QUESTION FOUR

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A 10 cm^3 block of metal is to be melted and made into a cylinder that has the smallest possible surface area.
Assuming that the volume of metal does not change in the process, find the radius of the cylinder.

(For a cylinder $V = \pi r^2 h$ and $SA = 2\pi r^2 + 2\pi rh$)

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

Assessor's use only

Question number

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

Assessor's use only

Question number