

91578



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

3

SUPERVISOR'S USE ONLY

Level 3 Calculus, 2014

91578 Apply differentiation methods in solving problems

9.30 am Tuesday 18 November 2014

Credits: Six

Achievement	Achievement with Merit	Achievement with Excellence
Apply differentiation methods in solving problems.	Apply differentiation methods, using relational thinking, in solving problems.	Apply differentiation methods, using extended abstract thinking, in solving problems.

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 attempt ALL the questions in this booklet.

Show ALL working.

Make sure that you have the Formulae and Tables Booklet L3-CALCF.

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 2–12 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.

TOTAL

ASSESSOR'S USE ONLY

QUESTION ONE

- (a) Differentiate $y = 5\cos(3x)$.

- (b) Find the gradient of the normal to the function $y = (3x^2 - 5x)^2$ at the point (1,4).

Show any derivatives that you need to find when solving this problem.

- (c) If $x = 2\sin t$ and $y = \cos 2t$ show that $\frac{dy}{dx} = -2\sin t$.

QUESTION TWO

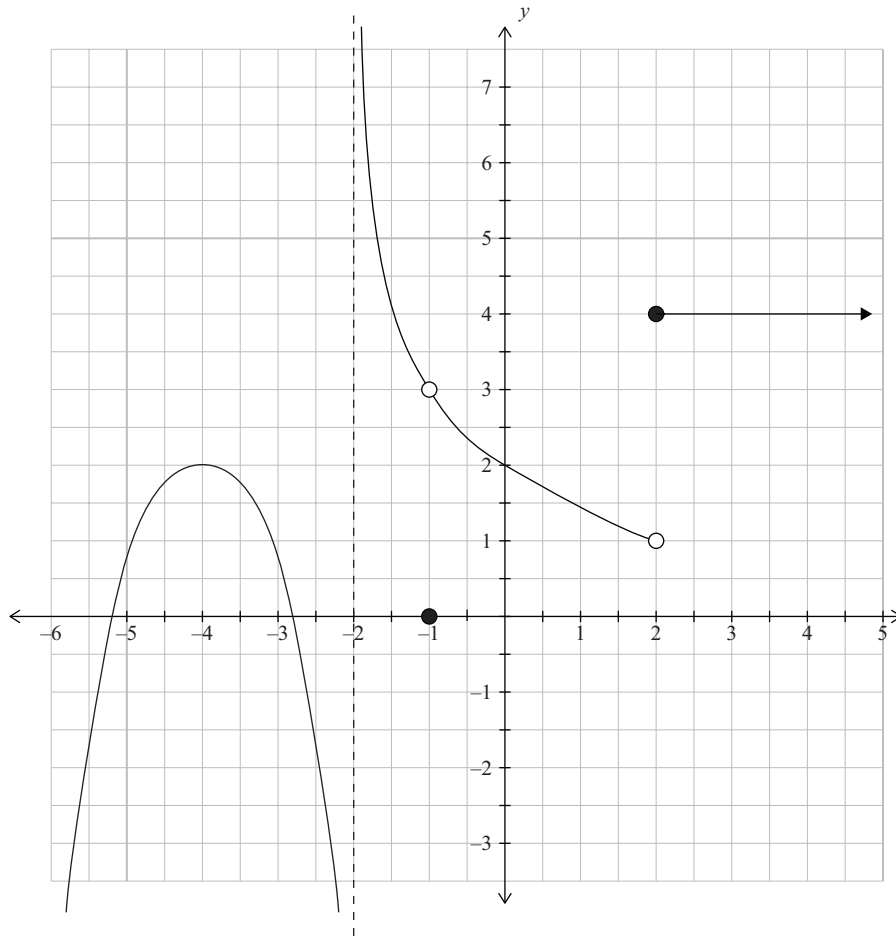
(a) Differentiate $f(x) = \frac{e^{4x}}{2x-1}$.

You do not need to simplify your answer.

(b) Find the gradient of the curve defined by $y = 8 \ln(3x - 2)$ at the point where $x = 2$.

Show any derivatives that you need to find when solving this problem.

(c) The graph below shows the function $y = f(x)$.



For the function $f(x)$ above:

(i) Find the value(s) for x that meet the following conditions:

1. $f(x)$ is not differentiable: _____
2. $f''(x) < 0$: _____
3. $f(x)$ is not defined: _____

(ii) What is the value of $f(2)$? _____
State clearly if the value does not exist.

(iii) What is the value of $\lim_{x \rightarrow -1} f(x)$? _____
State clearly if the value does not exist.

QUESTION THREE

(a) Differentiate $y = \left(\sqrt[3]{x^2 + 4x}\right)^2$.

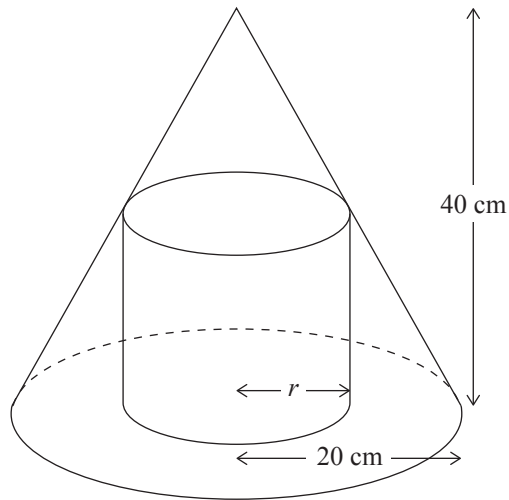
(b) Find the value(s) of x for which the graph of the function $y = x + \frac{32}{x^2}$ has stationary points.

Show any derivatives that you need to find when solving this problem.

(c) For what values of x is the function $f(x) = 5x - x \ln x$ increasing?

Show any derivatives that you need to find when solving this problem.

- (e) A cone has a radius of 20 cm and a height of 40 cm.
A cylinder fits inside the cone, as shown below.



What must the radius of the cylinder be to give the cylinder the maximum volume?

You do not need to prove that the volume you have found is a maximum.

Show any derivatives that you need to find when solving this problem.
