

See back cover for an English translation of this cover

3

91578M



915785



NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

SUPERVISOR'S USE ONLY

## Tuanaki, Kaupae 3, 2014

### 91578M Te whakahāngai i ngā tikanga pāronaki hei whakaoti rapanga

9.30 i te ata Rātū 18 Whiringa-ā-rangi 2014  
Whiwhinga: Ono

Paetae	Kaiaka	Kairangi
Te whakahāngai i ngā tikanga pāronaki hei whakaoti rapanga.	Te whakahāngai i ngā tikanga pāronaki mā te whakaaro whaipānga hei whakaoti rapanga.	Te whakahāngai i ngā tikanga pāronaki mā te whakaaro waitara hōhonu hei whakaoti rapanga.

Tirohia mehemea e ōrite ana te Tau Ākonga ā-Motu (NSN) kei tō pepa whakauru ki te tau kei runga ake nei.

**Whakautua e koe ngā pātai KATOA kei roto i te pukapuka nei.**

Whakaaturia ngā mahinga KATOA.

Me mātua riro mai i a koe te pukaiti o ngā Tikanga Tātai me ngā Papatau L3-CALCMF.

Ki te hiahia koe ki ētahi atu wāhi hei tuhituhi whakautu, whakamahia te (ngā) whārangi kei muri i te pukapuka nei, ka āta tohu ai i ngā tau pātai.

Tirohia mehemea kei roto nei ngā whārangi 2–23 e raupapa tika ana, ā, kāore hoki he whārangi wātea.

**HOATU TE PUKAPUKA NEI KI TE KAIWHAKAHAERE HEI TE MUTUNGA O TE WHAKAMĀTAUTAU.**

TAPEKE

MĀ TE KAIMĀKA ANAKE

**PĀTAI TUATAHI**

- (a) Whiriwhiria te pārōnaki o  $y = 5\cos(3x)$ .

---

---

- (b) Kimihia te rōnaki o te rārangi hāngai ki te pānga  $y = (3x^2 - 5x)^2$  i te pūwāhi (1,4).

*Whakaaturia ngā pārōnaki māmā e hiahiatia ana hei whakaoti i tēnei rapanga.*

---

---

---

---

---

---

---

---

---

---

- (c) Mēnā ko  $x = 2\sin t$ , ā, ko  $y = \cos 2t$ , whakaaturia ko  $\frac{dy}{dx} = -2\sin t$ .

---

---

---

---

---

---

---

---

---

---

**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  $\frac{dy}{dx} = -2\sin t$ .

---

---

---

---

---

---

---

---

---

---

- (d) Kimihia te uara- $x$  ko te pātapa ki te pānga  $y = \frac{4}{e^{2x-2}} + 8x$  he whakarara ki te tuaka- $x$ .

*Whakaaturia ngā pārōnaki māmā e hiahiatia ana hei whakaoti i tēnei rapanga.*

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

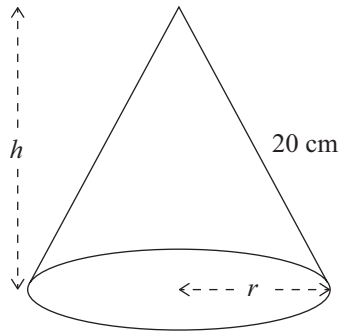
---

---

---



- (e) He aha te rōrahi mōrahi o tētahi koeko mēnā ko te roa tītaha o te koeko he 20 cm?



Kāore he tikanga kia parahautia e koe he mōrahi te rōrahi i tātaihia.

*Whakaaturia ngā pāwhiri mā mā e hiahia ana hei whakaoti i tēnei rapanga.*

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---



**PĀTAI TUARUA**

- (a) Whiriwhirihia te pāronaki o  $f(x) = \frac{e^{4x}}{2x-1}$

*Hei aha noa te whakarūnā i tō whakautu.*

---

---

---

---

---

---

---

---

---

---

- (b) Kimihia te rōnaki o te kōpiko  $y = 8 \ln(3x - 2)$  i te pūwāhi ko  $x = 2$ .

*Whakaaturia ngā pāronaki māmā e hiahiatia ana hei whakaoti i tēnei rapanga.*

---

---

---

---

---

---

---

---



**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.*

---

---

---

---

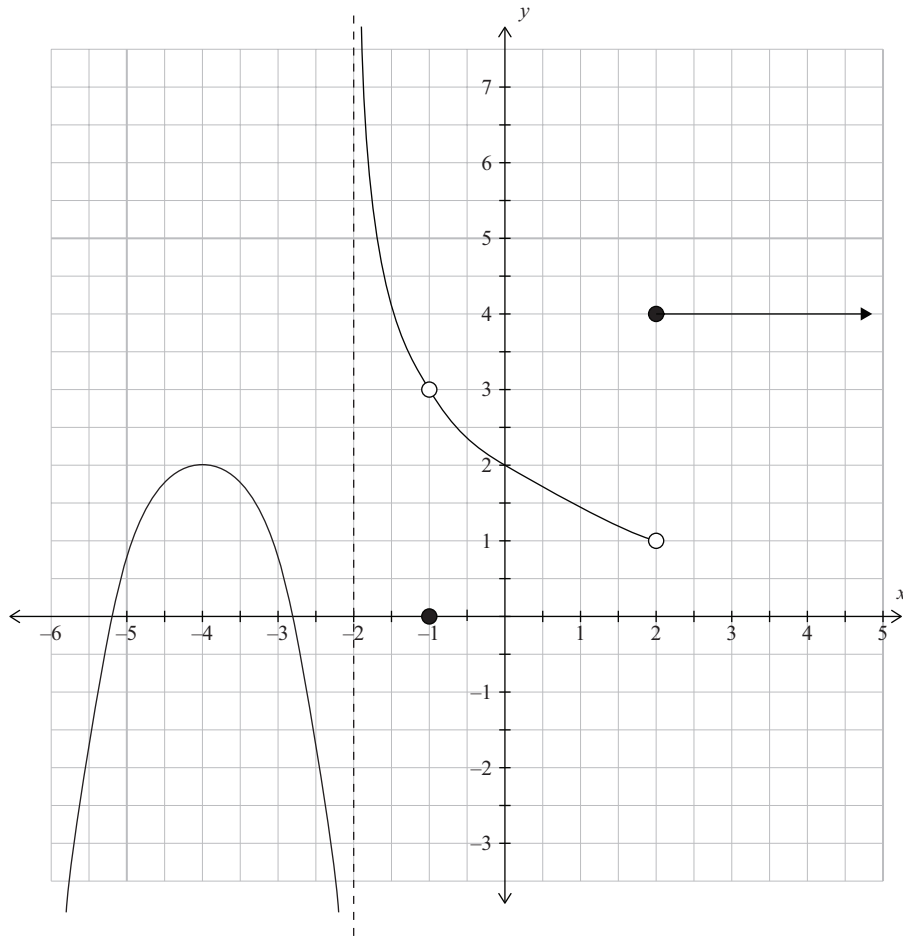
---

---

---

---

(c) E tohu ana te kauwhata i raro nei i te pānga  $y = f(x)$ .



Mō te pānga  $f(x)$  i runga ake:

(i) Kimihia te (ngā) uara mō  $x$  e ū ki ēnei whakaritenga e whai ake:

1. kāore e taea te kimi pāronaki mō  $f(x)$ : \_\_\_\_\_
2.  $f''(x) < 0$ : \_\_\_\_\_
3. kāore i te tautohua a  $f(x)$ : \_\_\_\_\_

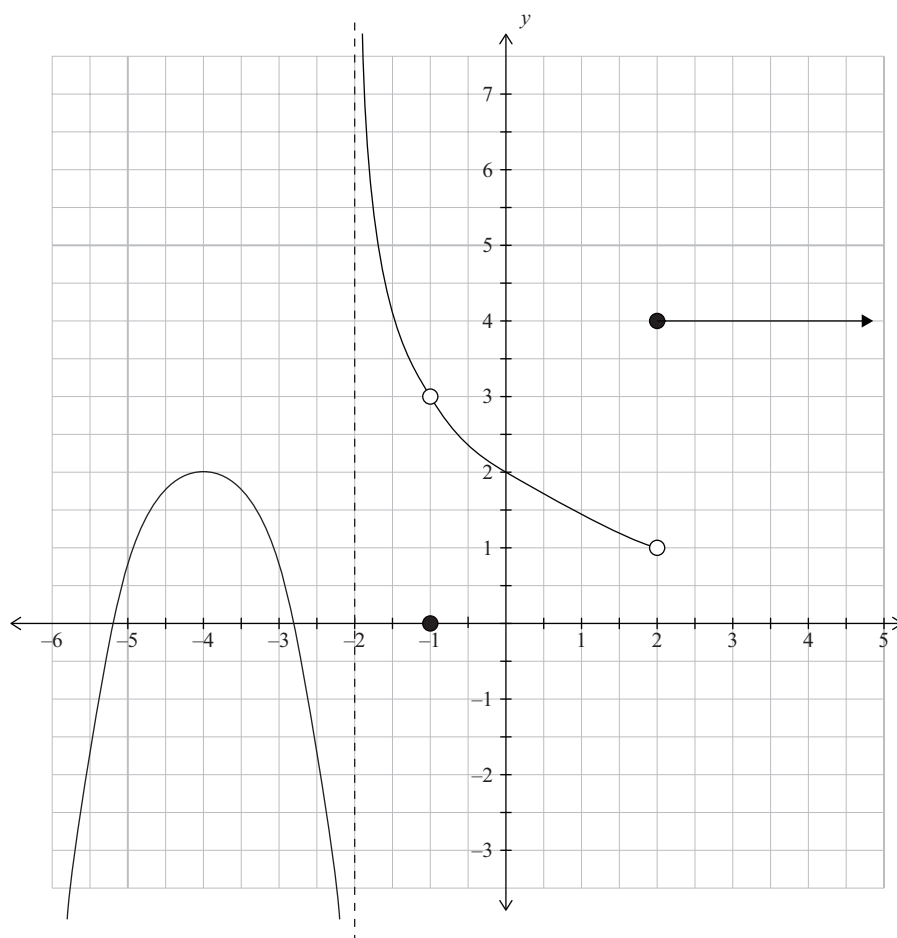
(ii) He aha te uara o  $f(2)$ ? \_\_\_\_\_

*Āta kōrero mai mēnā kāore rawa he uara.*

(iii) He aha te uara o  $\lim_{x \rightarrow -1} f(x)$ ? \_\_\_\_\_

*Āta kōrero mai mēnā kāore rawa he uara.*

(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.*

- (d) Mā te rere o te waka rererangi ka mohio ai he aha te utu mo te hāora kotahi.  
Ka pēnei kē te wharite mo te waha rerangi

$$C = 4v + \frac{1\,000\,000}{v}, \quad 200 \leq v \leq 800$$

ina ko  $C$  te utu ā-hāora o te whakahaere i te waka rererangi, ā-tāra i te hāora  
ko  $v$  te tere 0 te hau o te waka rererangi, ā-kiromita i te hāora

Kimihia te utu ā-hāora mōkito e taea ai te whakarere i tēnei waka rererangi.

*Whakaaturia ngā pāronaki māmā e hiahiatia ana hei whakaoti i tēnei rapanga.*

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---







## PĀTAI TUATORU

- (a) Whiriwhirihia te pāronaki o  $y = \left(\sqrt[3]{x^2 + 4x}\right)^2$ .

---



---



---

- (b) Kimihia te (ngā) uara o  $x$ , he pūwāhi tūnoa tō te kauwhata o te pānga  $y = x + \frac{32}{x^2}$ .

*Whakaaturia ngā pāronaki māmā e hiahiatia ana hei whakaoti i tēnei rapanga.*

---



---



---



---



---



---

- (c) Mō ēhea uara o  $x$  e piki ai te pānga  $f(x) = 5x - x \ln x$ ?

*Whakaaturia ngā pāronaki māmā e hiahiatia ana hei whakaoti i tēnei rapanga.*

---



---



---



---



---



---



---



---



## 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.*

---

---

---

---

---

---

---

---

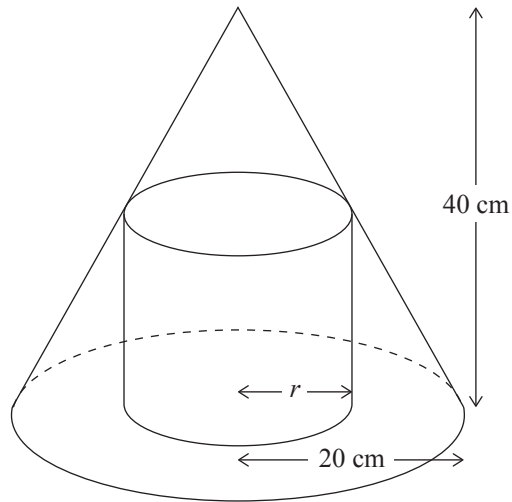
---

---





- (e) He 20 cm te pūtoru o te koeko, ā, he 40 cm te teitei.  
Ka uru tētahi rango ki te koeko, e ai ki te whakaaturanga i raro.



He aha te pūtoru o te rango kia whiwhi ai te rango i te rōrahi mōrahi?

Kāore he tikanga kia hāponotia e koe he mōrahi te rōrahi i tātaihia.

*Whakaaturia ngā pāpānaki māmā e hiahiatia ana hei whakaoti i tēnei rapanga.*

---



---



---



---



---



---



---



---



---



---



---



---



---



---



---



---



---



---



---



---



---



---







*English translation of the wording on the front cover*

## 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.

91578M

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–CALCMF.

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 2–23 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.**