

90638



NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

*For Supervisor's use only*

## Level 3 Calculus, 2009

### 90638 Manipulate real and complex numbers, and solve equations

Credits: Five  
2.00 pm Thursday 26 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 a copy of the Formulae and Tables Booklet L3–CALCF.**

You should answer ALL the questions in this booklet.

Show ALL working for ALL questions.

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.**

<i>For Assessor's use only</i>	<b>Achievement Criteria</b>	
<b>Achievement</b>	<b>Achievement with Merit</b>	<b>Achievement with Excellence</b>
Manipulate real and complex numbers, and solve equations. <input style="float: right;" type="checkbox"/>	Solve more complicated equations. <input style="float: right;" type="checkbox"/>	Solve problem(s) involving real or complex numbers. <input style="float: right;" type="checkbox"/>
<b>Overall Level of Performance</b>		<input style="width: 40px; height: 20px;" type="text"/>

You are advised to spend 40 minutes answering the questions in this booklet.

**QUESTION ONE**

(a) Solve  $z^2 - 8z + 28 = 0$ .

Express your solutions in their simplest form of  $z = a \pm b\sqrt{c}i$ , where  $a, b, c$  are rational numbers.

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(b) Solve for  $x$ :

$$\log_5(8x) - \log_5(3) = \log_5(x + 10)$$

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(c) Write  $\left(4 \operatorname{cis} \frac{\pi}{6}\right)^5$  as a complex number in the form  $a + bi$ .

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**QUESTION TWO**

- (a) Write  $(4 + \sqrt{k})(9 - 2\sqrt{k})$  in the form  $a + bk + c\sqrt{k}$ , where  $a$ ,  $b$  and  $c$  are rational numbers.

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- (b)  $u$  and  $v$  are complex numbers where  $u = 3B\text{cis}\frac{\pi}{3}$  and  $v = B\text{cis}\frac{3\pi}{4}$ .

Find  $u \div v$ , expressing your answer in polar form  $r\text{cis}\theta$ .

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- (c) Solve the following equation for  $x$ .

$$\log_4(5 - 2x) = 3$$

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- (d) Solve the following equation for  $x$  in terms of  $p$ .

$$\sqrt{x+p} = \sqrt{x} + 3$$

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- (e) Solve the following equation for  $x$  in terms of  $k$ .

$$\sqrt{\frac{x}{1-x}} + \sqrt{\frac{1-x}{x}} = \frac{k}{6}$$

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