3

SUPERVISOR'S USE ONLY

91577



Level 3 Calculus, 2019

91577 Apply the algebra of complex numbers in solving problems

9.30 a.m. Tuesday 26 November 2019 Credits: Five

Achievement		Achievement with Merit	Achievement with Excellence
	Apply the algebra of complex numbers in solving problems.	Apply the algebra of complex numbers, using relational thinking, in solving problems.	Apply the algebra of complex numbers, 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	
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QUESTION ONE

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(a) Solve the equation $x^2 - 4x + 7 = 0$.

Give your solution in the form $a \pm \sqrt{b}i$, where a and b are rational numbers.

(b) When the polynomial $2x^3 - x^2 - 4x + p$ is divided by x - 3, the remainder is 38.

Find the value of p.

(c) Complex numbers u and v are u = q + 2i and v = 1 - 2i.

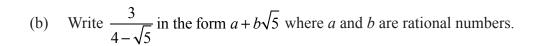
Given that $\left| \frac{u}{v} \right| = 13$, find all possible values of q.

l)	One solution of the equation $2z^3 - 5z^2 + cz - 5 = 0$ is $z = 1 - 2i$.					
	If c is real, find the value of c and the other two solutions of the equation.					

Find the values of	x and y, given the	at x and y are rea	$\frac{1}{x+iy}$	1+i -1-21.	

QUESTION TWO

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(c)	Solve the equation $z^4 + 16$	$6p^2i = 0$, where	p is real.

Write your solution in polar form, in terms of p.

Find all possible values of <i>m</i> that make $z = \frac{\sqrt{3 + mi}}{1 + \sqrt{3}i}$ a purely real number.

$f z = 1$, and $z \ne 1$, prove the		

QUESTION THREE

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(a) If $u = q^2 \operatorname{cis} \frac{3\pi}{4}$ and $v = q^3 \operatorname{cis} \frac{\pi}{3}$, write $\frac{u}{v}$ in the form $r \operatorname{cis} \theta$.

)	If x and y are real numbers and $(x + iy)(2 + i) = 3 - i$, find the values of x and y.					

(c) Solve the following equation for x in terms of w.

$$2\sqrt{x-3} - w\sqrt{x} = 0$$

(d)	Two complex numbers are defined by $u = 1 + pi$ and $v = 5 + 3i$.			
	Given that $\arg\left(\frac{u}{v}\right) = \frac{\pi}{4}$, find the value of p .			

Question Three continues on the following page.

For all real values of k .		

		Extra paper if required.	
IJESTION		Write the question number(s) if applicable.	
QUESTION NUMBER			

QUESTION NUMBER	Extra paper if required. Write the question number(s) if applicable.	