No part of the candidate evidence in this exemplar material may be presented in an external assessment for the purpose of gaining credits towards an NCEA qualification.

91261





## Level 2 Mathematics and Statistics, 2015 91261 Apply algebraic methods in solving problems

KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

2.00 p.m. Tuesday 10 November 2015 Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Apply algebraic methods in solving problems.	Apply algebraic methods, using relational thinking, in solving problems.	Apply algebraic 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.

Make sure that you have Resource Sheet L2-MATHF.

Show ALL working.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

You are required to show algebraic working in this paper. Guess-and-check methods and correct answer(s) only will generally limit grades to Achievement.

Check that this booklet has pages 2–11 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.

Excellence

**23** 

## **Annotated Exemplar Template**

Excellence exemplar for 91261 2015		Total score	23	
Q	Grade score	Annotation		
1	This is E7 because candidate successfully made x the subject in 1b, they failed to gain E8 because 1aiii justification was insufficient and answer to 1cii was not in the context of the question.			
2	Candidate gained E8 because all three answers which contributed t evidence were fully correct.			vidence
3	Solution to 3d omitted the constraint 0 < m < 2 for positive real roots but identification of constraint m>2 and both roots determined was sufficient abstract thinking for t to be awarded.			

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USE	: 0	NL.	Y

(a) (i) Find the value of  $\log_2 1024$ .

2 ~=	102	4
 γ =	10	_[/

(ii) Solve the equation  $\log_4(3w+1) = 2$ .

	Solve the equation $\log_4(3n+1)$
	$4^{2} = 3wt$
	16=3n+1
11	w= {

(iii) Luka says that the equation  $\log_x(4x+12)=2$  has only one solution.

Is he correct?

Find the solution(s), justifying your answer.

Find the solution(s), planty mass 
$$4x+12$$

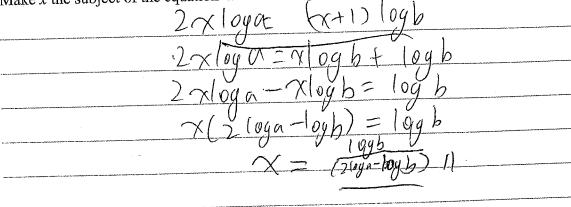
$$x^{2}-4x-12=0$$

$$x=-2 \quad \text{or} \quad x=b$$

$$x \quad (annot \quad be-2 \quad \text{because}$$

$$it \quad makes \quad the \quad equation$$

(b) Make x the subject of the equation  $a^{2x} = b^{x+1}$ .



i)	Assuming the exponential growth is of the form $y = A r^t$ , what was the value of the
	house at the start of 1999 when she bought it? $350000 = 4 \times (1.03)$
	$350000 = 14 \times (1.03)$ $350000 = 14 \times 1.03$
	A=\$218108,43/
ii)	A friend also bought a house at the start of 1999 that cost \$200 000.
	Its market value also has been steadily increasing, but at a slightly higher exponential rate of 3.5%.
	Its value, \$y, t years after the start of 1999, is given by the function
	$y = 200000 \times (1.035)^t$
	If the houses continue to keep increasing in value at the original rates, in which year will the two houses be worth the same amount?
	will the two houses be worth the same amount? $t = 218108.43 \times (1.03)^{t}$
	$\frac{(1.035)^{t}}{(1.03)^{t}} = \frac{218108.43}{200000}$
	(1,03)t - 20000
	$(\frac{1.035}{1.03})^{t} = 1.09 (12dp)$
	t (04 ( 1.035) 2(04), 09
	$f = \frac{1091.09}{1005}$
	f = 17.
	17 0 (10.66)
	10 11, 8 Gents.11

## **QUESTION TWO**

ASSESSOR'S USE ONLY

(a) Simplify  $\frac{2x^2 + 7x - 4}{2x^2 - 32}$   $= \frac{(2 \times -1)(\times 4)}{2(\times -4)(\times 4)}$ 

27-9-1/

(c) Solve the equation  $2u^{\frac{2}{3}} + 7u^{\frac{1}{3}} = 4$   $1 + 4 \times 6u \times \frac{1}{3}$   $2 \times 2 + 7 \times 2 + 4$   $2 \times 2 + 7 \times -4 = 0$   $1 \times 3 = 0.5 \times 6 \times 1 = -4$   $1 \times 3 = 0.125 \times 6 \times 1 = -64$   $1 \times 3 = 0.125 \times 6 \times 1 = -64$ 

(d)	Talia used timber to form the exterior sides of her rectangular garden. The length	of the
	garden is $x$ metres, and its area is 50 m <sup>2</sup> .	

(i) Show that the perimeter of the garden is given by  $2x + \frac{100}{x}$ 

show that t	he perimeter of	t the ga	arden is	given by	2x + -
	7/ 1/1	1	•	50	
	The widt	$\wedge$	15	文	
		- ( (	501		
	P=2(	$\chi +$	つ)		
	( - )		100		
	4 1 2	$\sim$ $\perp$	3	_	

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(ii) If she uses 33 m of timber to build the sides, find the dimensions of the garden.

If Sho deep 33 in or innoce to deare the bides, and the dimensions of the Burney	
$2 \times \frac{100}{2} = 33$	
$2 \times 7^{2} + (00 = 33)$	
2x2-33x+100=0	
x=12.5 or $x=4$	~~~~~~~
33-125=4 (ignore)	<i>(</i>
the garden is 4m x 12.5m	

t

(e)	David and Sione a	re competing in a	cycle race	of 150 km
-----	-------------------	-------------------	------------	-----------

Sione cycles on average 4 km per hour faster than David, and finishes half an hour earlier than David.

Find David's average speed.

You MUST use algebra to solve this problem. (Hint: average speed =  $\frac{distance}{time}$ )

siones time: 427 Sione took 37,5 hours:/ This means

Let David's time he x

Sione's time is x+4

f(xf4) = 150

8(t+0,5) x = 150

 $t \propto f 0.5 \propto = t \propto f + t$ 

x= 8t

t (8t+4)=150 8f²+41-150=0

E= 4.09 or t=-4.59

it took sione 4.09 hours. Cignore

150 - 32.68 4.59 - 32.68

David fravelled at an average speed at 32.68 kmhr

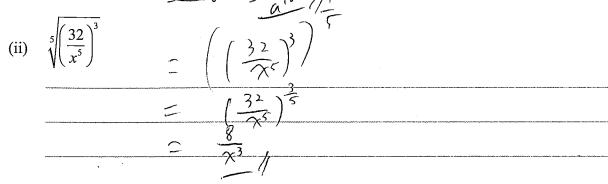
## **QUESTION THREE**

ASSESSOR'S USE ONLY

(a) Simplify, giving your answer with positive exponents:

(i)	$\left(\frac{a^{10}}{4a^5}\right)^{-2}$	4a5)2
		1601

 	420
	1600
 <u></u>	1001
5	= 10 //
	Di Villa

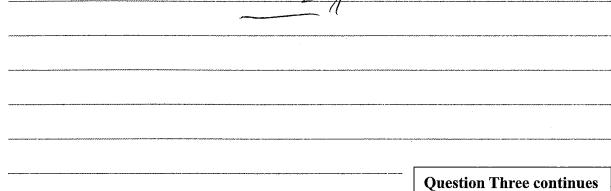


(b) Solve the following equation for t:

$$\frac{\frac{1}{t(t-1)} - \frac{1}{t} = \frac{3}{t-1}}{|-(t-1)| - 3t}$$

$$-4t = -2$$

$$t = \frac{1}{2}$$



Question Three continues on the following page.

ASSESSOR'S USE ONLY

(c)

For what value(s) of $k$ does the graph of the quadratic function
$y = x^2 + (3k - 1)x + (2k + 10)$
never touch the x-axis?
$\Delta = 6 - 4ac$
△ ∠0 because it doesn't touch
the y-axis
$\frac{1}{(3k-1)^2-4(2k+10)} = 0$
$9k^2 - bk + 1 - 8k - 40 < 0$
9K²-14K-39<0
$(\sqrt{-3})(13\sqrt{+9}) \angle 0$
$28 - \frac{13}{9} < K < 311$

(d)	The	quadratic	equation
(4)		quadratic	oquation

$$mx^2 - (m+2)x + 2 = 0$$

has two positive real roots.

Find the possible value(s) of m, and the roots of the equation.

(-m-2)(-m-2)
$(-M-2)^2 - 8m4 > 0$
$m^2 + 4m + 4 - 8m > 0$
$m^2 - 4m + 4 > 0$
$C = 2$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$

m-2 > 0

	$\sqrt{M} > 2\sqrt{\frac{1}{2}}$
routs are	(m+2) + 1 m2-4m44
	X - M+2 + m-2
	2 hotte

 $\frac{(m+2) - \sqrt{m^2 - 4m + 4}}{\chi} = \frac{m+2 - m+2}{2m}$ 

 $x = \frac{2}{\pi}$ 

ASSESSOR'S USE ONLY