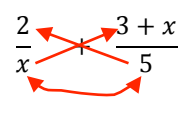


			consistent with incorrectly simplified expressions for A and B as long as both expressions are still quadratics.	
(d)	$2^2 \times 2^x = 2^{6x+3}$ $x + 2 = 6x + 3$ $5x = -1$ $x = -\frac{1}{5}$ <p>OR</p> $2^2 = \frac{2^{6x+3}}{2^x}$ $2^{5x+3} = 2^2$ <p>OR</p> $2^x = \frac{2^{6x+3}}{2^2}$ $2^{6x+1} = 2^x$	Equation established with base 2.	Linear equation formed.	Equation solved from correct algebraic evidence.

TWO	Evidence	Achievement (u)	Merit (r)	Excellence (t)
(a)	45	y calculated. No alternative.		
(b)	$x^2 - 4 > x^2 + x - 6$ $-4 > x - 6$ $x < 2$ (or $2 > x$) <i>Accept with working as an equality and provided inequality inserted at the end.</i>	One correct expansion.	Both expansions correct and simplified. OR Solved as an equality. OR Consistent solving with 1 incorrect expansion.	Correct solution. Accept $-x > -2$ and ignore further incorrect working.
(c)	$2^{n+1} > \frac{123}{6}$ or $2^{n+1} > 20.5$ $2^4 = 16 < 20.5$ $2^5 = 32$ $n + 1 \geq 5$ or $n > 3$ or $n \geq 4$ Or $n = 4, 5, 6, \dots$ OR $2 \times 2^{n+1} > \frac{123}{3}$ $2^{n+2} > 41$ etc	Inequality simplified. OR Correct trialling of at least one number (as the powers of 2 are well known). OR Inequality simplified. OR CAO.	Consistent solution from incorrect working OR Correct simplification leading to $n = 4$ or $n > 4$ OR Correct simplification and ignoring the +1 in finding the solution.	Correct simplification leading to correct inequation
(d)	$(x + 4)(x - 2) = 0$ $x = -4$ or $x = 2$	Factorised correctly (<i>evidence can come from 2 (e)</i>). OR Correct answers only. OR Consistently solved from $(x - 4)(x + 2) = 0$	Solved correctly.	

<p>(e)</p>	<p>Either</p> $\frac{(x+4)(x-2)}{(x+2)(x-2)} = \frac{x}{2}$ $\frac{(x+4)}{(x+2)} = \frac{x}{2}$ $2x + 8 = x^2 + 2x$ $x^2 = 8$ $x = \pm\sqrt{8} \text{ } (\pm \text{ not required})$ <p>or $x = \pm 2\sqrt{2}$</p> <p>OR</p> $2x^2 + 4x - 16 = x^3 - 4x$ $x^3 - 2x^2 - 8x + 16 = 0$ <p>which cannot be solved at NCEA Level 1. <i>(This method gains highest grade r)</i></p>	<p>Correctly expanded.</p>	<p>Expression simplified. ($x \neq -2$ not required) to second line of evidence</p> <p>OR</p> <p>Simplified and = 0.</p>	<p>$x^2 = 8$ or $x = \pm\sqrt{8}$ or $x = \pm 2\sqrt{2}$ (\pm not required)</p>
<p>(f)(i)</p>	<p>The horizontal distance from the point where the ball was kicked.</p>	<p>Defines x in context.</p>		
<p>(f)(ii)</p>	$3 = -x^2 + 4x$ $x^2 - 4x + 3 = 0$ $(x-3)(x-1) = 0$ <p>Ball is 3 metres above the ground when $x = 3$ or 1</p> <p>Therefore 3 m or more above the ground for 2 m.</p> <p>Intercepts are 0 and 4</p> <p>Total horizontal distance = 4 m</p> <p>Percentage of horizontal distance above 3 m is 50%.</p> <p>May be given as a fraction or decimal.</p>	<p>Equates relationship to 3.</p>	<p>Solves equation.</p>	<p>Percentage calculated showing some working. Accept equivalent solution.</p>

THREE	Evidence	Achievement (u)	Merit (r)	Excellence (t)
(a)(i)	$A = (x + 6)(x - 2)$ (So the sides are $x - 2$ and $x + 6$) – not required.	Factorised. Ignore any solving.		
(ii)	$x^2 + 4x - 12 = 128$ $x^2 + 4x - 140 = 0$ $(x + 14)(x - 10) = 0$ $x = -14, 10$ $x = 10$ CAO gains u	Equation rearranged to equal 0. OR $x^2 + 4x = 140$	Factorised and solved giving two correct solutions.	One positive solution only. This may come directly from factorised form without showing negative solution.
(b)	$\frac{T}{2\pi} = \sqrt{\frac{L}{9.8}}$ $L = 9.8 \left(\frac{T}{2\pi}\right)^2$	Progress in rearrangement.	One error in the rearranged formula. Square root must be rearranged to give squared.	Correct rearrangement.
(c)	LHS = $\frac{2 \times 5 + x(3 + x)}{5x}$ OR 	Writing over a common denominator, showing some evidence of algebraic working, or lines.		
In part (d) of this question, three grades are to be allocated. Up to 2t grades may be awarded across part (d) of this question for providing: <ol style="list-style-type: none"> full explanation of the changing of the terminal numbers when the order of the starting numbers are changed. full explanation of the terminal number being divisible by 3 when 4 consecutive numbers are used to form the triangle. The rearranged triangles may occur on the original triangle.				
(d)(i)	Numbers rearranged using 1, 3, 5, 7	Two rearranged triangles set up correctly. OR One rearrangement and correct statement of comparison consistent with their triangles.	At least two different triangles set up resulting in two different terminal numbers and they make a statement as to whether they are the same or different.	

Guidelines for marking the MCAT 2016

The title of the standard requires the candidate to use algebraic procedures in solving problems, therefore the questions require the students to choose their processes. The majority of questions require algebraic manipulation using a combination of skills required by the standard; e.g. to solve a simple equation in itself is not sufficient to demonstrate the level of algebraic thinking necessary for higher levels of performance.

Explanatory note two in the standard requires the candidates to select an appropriate procedure from those listed in explanatory note four and these will be at approximately level six of the curriculum. This requirement is consistent with the spirit of the New Zealand Curriculum.

Guess and check is a basic substitution method of solving a problem and is at a lower curriculum level. It does not show that the solution is unique in some questions. If the candidate requires **one** u grade to achieve the standard the assessor may award one grade of **us** anywhere in the paper where they have shown evidence of the correct use of guess and check to solve the problem.

As an alternative, a correct answer only may be awarded a **us** grade once in the paper. You may only use this bonus grade for either a guess and check response or a correct answer once in the paper. This should be coded as “**us**”.

Implications

In order to be awarded achievement or higher in this standard, the candidate must demonstrate the selection and correct use of an appropriate procedure which would lead them towards the correct solution. This may involve a consistent application of an appropriate procedure applied to an incorrect algebraic expression on the condition that the expression does not significantly simplify the application. This means that the candidate may give an appropriate and consistent response to an incorrect algebraic expression.

Grading in general

1. In grading a candidate's work, the focus is on evidence required within the achievement standard.
2. Where there is evidence of correct algebraic processing and the answer is then changed by a numerical error anywhere in the question, the candidate should not be penalised in **most** questions. If it cannot be determined if it is a numerical or an algebraic error, the grade should not be awarded. e.g. factorising of a quadratic expression. Where the solution is inappropriate to the given context, the student's grade will drop down one.
3. Units are not required anywhere in the paper.
4. The grade for evidence towards the awarding of **achievement** is coded as “**u**” or “**us**”,
For **merit**, the demonstrating of relational thinking is coded as “**r**”,
and for **excellence**, the demonstrating of abstract thinking is coded as “**t**”.

Grading parts of questions

1. Check each part of the question and grade as **n**, **u** (**or us**), **r**, **t**.
2. When the highest level of performance for a part of a question is demonstrated in the candidate's work, a code is recorded against that evidence. Only the highest grade is recorded for each part of a question.

Question grade

Each question gains the overall grade indicated below:

No u or us gains N	1 u or us gains 1A 2 u or more gains 2A	1 r gains 1M 2 r or more gains 2M	1 t gains 1E 2 t or more gains 2E
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Sufficiency across the paper

1. For a Not Achieved grade (N)

2A or lower.

2. For the award of an Achievement grade (A)

3A or higher from either:

- 1A or higher in each question
- 1A in one question and 2A in another
- 1A and 1M or 1A and 1E when the candidate has a u grade in the question with the r or t

3. For the award of a Merit grade (M)

3M or higher from either:

- 1 M in each question
- 2E and 1A
- 1E, 1M and 1A

4. For the award of an Excellence grade (E)

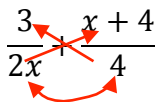
3E or higher from 2 or more questions.

Results and Verification Report

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Verifying

1. A reminder that candidates' work submitted for verification should not be scripts where assessors have allocated final grades by professional judgement or on a holistic basis or scripts that have been discussed on the help line. The purpose of verification is to check the school's ability to correctly apply the schedule.
2. Holistic decision. If a candidate's work provides significant evidence towards the award of a higher grade across the paper and the assessor believes it would be appropriate to award such a grade, the assessor should review the entire script and determine if it is a minor error or omission that is preventing the award of the higher grade. The question then needs to be asked "Is this minor error preventing demonstration of the requirements of the standard?". The final grade should then be determined in the basis of the response to this question.

(c)	$\text{LHS} = \frac{3 \times 4 + 2x(x+4)}{4 \times 2x}$ <p>OR</p> 	<p>Writing over a common denominator, showing some evidence of algebraic working, or lines.</p>		
(d)	$9 \times 3^x = 3^{5x+4}$ $3^{x+2} = 3^{5x+4}$ $x+2 = 5x+4$ $4x = -2$ $x = -\frac{1}{2}$ <p>OR</p> $3^2 = \frac{3^{5x+4}}{3^x}$ $3^{4x+4} = 3^2$ <p>OR</p> $3^x = \frac{3^{5x+4}}{3^2}$ $3^x = 3^{5x+2}$	<p>Equation established with base 3.</p>	<p>Linear equation formed.</p>	<p>Equation solved from correct algebraic evidence.</p>

TWO	Evidence	Achievement (u)	Merit (r)	Excellence (t)
(a)	9	y calculated. No alternative.		
(b)	$x^2 - 9 < x^2 - 2x - 8$ $-9 < -2x - 8$ $-1 < -2x$ $-\frac{1}{2} < -x$ Or $x < \frac{1}{2}$ <i>Accept with working as an equality and provided inequality inserted at the end.</i>	One correct expansion.	Both expansions correct and simplified. OR Solved as an equality. OR Consistent solving with 1 incorrect expansion.	Solved to $-\frac{1}{2} < -x$ or equivalent Ignore further incorrect working.
(c)	$10 \times 2^{p-1} < 165$ $2^{p-1} < 16.5$ $2^4 = 16$ $2^5 = 32$ $p - 1 \leq 4$ $p \leq 5$ or $p < 6$ or $p = 0, 1, 2, 3, 4, 5$ OR $2 \times 2^{p-1} < 33$ $2^p < 33$ $p \leq 5$ or $p < 6$	Inequality simplified. OR Correct trialling of at least one number (as powers of 2 are well known). OR Inequality simplified. OR CAO	Consistent solution from incorrect working OR Correct simplification leading to $p = 5$ or $p < 5$ OR Correct simplification and ignoring the -1 in finding the solution.	Correct simplification leading to correct inequation.
(d)	$M = 5a^2 - 15a + 20 + a^2$ $= 6a^2 - 15a + 20$ $N = 6a^2 - 10a - 12a + 20 + 7a$ $= 6a^2 - 15a + 20$ $M = N$	M or N correctly expanded	M and N correctly expanded and simplified M in terms of N consistent with incorrectly simplified expressions for M and N as long as both expressions are still quadratics.	Correct expression for M in terms of N.

THREE	Evidence	Achievement (u)	Merit (r)	Excellence (t)
(a)(i)	$n - 5$ accept $(n + 1)(n - 5)$ even if they continue to solve for $= 0$	Correct factor.		
(ii)	<ul style="list-style-type: none"> $n > 5$ area cannot be negative (or 0) or the length of side(s) must be positive <i>ignore the missing 0</i> 	Either bullet.	Both bullets.	
(b)	$\frac{4A}{3\pi} = r^2$ $r = \sqrt{\frac{4A}{3\pi}}$ ± not required in front of square root Accept $\sqrt{\left(\frac{A}{0.75\pi}\right)}$ or $\sqrt{\left(\frac{A}{3\pi/4}\right)}$	Progress in rearrangement.	One error in the rearranged formula. Square must be rearranged to give square root.	Correct rearrangement.
(c)	$(x - 5)(x + 2) = 0$ $x = 5$ or -2	Factorised (<i>evidence can come from 2 (d)</i>). OR Correct answers only. OR Consistently solved from $(x + 5)(x - 2) = 0$	Solved correctly.	
(d)	$\frac{(x - 5)(x + 2)}{(x + 5)(x - 5)} = \frac{x}{2}$ $\frac{(x + 2)}{(x + 5)} = \frac{x}{2}$ $2x + 4 = x^2 + 5x$ $x^2 + 3x - 4 = 0$ $(x + 4)(x - 1) = 0$ $x = -4$ or $x = 1$ OR $2x^2 - 3x - 10 = x^3 - 25x$ $x^3 - 2x^2 - 22x + 10 = 0$ which cannot be solved at NCEA Level 1. (<i>This method gains highest grade r</i>)	Correctly expanded.	Expression simplified. ($x \neq -5$ not required) to second line of evidence Or consistent solution from 2d OR Simplified and $= 0$.	Solution calculated.

(e)(i)	The depth of the groove.	Defines y in context.		
(ii)	$-3 = x^2 - 4x$ $x^2 - 4x + 3 = 0$ $(x - 3)(x - 1) = 0$ 3 cm below the maximum width of the groove, $x = 3$ or 1. This may be shown on diagram or written (1, 3) or shown on a table of points Therefore at this depth, the width of the groove = 2 cm. Intercepts are 0 and 4. Maximum width of the groove = 4 cm. At 3 cm deep, the width of the groove is 50% of the maximum width. May be given as a fraction.	Equates relationship to -3. If equates to 3 accept rearranged for u ie. $x^2 - 4x - 3 = 0$	Solves equation.	Percentage calculated showing some working. Accept equivalent solution.

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3A or higher from either:

- 1A or higher in each question
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3M or higher from either:

- 1 M in each question
- 2E and 1A
- 1E, 1M and 1A

4. For the award of an Excellence grade (E)

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