Guidelines for marking the MCAT 2021

As you begin to assess your candidates' answers, you may find it helpful to check the FAQ page link https://bit.ly/2021_MCAT_FAQ This will be updated regularly.
The title of the standard requires candidates to use algebraic procedures in solving problems. To fulfill the requirements of explanatory note 2, all questions require the candidates to choose the procedures from explanatory note 4 (EN4) which will lead them towards a solution, and apply these correctly. Evidence of algebraic working must be shown.

In order to provide evidence towards any grade, the candidate must demonstrate a level of algebraic thinking consistent with level six of the curriculum and be consistent with the spirit of the New Zealand Curriculum.

If a candidate requires **one** u grade to achieve the standard, the assessor may award **one** grade of **us** anywhere in the paper for where there is evidence of:

- a correct guess and check response or
- a correct answer only or
- a borderline case for an overall award of Achieved where professional judgement has been used.

Likewise, if a candidate is borderline for an overall award of Merit or Excellence, one **rs** (soft Merit) or one **ts** (soft Excellence) grade may be used **(*but only if a us, rs or ts has not been used prior*)**. These grades are only awarded on professional judgement responses where the marker is struggling with the decision.

Implications
All working must be checked in order to identify evidence of the application of a listed procedure. 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.

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 incorrect due to a numerical error, the candidate should not be penalised **except** in questions **1a and 1b on day 1 and 3a and 3b on day 2**. 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.
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" or "rs"**,
   and for **excellence**, the demonstrating of abstract thinking is coded as **"t" or "ts"**.

Grading parts of questions

1. Check each part of each question to ensure they have been allocated a grade.
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** 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**
Note: Only one us, rs or ts grade may be awarded across the paper.			

Minimum requirements of 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 in one question and 1E in another (because the award of a t grade will involve more than one of the procedures)

OR a total of

- 1 r and 2 u across at least two questions

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

3M or higher from either:

- 1M in each question
- 1M in one question and 2M in another
- 2E in one question and 1A in another
- 1E, 1M, and a total of 2u or more from any questions

OR a total of

- 2 r and 2 u across at least two questions.

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

A total of

- At least 2 t grades and at least 1 r grade across at least two questions.

Results

1. When loading school data, ensure you follow the instructions given on the NZQA schools' secure web site. (In high security features, Provisional and Final Results Entry, L1 MCAT Instructions – School's PN has access to this).
2. **Please ensure that all registered candidates have a grade recorded on the website before submitting your school's papers for verification otherwise this does not allow verification to take place.** ***Do not share results with your candidates prior to them being released by NZQA.***
3. Verification reports will not be included in the envelope returned to the school. It can be accessed on the NZQA secure web site. You may receive your scripts back to the school before your report is available online. This is because the report is not visible for a week after the final report is loaded to allow for any checking by the National Verifier.

Verifying

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 (i.e. a us, ms or ts grade) 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.

A holistic decision is when 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 on the basis of the response to this question.

For assistance with marking please use:

Email: mcat.help@xtra.co.nz

FAQ page link (this will be updated regularly): https://bit.ly/2021_MCAT_FAQ

You may wish to include a contact phone number as in some cases it can be easier to discuss the response.

The completed verification report will be posted on the NZQA schools' secure site.

Assessment Schedule – 2021

Mathematics and Statistics: Apply algebraic procedures in solving problems (91027A) Day 1

Candidates must show algebraic working.
Solutions in a multi-part question may be found in **any** part and awarded credit.
Equivalent methods of solving problems are accepted on condition that the candidate is demonstrating algebraic solutions at curriculum level 6, which may include algebraic thinking at curriculum level 6.
Once a student has made an error, for any consistent working to provide evidence towards a grade, the procedure must be performed at curriculum level 6.

Q ONE	**Expected Coverage**	**Grade (generated by correctly demonstrating the procedures listed in EN4) Requirements are for the student responses to be correct (ignoring numerical errors) unless the statement specifies consistent**
(a)	S = $2 \times (-3)^2 - 3 \times -3 \times 4$ $= 2 \times 9 + 9 \times 4$ $= 18 + 36$ $= 54$	For award of u: ● correct solution (accept 18 + 36) (numerical errors not allowed)
(b)	$2x^2 - 11x - 6 = 0$ $(2x + 1)(x - 6) = 0$ Either $2x + 1 = 0$ $x = -\frac{1}{2} = -0.5$ or $x - 6 = 0$ $x = 6$ then $p - q = 6\frac{1}{2} = 6.5$ Accept alternative formats of the answer.	For award of u: ONE of: ● factorising the quadratic expression ● consistent solving of the quadratic equation.
		For award of r: ONE of: ● both correct values for x (or p and q) found ● consistent difference between p and q found.
		For award of t: ● correct difference between p and q found.
(c)	$(2x + m)(2x + m) = 4x^2 + nx + 9$ $4x^2 + 2mx + 2mx + m^2$ $= 4x^2 + nx + 9$ $4x^2 + 4mx + m^2 = 4x^2 + nx + 9$ $m^2 = 9$ and $4m = n$ $m = 3$ (or $m = -3$ not required) $n = 4 \times 3$ $n = 12$ and $m = 3$	For award of u: ONE of: ● correct expansion of $(2x + m)^2$ (does not need to be simplified) ● using algebra to find the value of $m = 3$ OR $n = 12$
		For award of r: ● using algebra to find the values of $m = 3$ AND $n = 12$

(d)	$(w^2 - 9)(w^2 - 9) = 0$ $w^2 - 9 = 0$ $(w+3)(w-3) = 0$ $w = \pm 3$ or $w^2 - 9 = 0$ $w^2 = 9$ $w = \pm 3$	For award of u: ONE of: ● recognising that $w^4 = (w^2)^2$ within a quadratic factorisation process ● consistent solving of their quadratic equation.
		For award of r: ONE of: ● correct factorisation of the equation into quadratic factors ● consistent solution of their equation involving w^2 ● one correct solution.
		For award of t: ● correct solutions of $w = 3$ and $w = -3$
(e)	$R(y - 2x) = 5y - 4x$ #1 $Ry - 2Rx = 5y - 4x$ $4x - 2Rx = 5y - Ry$ #2 $x(4 - 2R) = 5y - Ry$ #3 $x = \dfrac{5y - Ry}{4 - 2R}$ Accept other equivalent solutions.	For award of u: ONE of: ● multiply LHS by $(y - 2x)$ and left numerator on RHS #1 ● consistently collecting terms involving x and terms not involving x on different sides of the equation #2 ● consistently factorising the pair of terms involving x #3
		For award of r: TWO of: ● multiply LHS by $(y - 2x)$ and left numerator on RHS #1 ● consistently collecting terms involving x and terms not involving x on different sides of the equation #2 ● consistently factorising the pair of terms involving x #3
		For award of t: ● correct rearrangement.

Q TWO	Expected Coverage	Grade (generated by correctly demonstrating the procedures listed in EN4) Requirements are for the student responses to be correct (ignoring numerical errors) unless the statement specifies consistent
(a)	$x + 3 + x + 2 + x + 2x - 1 = 34$ $5x + 4 = 34$ $5x = 30$ $x = 6$	For award of u: ● form and solve linear equation.
(b)	$6x^2 + x - 2 \le 6x^2 - 17x - 3$ #1 $x - 2 \le -17x - 3$ $18x \le -1$ $x \le -\frac{1}{18}$	For award of u: ONE of: ● expand either quadratic expression #1 ● solution found as an equation instead of an inequation ● consistent solution to the inequality ● consistent simplifying of both sides of the inequality.
		For award of r: ● correct inequality found (accept $<$)
(c)	$14p + 6q = 46$ $\times 2$ $10p + 4q = 32$ $\times 3$ $28p + 12q = 92$ $30p + 12q = 96$ Subtracting gives $-2p = -4$ $p = 2$ Then $q = 3$ Rectangle A dimensions: 9 cm by 14 cm Rectangle B dimensions: 6 cm by 10 cm	For award of u: ONE of: ● forms both equations for perimeters (must have combined like terms) ● consistent combining of their equations in one variable ● consistent solution for one variable.
		For award of r: ONE of: ● correctly combines the equations in one variable ● consistently finds dimensions.
		For award of t: ● correct dimensions of both rectangles found (units not required).
(d)	$\frac{5(x+2) - 3(2x-1)}{15} = 1$ $\frac{5x + 10 - 6x + 3}{15} = 1$ $5x + 10 - 6x + 3 = 15$ $-x + 13 = 15$ $-x = 2$ $x = -2$	For award of u: ONE of: ● correct arrangement for both numerator and denominator (does not need to be expanded or simplified) ● consistent solution found.
		For award of r: ● correct solution found.

(e)	$(3 + 2x)(2 + 2x) = 2 \times 6$ $6 + 6x + 4x + 4x^2 = 12$ $4x^2 + 10x - 6 = 0$ # 1 $2x^2 + 5x - 3 = 0$ $(2x - 1)(x + 3) = 0$	For award of u: ONE of: ● forms correct expression for lengths of both walls in terms of x ● consistent simplifying of equation to a quadratic equated to 0 #1 ● consistent factorising of their quadratic equation.
	Either $2x - 1 = 0$ $x = \frac{1}{2}$	For award of r: ONE of: ● simplification to a quadratic equation (= 0 not required) #1 ● consistent solving of their quadratic equation and recognition of positive value.
	Or $x + 3 = 0$ $x = -3$ (ignore) Units not required.	For award of t: ● correct positive solution found for the question, with evidence of correct negative value disregarded.

Q THREE	Expected Coverage	Grade (generated by correctly demonstrating the procedures listed in EN4) Requirements are for the student responses to be correct (ignoring numerical errors) unless the statement specifies consistent
(a)	$(3x + 5)(3x + 5)$ $9x^2 + 15x + 15x + 25$ $9x^2 + 30x + 25$	For award of u: ● expanding and simplifying the quadratic.
(b)	$2^x \times 2^{3x-8} = 2^4$ $2^{x + 3x - 8} = 2^4$ $x + 3x - 8 = 4$ $4x - 8 = 4$ $4x = 12$ $x = 3$	For award of u: ONE of: ● simplification of the powers of 2 on the LHS ● consistently forming a linear equation from a base of 2
		For award of r: ● correct value of x found.
(c)	$\dfrac{2(x+1) - 2(x-3)}{(x-3)(x+1)} = \dfrac{3}{x+5}$ $\dfrac{2x + 2 - 2x + 6}{(x-3)(x+1)} = \dfrac{3}{x+5}$ $8(x + 5) = 3(x - 3)(x + 1)$ $8x + 40 = 3(x^2 - 2x - 3)$ $8x + 40 = 3x^2 - 6x - 9$ $3x^2 - 14x - 49 = 0$ $0 = (3x + 7)(x - 7)$ Either $3x + 7 = 0$ $x = -\frac{7}{3}$ Or $x - 7 = 0$ $x = 7$	For award of u: ONE of: ● correct arrangement of numerator and denominator on LHS (accept unsimplified expression) ● consistent factorisation of quadratic expression ● consistently rearranges equation to remove denominators.
		For award of r: ONE of: ● correctly rearranges equation to remove denominators ● consistent solutions from their quadratic equation ● correctly combines into a single fraction (numerator must be simplified).
		For award of t: ● equation solved for both values.
(d)	$\dfrac{(2x-7)(x+2)}{2(x+2)(x-2)}$ $= \dfrac{2x-7}{2(x-2)}$ or $= \dfrac{2x-7}{2x-4}$ ($x \neq 2$ not required)	For award of u: ONE of: ● numerator or denominator fully factorised ● consistent simplification from their factorisation.
		For award of r: ● simplification of expression.

<table>
<tr>
<td rowspan="3">(e)</td>
<td rowspan="3">$3x + 2y = 20$
$2y = 20 - 3x$
$$y = \frac{20 - 3x}{2}$$
Area = 14 gives $xy = 14$
$$x \times \frac{20 - 3x}{2} = 14$$
$x(20 - 3x) = 28$
$20x - 3x^2 = 28$
$0 = 3x^2 - 20x + 28$
$0 = (3x - 14)(x - 2)$

Either $3x - 14 = 0$
$x = \frac{14}{3}$ (or equivalent)
Or $x - 2 = 0$
$x = 2$

Alternative Method
$3x + 2y = 20$
Area = 14 gives $xy = 14$
$$y = \frac{14}{x}$$
Giving $3x + 2 \times \frac{14}{x} = 20$
$3x^2 + 28 = 20x$
$3x^2 - 20x + 28 = 0$
$(3x - 14)(x - 2) = 0$
Either $3x - 14 = 0$
$x = \frac{14}{3}$ (or equivalent)
Or $x - 2 = 0$
$x = 2$
Both values required.</td>
<td>For award of u:
ONE of:
● forms the equation $3x + 2y = 20$
● consistently factorises quadratic expression
● consistently solves quadratic equation
● consistently forms an equation in 1 variable.</td>
</tr>
<tr>
<td>For award of r:
ONE of:
● forms an equation in one variable
● consistently solves their equations for x</td>
</tr>
<tr>
<td>For award of t:
● finds both possible values of x</td>
</tr>
</table>

Assessment Schedule – 2021

Mathematics and Statistics: Apply algebraic procedures in solving problems (91027B) Day 2

Candidates must show algebraic working.
Solutions in a multi-part question may be found in **any** part and awarded credit.
Equivalent methods of solving problems are accepted on condition that the candidate is demonstrating algebraic solutions at curriculum level 6, which may include algebraic thinking at curriculum level 6.
Once a student has made an error, for any consistent working to provide evidence towards a grade, the procedure must be performed at curriculum level 6.

Q ONE	**Expected Coverage**	**Grade (generated by correctly demonstrating the procedures listed in EN4) Requirements are for the student responses to be correct (ignoring numerical errors) unless the statement specifies consistent**
(a)	$y + 5 + y + 2 + y + 3y – 2 = 35$ $6y + 5 = 35$ $6y = 30$ $y = 5$	For award of u: ● form and solve linear equation.
(b)	$8x^2 + 2x - 3 \geq 8x^2 - 15x - 2$ #1 $2x - 3 \geq -15x - 2$ $17x \geq 1$ $x \geq \frac{1}{17}$	For award of u: ONE of: ● expand either quadratic expression #1 ● solution found as an equation instead of an inequation ● consistent solution to the inequality ● consistent simplifying of both sides of the inequality.
		For award of r: ● correct inequality found (accept >).
(c)	$6g + 8h = 20$ × 4 $8g + 10h = 26$ × 3 $24g + 32h = 80$ $24g + 30h = 78$ Subtracting gives $2h = 2$ $h = 1$ Then $g = 2$ Rectangle A dimensions: 6 cm by 4 cm. Rectangle B dimensions: 8 cm by 5 cm.	For award of u: ONE of: ● forms both equations for perimeter (must have combined like terms) ● consistent combining of their equations in one variable ● consistent solution for one variable.
		For award of r: ONE of: ● correctly combines the equations in one variable ● consistently finds dimensions.
		For award of t: ● correct dimensions of both rectangles found (units not required).
(d)	$\frac{3(y + 3) - 4(2y - 3)}{12} = 3$ $\frac{3y + 9 - 8y + 12}{12} = 3$ $3y + 9 – 8y + 12 = 36$ $–5y + 21 = 36$ $–5y = 15$ $y = –3$	For award of u: ONE of: ● correct arrangement for both numerator and denominator (does not need to be simplified) ● consistent solution found.
		For award of r: ● correct solution found.

<table>
<tr><td rowspan="3">(e)</td><td rowspan="3">$(9 + 2x)(6 + 2x) = 2 \times 54$
$54 + 18x + 12x + 4x^2 = 108$
$4x^2 + 30x - 54 = 0$ #1
$2x^2 + 15x - 27 = 0$
$(2x - 3)(x + 9) = 0$

Either $2x - 3 = 0$
$x = \frac{3}{2}$

Or $x + 9 = 0$
$x = -9$ (ignore)

Units not required.</td><td>For award of u:
ONE of:
● forms correct expression for lengths of both edges in terms of x
● consistent simplifying of equation to a quadratic equated to 0 #1
● consistent factorising of their quadratic equation.</td></tr>
<tr><td>For award of r:
ONE of:
● simplification to a quadratic equation (= 0 not required) #1
● consistent solving of their quadratic equation and recognition of positive value.</td></tr>
<tr><td>For award of t:
● correct positive solution found for the question, with evidence of correct negative value disregarded.</td></tr>
</table>

Q TWO	Expected Coverage	Grade (generated by correctly demonstrating the procedures listed in EN4) **Requirements are for the student responses to be correct (ignoring numerical errors) unless the statement specifies consistent**
(a)	$(4y + 7)(4y + 7)$ $16y^2 + 28y + 28y + 49$ $16y^2 + 56y + 49$	For award of u: ● expanding and simplifying the quadratic.
(b)	$2^{2y + 2y - 12} = 2^4$ $2y + 2y - 12 = 4$ $4y - 12 = 4$ $4y = 16$ $y = 4$	For award of u: ONE of: ● simplification of the powers of 2 on the LHS ● consistently forming a linear equation from a base of 2
		For award of r: ● correct value of y found.
(c)	$\frac{3(y+4) - 3(y-4)}{(y-4)(y+4)} = \frac{2}{y+1}$ $\frac{3y + 12 - 3y + 12}{(y^2 - 16)} = \frac{2}{y+1}$ $24(y + 1) = 2(y^2 - 16)$ $24y + 24 = 2y^2 - 32$ $0 = 2y^2 - 24y - 56$ $0 = y^2 - 12y - 28$ $0 = (y + 2)(y - 14)$ Either $y + 2 = 0$ $y = -2$ Or $y - 14 = 0$ $y = 14$	For award of u: ONE of: ● correct arrangement of numerator and denominator on LHS (accept unsimplified expression) ● consistent factorisation of quadratic expression ● consistently rearranges equation to remove denominator.
		For award of r: ONE of: ● correctly rearranges equation to remove denominators ● consistent solutions from their quadratic equation ● correctly combines into a single fraction (numerator must be simplified).
		For award of t: ● equation solved for both values.
(d)	$\frac{(3x+4)(x-2)}{3(x+2)(x-2)}$ $= \frac{3x+4}{3(x+2)}$ or $= \frac{3x+4}{3x+6}$ ($x \neq -2$ not required)	For award of u: ONE of: ● numerator or denominator fully factorised ● consistent simplification from their factorisation.
		For award of r: ● simplification of expression.

<table>
<tr>
<td rowspan="3">(e)</td>
<td rowspan="3">$3x + 2y = 16$
$2y = 16 - 3x$
$$y = \frac{16 - 3x}{2}$$
Area = 10 gives $xy = 10$
$$x \times \frac{16 - 3x}{2} = 10$$
$x(16 - 3x) = 20$
$16x - 3x^2 = 20$
$0 = 3x^2 - 16x + 20$
$0 = (3x - 10)(x - 2)$

Either $3x - 10 = 0$
$x = \frac{10}{3}$ (or equivalent)
Or $x - 2 = 0$
$x = 2$

Alternative Method
$3x + 2y = 16$
Area = 10 gives $xy = 10$
$$y = \frac{10}{x}$$
Giving
$$3x + 2 \times \frac{10}{x} = 16$$
$3x^2 + 20 = 16x$
$3x^2 - 16x + 20 = 0$
$(3x - 10)(x - 2) = 0$

Either $3x - 10 = 0$
$x = \frac{10}{3}$ (or equivalent)
Or $x - 2 = 0$
$x = 2$

Both values required.</td>
<td>For award of u:
ONE of:
● forms equation $3x + 2y = 16$
● consistently factorises quadratic expression
● consistently solves quadratic equation
● consistently forms an equation in 1 variable.</td>
</tr>
<tr>
<td>For award of r:
ONE of:
● forms an equation in one variable
● consistently solves their equations for x</td>
</tr>
<tr>
<td>For award of t:
● finds both possible values of x</td>
</tr>
</table>

Q THREE	Evidence	Grade (generated by correctly demonstrating the procedures listed in EN4) Requirements are for the student responses to be correct (ignoring numerical errors) unless the statement specifies consistent
(a)	$= 3 \times (-3)^2 - 4 \times 2 \times -3$ $= 3 \times 9 + 24$ $= 27 + 24$ $= 51$	For award of u: ● correct solution (accept 27 + 24) (numerical errors not allowed)
(b)	$3x^2 - 14x - 5 = 0$ $(3x + 1)(x - 5) = 0$ Either $3x + 1 = 0$ $x = -\frac{1}{3} = -0.3333$ Or $x - 5 = 0$ $x = 5$ Then $a - b = 5\frac{1}{3}$ Accept alternative formats of the answer.	For award of u: ONE of: ● factorising the quadratic expression ● consistent solving of the quadratic equation.
		For award of r: ONE of: ● both correct values for x (or a and b) found ● consistent difference between a and b found.
		For award of t: ● correct difference between a and b found.
(c)	$(3x + v)(3x + v) = 9x^2 + wx + 16$ $9x^2 + 3vx + 3vx + v^2$ $= 9x^2 + wx + 16$ $9x^2 + 6vx + v^2 = 9x^2 + wx + 16$ $v^2 = 16$ and $6v = w$ $v = 4$ (or $v = -4$ not required) $w = 6 \times 4$ $w = 24$ and $v = 4$	For award of u: ONE of: ● correct expansion of $(3x + v)^2$ (does not need to be simplified) ● using algebra to find the value of $v = 4$ OR $w = 24$
		For award of r: ● using algebra to find the values of $v = 4$ AND $w = 24$
(d)	$(g^2 - 4)(g^2 - 4) = 0$ $g^2 - 4 = 0$ $(g + 2)(g - 2) = 0$ $g = \pm 2$ or $g^2 - 4 = 0$ $g^2 = 4$ $g = \pm 2$	For award of u: ONE of: ● recognising that $g^4 = (g^2)^2$ within a quadratic factorisation process ● consistent solving of their quadratic equation.
		For award of r: ONE of: ● correct factorisation of the equation into quadratic factors ● consistent solution of their equation involving g^2 ● one correct solution.
		For award of t: ● correct solutions for both values of $g = 2$ and $g = -2$

<table>
<tr><td rowspan="3">(e)</td><td rowspan="3">$T(p - 3q) = 7p - 6q$ #1

$Tp - 3Tq = 7p - 6q$
$6q - 3Tq = 7p - Tp$ #2
$q(6 - 3T) = 7p - Tp$ #3
$q = \dfrac{7p - Tp}{6 - 3T}$

Accept other equivalent solutions.</td><td>For award of u:
ONE of:
● multiplies LHS by (p - 3q) and left numerator on RHS #1
● consistently collecting terms involving q and terms not involving q on different sides of the equation #2
● consistently factorising the pair of terms involving q #3</td></tr>
<tr><td>For award of r:
TWO of:
● multiplies LHS by (p - 3q) and left numerator on RHS #1
● consistently collecting terms involving q and terms not involving q on different sides of the equation #2
● consistently factorising the pair of terms involving q #3</td></tr>
<tr><td>For award of t:
● correct rearrangement.</td></tr>
</table>