Guidelines for marking the MCAT 2018

The title of the standard requires the candidate 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) that will lead them towards a solution of the question 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.

Guess and check is a basic substitution method of solving a problem and is at a lower curriculum level and cannot be used to demonstrate that the solution is unique in some questions eg. Question 3d on day 1 and 3e on day 2. If a 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 where a specific solution is required.

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

All working must be checked in order to identify evidence of the application of a listed procedure which 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 question **1a**. 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** 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: A us grade may only be used once across the paper.			

Some examples 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
   - 2A and 1M or higher i.e. 3 questions correct across the paper.
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

   OR a total of
   - 2E and 1A
   - 1E, 1M and a total of 2u or more from any questions.
4. **For the award of an Excellence grade (E)** – 3E or more from 2 or more questions.
   OR a total of
   - 2E and 2M

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.**
3. Verification reports will not be included in the envelope returned to the school. It can be accessed on the NZQA secure web site.

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 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 in response to teacher's questions): https://goo.gl/nK62gG
You may wish to add a contact phone number as in some cases it can be easier to discuss the response.
Final date for entering provisional results and sending verification submission to NZQA is **27th October**.
The completed verification report will be posted on the NZQA schools' secure site.

ASSESSMENT SCHEDULE – 2018

The assessment schedule for the MCAT 2017 looks a little different.

There are several reasons for this:

All parts of questions are problems in which the candidates are required to demonstrate the use of mathematical processes in order to find a solution.

E.g. at achieved level, all of the processes below must be included in all parts:
- selecting and using procedures in solving problems
- demonstrating knowledge of algebraic concepts and terms
- communicating solutions using appropriate mathematical symbols

In order to do this they need to apply the procedures listed in AS91027 explanatory note 4 (EN4) at curriculum level 6 difficulty.

The procedures are “selected by the candidate” hence it is not always possible to give a “defined” way of solving the problem. Alternative methods of solving the problem are to be accepted if the mathematical procedure is from the given list, and demonstrates working at curriculum level 6.

A likely method of solution is given in the expected coverage.

A way of identifying the grade to be allocated for a part of a question is given in the last column of the table, where the procedures used in the expected coverage are listed.

If a candidate makes an error in their working that demonstrates the lack of ability to perform that procedure, they may well demonstrate further evidence of appropriate application of other procedures later in their solution. The remainder of the question must be considered for the application of procedures that lead to a consistent solution, as long as it does not simplify the problem before the allocation of the grade.

Assessment Schedule – 2018

Mathematics (CAT): Apply algebraic procedures in solving problems (91027A) – Day 1

Candidates must show algebraic working.

Be aware that solutions in a multi-part question may be found in any part and awarded credit.

Equivalent answers are accepted.

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.

Evidence Statement

Q	Expected Coverage	Grade (generated by correctly demonstrating the procedures listed in EN4)
ONE (a)	$(2x + 3)(x - 2)$ $= 2x^2 - x - 6$	For award of u: • Expanding and simplifying quadratic.
(b)	$3^{x+1} = 3^4$ $x + 1 = 4$ $x = 3$	For award of u: • correct solution – no alternative. • can be solved using guess and check methods.
(c)	$(3x - 4)(x + 2) = 0$ $x = \frac{4}{3}$ or $x = -2$	For award of u: ONE of: • correct factorising • **both** solutions consistent.
		For award of r: • both solutions correct.
(d)	Area = $\frac{1}{2}x(4x + 6)$ $= 35$ $x(2x + 3) = 35$ $2x^2 + 3x - 35 = 0$ $(2x - 7)(x + 5) = 0$ $x = 3.5$ or -5 area can't be –ve $x = \frac{7}{2}$ or 3.5	For award of u: ONE of: • equation correct by expanding **or** removal of the factor of 2 from the term in brackets **or** equating to 70 • consistent factorisation of the quadratic equation into two brackets • consistent solving.
		For award of r: • TWO of the above procedures.
		For award of t: • correct solution justified.

<table>
<tr>
<td rowspan="3">(e)</td>
<td rowspan="3">Sophia
$= n^3 + 3n$
$= n(n^2 + 3)$
Tama
$= 2n^2 + 6n$
$= n(2n + 6)$

$n(2n + 6) > n(n^2 + 3)$
$2n + 6 > n^2 + 3$
$n^2 - 2n - 3 < 0$
$(n - 3)(n + 1) < 0$
$n = 3$ or -1
Hence $n = 1, 2$, as n can't be negative or zero.
Accept $-1 < n < 3$</td>
<td>For award of u:
ONE of:
• correctly writing the (in)equation for both Sophia and Tama (accept > or ≥ or =)
• equated expression consistently to a quadratic
• consistent relationship involving n.</td>
</tr>
<tr>
<td>For award of r:
ONE of:
• generates simplified quadratic expression ignoring the inequation
• correctly solved a consistent quadratic to give 2 solutions.</td>
</tr>
<tr>
<td>For award of t:
• solution found and justified or interval stated.</td>
</tr>
</table>

Q	Expected Coverage	Grade (generated by correctly demonstrating the procedures listed in EN4)
TWO (a)	$r = \sqrt{\frac{4}{9}A}$ or $r = \frac{2}{3}\sqrt{A}$ Accept $\pm\sqrt{\frac{4}{9}A}$	For award of u: • correct expression.
(b)	$32x - 7 = 6x + 5 + 8x + 3 + 4x - 2 + 10x + 1 + \text{AB}$ $32x - 7 = 28x + 7 + \text{AB}$ $\text{AB} = 4x - 14$	For award of u: ONE of: • establishing relationship including AB • consistent simplifying of expression.
		For award of r: • correct simplification of expression.
(c)	$\frac{2(x-2)+3(x+1)}{(x+1)(x-2)} = \frac{2x-4+3x+3}{x^2-x-2}$ $= \frac{5x-1}{x^2-x-2}$	For award of u: ONE of: • correct arrangement for numerator • consistent simplification of numerator.
		For award of r: • correct statement with numerator simplified (denominator does not need to be expanded).

<table>
<tr><td rowspan="3">(d)</td><td rowspan="3">$2^3 \cdot 2^{(x-4)} < 20$
$2^{x-1} < 20$
$2^4 = 16$ or $2^5 = 32$
$x - 1 \leq 4$
$x \leq 5$ (accept this as integer solution)
or $x < 6$</td><td>For award of u:
ONE of:
• writes 8 as 2^3
• divides by 8 and then simplifies RHS to $\frac{5}{2}$ or 2.5
• RHS in index form
• combines the indices on the LHS to their simplest form
• consistently identifies the appropriate power of 2
• ie $x < 5$ or $x = 5$.
Note:
Guess and check leading to the correct solution can be awarded a u grade as long as candidate has not used guess and check to correctly solve Q1(b).</td></tr>
<tr><td>For award of r:
• THREE or more of the procedures for u.</td></tr>
<tr><td>For award of t:
• correct solution.
Note:
Guess and check following at least one correct algebraic process leading to a correct answer can be awarded a t grade.</td></tr>
</table>

(e)	A = the number of adults C = the number of students. $A + C = 27$ $A = 27 - C$ $C = 27 - A$ $30A + 20C = 650$ $30A + 20(27 - A) = 650$ $30A + 540 - 20A = 650$ $10A = 110$ $A = 11$ $C = 16$ $\frac{1}{2}G + \frac{2}{3}L = 16$ $\frac{1}{2}G + \frac{1}{3}L = 11$ $G = 12, L = 15$ $\frac{2}{3} \cdot 15 = 10$ Number of students for Leo = 10	For award of u: ONE of: • 2 equations correct • 1 equation correct and 1 variable eliminated.
		For award of r: ONE of: • simultaneous equations correctly solved giving both solutions of A =11 and C = 16 • uses algebra to find the number of people in either person's group • simultaneous equations consistently solved and simultaneous equations set up to find the number of students in Leo's group.
		For award of t: • correct solution of 10 students found using any valid algebraic method or evidence of proportional reasoning.
	Alternative solution Let x = number students in George's group. Number of adults in George's group = x Number of people in George's group $= 2x$ Number of people in Leo's group $= 27 - 2x$ Number of students in Leo's group $= 18 - \frac{4x}{3}$ Number of adults in Leo's group $= 9 - \frac{2x}{3}$ Total number of adults $= x + 9 - \frac{2x}{3}$ $= 9 + \frac{x}{3}$ Total number of students $= x + 18 - \frac{4x}{3}$ $= 18 - \frac{x}{3}$ $(9 + \frac{x}{3})30 + (18 - \frac{x}{3})20 = 650$ $270 + 10x + 360 - \frac{20x}{3} = 650$ $630 + \frac{10x}{3} = 650$ $\frac{10x}{3} = 20$ $x = 6$ So number of students in Leo's group is 10.	For the award of u: ONE of: • writes expressions for the number of people in each of the groups in terms of one common variable • writes expressions for total number of adults in terms of a common variable • writes expressions for total number of students in terms of a common variable • writes equation for total cost of the tickets • consistently solves the problem.
		For the award of r: • at least one of the simultaneous equations correct with one common variable.
		For the award of t: • correct solution.

Q	Expected Coverage	Grade (generated by correctly demonstrating the procedures listed in EN4)
THREE (a)	$A = 2(5 + 3 \cdot 5 \cdot 2^2)$ $= 130$	For award of u: • correct solution (no alternative).
(b)	$\frac{3x(x+4)}{(x-4)(x+4)} = \frac{3x}{x-4}$	For award of u: ONE of: • correct factorising of numerator or denominator • consistently simplified.
		For award of r: • correct solution.
(c)(i)	*Examples of evidence of a numerical methods:* *For one pair of different radii* $C = 2\pi r$ Radii = 4 and 6 $2\pi(4) + 2\pi(6) = 2\pi(10)$ $=20\pi$ *or* *For one pair of different diameters* $C + \pi d$ Diameters = 8 and 12 $\pi(8) + \pi(12) = 20\pi$ *Generalised evidence for an r or t grade* $C = 2\pi r$ $r_1 + r_2 = 10$ $C = 2\pi r_1 + 2\pi r_2$ $= 2\pi(r_1 + r_2)$ $= 2\pi(10)$ $= 20\pi$ OR $C = \pi d$ $d_1 + d_2 = 20$ $C = \pi d_1 + \pi d_2$ $= \pi(d_1 + d_2)$ $= \pi(20)$ $= 20\pi$	For award of u: ONE of: • uses two different radii (one pair that add to 10) to calculate the total circumference (or diameters that add to 20) • relationship given for radii or diameter of 2 circles • generalised relationship factorised • consistent solutions from the generalised equation.
		For the award of r: ONE of: • a second numerical calculation using 2 different pairs of radii or diameters • two correct procedures from u in processing to a generalised solution.
		For the award of t: • correct proof using generalised algebra for radii or diameter.

(ii)	Difference in areas $= \pi r^2 - \pi(10 - r)^2$ $= \pi r^2 - \pi(100 - 20r + r^2)$ $= \pi r^2 - 100\pi + 20\pi r - \pi r^2$ $= 20\pi r - 100\pi$ or $20\pi(r - 5)$	For award of u: ONE of: • forms equation • consistently expand quadratic • consistently simplifies • consistently factorises.
		For award of r: • TWO or more of procedures for u.
		For award of t: • relationship established.
(d)	$5^1 \times 5^{3x} = 5^{-2x^2}$ $2x^2 + 3x + 1 = 0$ $(2x + 1)(x + 1) = 0$ $x = -½$ or $x = -1$	For award of u: ONE of: • simplifies indices on LHS • consistently generates quadratic equation from powers of 5 that contains three terms when simplified • consistently calculates correct values of x from a quadratic equation.
		For award of r: • TWO or more of the procedures for u.
		For award of t: • correct solutions.

Guidelines for marking the MCAT 2018

The title of the standard requires the candidate 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) that will lead them towards a solution of the question 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:

- 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. 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 which 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 **3a and 2b**. 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 the question has 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** gains **2E**
Note: A us, rs or ts grade may only be used once 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 and 1M where the 1M has a u grade awarded in another part of the question i.e. 3 parts of questions correct across the paper.
   - 1A and 1E
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,

   OR a total of
   - 2E and 1A
   - 1E, 1M and a total of 2u or more from any questions.
4. **For the award of an Excellence grade (E)**
   3E or more from 2 or more questions,

   OR a total of
   - 2E and 2M

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.**
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 (ie. 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 in response to teacher's questions): http://bit.ly/mcat_faq
You may wish to add a contact phone number as in some cases it can be easier to discuss the response.

The final date for entering provisional results and sending verification submission to NZQA is **26th October**.
The completed verification report will be posted on the NZQA schools' secure site.

Assessment Schedule – 2018

Mathematics (CAT): Apply algebraic procedures in solving problems (91027B) – Day 2

Candidates must show algebraic working.

Be aware that solutions in a multi-part question may be found in any part and awarded credit.

Equivalent answers are accepted.

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.

Evidence Statement

D2	Expected Coverage	Grade (generated by correctly demonstrating the procedures listed in EN4)
ONE (a)	$r=\sqrt{\frac{9}{25}A}$ or $\frac{3}{5}\sqrt{A}$ *accept* $\pm\sqrt{\frac{9}{25}A}$	For award of u: • correct expression.
(b)	$2^{x-1}=2^6$ $x-1=6$ $x=7$	For award of u: • correct solution – no alternative. • can be solved using guess and check methods.
(c)	$\frac{3(x+1)+5(x-4)}{(x-4)(x+1)}=\frac{3x+3+5x-20}{x^2-3x-4}$ $=\frac{8x-17}{x^2-3x-4}$	For award of u: ONE of: • correct arrangement for numerator • consistent simplification of numerator .
		For award of r: • correct statement with numerator simplified (denominator does not need to be expanded).
(d)	Area = $\frac{1}{2}x(6x-4)$ $=65$ $x(3x-2)=65$ $3x^2-2x-65=0$ $(3x+13)(x-5)=0$ $x=-\frac{13}{3}$ or 5 area can't be –ve $x=5$	For award of u: ONE of: • equation correct by expanding **or** removal of the factor of 2 from the term in brackets **or** equating to 130 • consistent factorisation of the quadratic equation into two brackets. • consistent solving.
		For award of r: • TWO of the above procedures.
		For award of t: • correct solution justified.

(e)	A = the number of adults C = the number of students A + C = 28 A = 28 – C C = 28 – A 25A + 20C = 600 25A + 20(28 – A) = 600 25A + 560 – 20A = 600 5A = 40 A = 8 C = 20 $\frac{1}{2}J + \frac{1}{4}S = 8$ $\frac{1}{2}J + \frac{3}{4}S = 20$ J = 4 S = 24 $\frac{1}{2} \times 4 = 2$ Number of adults for James = 2	For award of u: ONE of: • 2 equations correct • 1 equation correct and 1 variable eliminated.
		For award of r: ONE of: • simultaneous equations correctly solved giving both solutions of A = 8 and C = 20 • uses algebra to find the number of people in either person's group • simultaneous equations consistently solved and simultaneous equations set up to find the number of adults in James's group.
		For award of t: • correct solution of 2 adults found using any valid algebraic method or evidence of proportional reasoning.
	Alternative solution Let x = number adults in James's group. Number of people in James's group = $2x$. Number of people in Samantha's group = $28 - 2x$ Adults in Samantha's group = ¼ $(28 - 2x)$ = $7 - 0.5x$ Total number of adults = $x + 7 - 0.5x$ = $0.5x + 7$ Total number of students = $28 - (0.5x + 7)$ = $21 - 0.5x$ $(0.5x + 7)25 + (21 - 0.5x)20 = 600$ $12.5x + 175 + 420 - 10x = 600$ $2.5x + 595 = 600$ $2.5x = 5$ $x = 2$ So number of adults in James's group is 2.	For the award of u: ONE of: • writes expressions for the number of people in each of the groups in terms of one common variable • writes expressions for total number of adults in terms of a common variable • writes expressions for total number of students in terms of a common variable • writes equation for total cost of the tickets • consistently solves the problem.
		For the award of r: • at least one of the simultaneous equations correct with one common variable.
		For the award of t: • correct solution.

D2	Expected Coverage	Grade (generated by correctly demonstrating the procedures listed in EN4)
TWO (a)	A = 3(2 × 9 × 5 – 6) = 252	For award of u: • correct solution (no alternative).
(b)	$25x - 2 = 4x + 2 + 7x + 1 + 6x - 3 + 5x + 7 + AB$ $25x - 2 = 22x + 7 + AB$ $AB = 3x - 9$	For award of u: ONE of: • establishing relationship including AB • consistent simplifying of expression.
		For award of r: • correct simplification of expression.
(c)	$\frac{3x(x+5)}{(x-5)(x+5)} = \frac{3x}{x-5}$	For award of u: ONE of: • correct factorising of numerator or denominator • consistently simplified.
		For award of r: • correct solution.
(d)	$7^1 \times 7^{1-x} = 7^{3x^2}$ $2 - x = 3x^2$ $3x^2 + x - 2 = 0$ $(3x-2)(x+1) = 0$ $x = \frac{2}{3}$ or $x = -1$	For award of u: ONE of: • simplifies indices on LHS. • consistently generates quadratic equation from powers of 7 that contains three terms when simplified • consistently calculates correct values of x from a quadratic equation.
		For award of r: • TWO or more of the procedures for u.
		For award of t: • correct solutions.

(e)	Ranee = $n^2 + 10n = n(n + 10)$ Raj = $n^3 + 8n = n(n^2 + 8)$ $n(n + 10) > n(n^2 + 8)$ $n + 10 > n^2 + 8$ $n^2 - n - 2 < 0$ $(n - 2)(n + 1) < 0$ $n = 2$ or -1 [for $(n - 2)(n + 1) = 0$] Hence $n = 1$, as n can't be negative or zero. Accept $-1 < n < 2$	For award of u: ONE of: • correctly writing the (in)equation for both Raj and Ranee (accept $>$ or $\geq$ or $=$) • equated expression consistently to a quadratic • consistent relationship involving n.
		For award of r: ONE of: • generates simplified quadratic expression ignoring the inequation • correctly solved a consistent quadratic to give 2 solutions.
		For award of t: • solution found and justified or interval stated.

D2	Expected Coverage	Grade (generated by correctly demonstrating the procedures listed in EN4)
THREE (a)	$(x + 2)(3x - 2)$ $= 3x^2 + 4x - 4$	For award of u: • Expanding and simplifying quadratic.
(b)	$(3x - 2)(x + 5) = 0$ $x = \frac{2}{3}$ or $x = -5$	For award of u: ONE of: • correct factorising • **both** solutions consistent.
		For award of r: • **both** solutions correct.
(c)(i)	*Examples of evidence of a numerical methods:* *For one pair of different radii* $C = 2\pi r$ Radii = 4 and 8 $2\pi(4) + 2\pi(8) = 2\pi(12)$ $=24\pi$ *or* *For one pair of different diameters* $C = \pi d$ Diameters = 8 and 16 $\pi(8) + \pi(16) = 24\pi$ *Generalised evidence for an r or t grade* $C = 2\pi r$ $r_1 + r_2 = 12$ $C = 2\pi r_1 + 2\pi r_2$ $= 2\pi(r_1 + r_2)$ $= 2\pi(12)$ $= 24\pi$ OR $C = \pi d$ $d_1 + d_2 = 24$ $C = \pi d_1 + \pi d_2$ $= \pi(d_1 + d_2)$ $= \pi(24)$ $= 24\pi$	For award of u: ONE of: • uses two different radii (one pair that add to 12) to calculate the total circumference (or different diameters that add to 24) • relationship given for radii or diameter of 2 circles • generalised relationship factorised • consistent solutions from the generalised equation.
		For the award of r: ONE of • a second numerical calculation using 2 different pairs of radii or diameters • two correct procedures from u in processing to a generalised solution.
		For the award of t: • correct proof using generalised algebra for radii or diameter.

(ii)	Difference in areas $= \pi r^2 - \pi(12 - r)^2$ $= \pi r^2 - \pi(144 - 24r + r^2)$ $= \pi r^2 - 144\pi + 24\pi r - \pi r^2$ $= 24\pi r - 144\pi$ Or $24\pi(r - 6)$	For award of u: ONE of: • forms equation • consistently expand quadratic • consistently simplifies • consistently factorises. For award of r: • TWO or more of procedures for u. For award of t: • relationship established.
(d)	$3^2 \times 3^{(x-4)} < 30$ $3^{x-2} < 30$ $3^3 = 27$ or $3^4 = 81$ $x - 2 \leq 3$ $x \leq 5$ (accept this as integer solution) or $x < 6$	For award of u: ONE of: • writes 9 as 3^2 • divides by 9 and then simplifies RHS to $\frac{10}{3}$ or 3.33 • RHS in index form • combines the indices on the LHS to their simplest form • consistently identifies the appropriate power of 3 • ie $x < 5$ or $x = 5$. **Note:** **Guess and check leading to the correct solution can be awarded a u grade as long as candidate has not used guess and check to correctly solve Q1(b).** For award of r: • THREE or more of the procedures for u. For award of t: • correct solution. **Note**: **Guess and check following at least one correct algebraic process leading to a correct answer can be awarded a t grade.**