National Qualifications 2017

2017 Mathematics Paper 1 (Non-calculator)

N5

Finalised Marking Instructions

© Scottish Qualifications Authority 2017

The information in this publication may be reproduced to support SQA qualifications only on a non-commercial basis. If it is reproduced, SQA should be clearly acknowledged as the source. If it is to be used for any other purpose, written permission must be obtained from permissions@sqa.org.uk.

Where the publication includes materials from sources other than SQA (secondary copyright), this material should only be reproduced for the purposes of examination or assessment. If it needs to be reproduced for any other purpose it is the centre's responsibility to obtain the necessary copyright clearance. SQA's NQ Assessment team may be able to direct you to the secondary sources.

These marking instructions have been prepared by examination teams for use by SQA appointed markers when marking external course assessments. This publication must not be reproduced for commercial or trade purposes.

SQA ©

General marking principles for National 5 Mathematics

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.

For each question the marking instructions are generally in two sections, namely Illustrative Scheme and Generic Scheme. The illustrative scheme covers methods which are commonly seen throughout the marking. The generic scheme indicates the rationale for which each mark is awarded. In general, markers should use the illustrative scheme and only use the generic scheme where a candidate has used a method not covered in the illustrative scheme.

(a) Marks for each candidate response must always be assigned in line with these general marking principles and the detailed marking instructions for this assessment.

(b) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.

(c) If a specific candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you must seek guidance from your Team Leader.

(d) Credit must be assigned in accordance with the specific assessment guidelines.

(e) One mark is available for each •. There are no half marks.

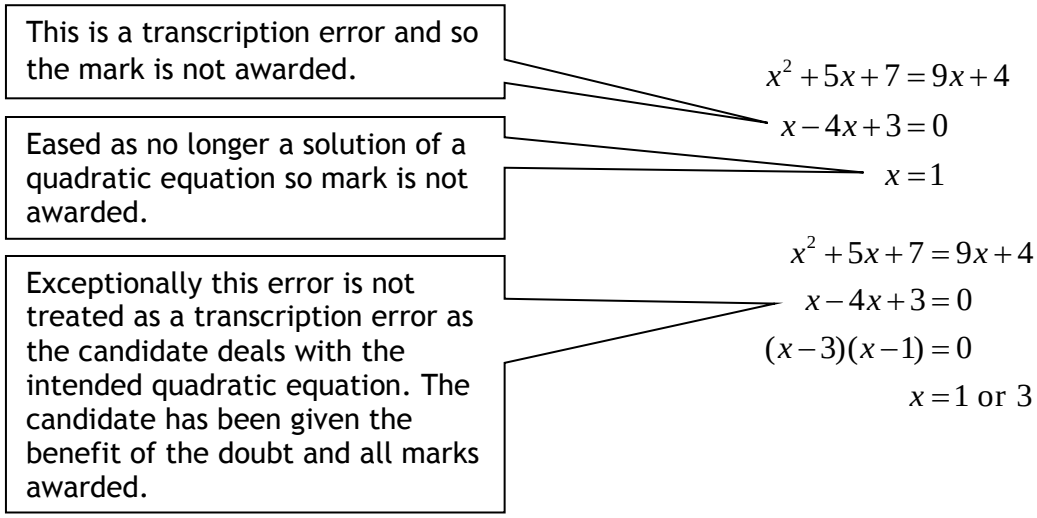
(f) Working subsequent to an error must be **followed through**, with possible credit for the subsequent working, provided that the level of difficulty involved is approximately similar. Where, subsequent to an error, the working for a follow through mark has been eased, the follow through mark cannot be awarded.

(g) As indicated on the front of the question paper, full credit should only be given where the solution contains appropriate working. Unless specifically mentioned in the marking instructions, a correct answer with no working receives no credit.

(h) Candidates may use any mathematically correct method to answer questions except in cases where a particular method is specified or excluded.

(i) As a consequence of an error perceived to be trivial, casual or insignificant, eg $6\times6=12$ candidates lose the opportunity of gaining a mark. However, note the second example in comment **(j)**.

(j) Where a transcription error (paper to script or within script) occurs, the candidate should normally lose the opportunity to be awarded the next process mark, eg



(k) **Horizontal/vertical marking**
Where a question results in two pairs of solutions, this technique should be applied, but only if indicated in the detailed marking instructions for the question.

Example:

	$\bullet^5$	$\bullet^6$
$\bullet^5$	$x=2$	$x=-4$
$\bullet^6$	$y=5$	$y=-7$

Horizontal: $\bullet^5$ $x=2$ and $x=-4$ Vertical: $\bullet^5$ $x=2$ and $y=5$
$\bullet^6$ $y=5$ and $y=-7$ $\bullet^6$ $x=-4$ and $y=-7$

Markers should choose whichever method benefits the candidate, but **not** a combination of both.

(l) In final answers, unless specifically mentioned in the detailed marking instructions, numerical values should be simplified as far as possible, eg:

$\frac{15}{12}$ must be simplified to $\frac{5}{4}$ or $1\frac{1}{4}$ $\frac{43}{1}$ must be simplified to 43

$\frac{15}{0\cdot3}$ must be simplified to 50 $\frac{4/5}{3}$ must be simplified to $\frac{4}{15}$

$\sqrt{64}$ must be simplified to 8*****

*The square root of perfect squares up to and including 100 must be known.

(m) Commonly Observed Responses (COR) are shown in the marking instructions to help mark common and/or non-routine solutions. CORs may also be used as a guide when marking similar non-routine candidate responses.

(n) Unless specifically mentioned in the marking instructions, the following should not be penalised:

- Working subsequent to a correct answer
- Correct working in the wrong part of a question
- Legitimate variations in numerical answers/algebraic expressions, eg angles in degrees rounded to nearest degree
- Omission of units
- Bad form (bad form only becomes bad form if subsequent working is correct), eg $(x^3+2x^2+3x+2)(2x+1)$ written as $(x^3+2x^2+3x+2)\times 2x+1$

  $2x^4+4x^3+6x^2+4x+x^3+2x^2+3x+2$ written as $2x^4+5x^3+8x^2+7x+2$ gains full credit

- Repeated error within a question, but not between questions or papers

(o) In any 'Show that…' question, where the candidate has to arrive at a required result, the last mark of that part is not available as a follow-through from a previous error unless specified in the detailed marking instructions.

(p) All working should be carefully checked, even where a fundamental misunderstanding is apparent early in the candidate's response. Marks may still be available later in the question so reference must be made continually to the marking instructions. The appearance of the correct answer does not necessarily indicate that the candidate has gained all the available marks.

(q) Scored-out working which has not been replaced should be marked where still legible. However, if the scored out working has been replaced, only the work which has not been scored out should be marked.

(r) Where a candidate has made multiple attempts using the same strategy and not identified their final answer, mark all attempts and award the lowest mark. Where a candidate has tried different valid strategies, apply the above ruling to attempts within each strategy and then award the highest resultant mark.

For example:

Strategy 1 attempt 1 is worth 3 marks.	Strategy 2 attempt 1 is worth 1 mark.
Strategy 1 attempt 2 is worth 4 marks.	Strategy 2 attempt 2 is worth 5 marks.
From the attempts using strategy 1, the resultant mark would be 3.	From the attempts using strategy 2, the resultant mark would be 1.

In this case, award 3 marks.

Detailed marking instructions for each question.

Question			Generic scheme	Illustrative scheme	Max mark
1.			**Ans: 10** •[1] substitute into x^2+3x •[2] evaluate x^2+3x	•[1] $(-5)^2+3\times(-5)$ •[2] 10	**2**
Notes: 1. Correct answer without working award 0/2 2. Accept $-5^2+3\times-5$ for •[1] 3. For subsequent incorrect working, •[2] is not available					
Commonly Observed Responses: 1. (a) For $-5=(-5)^2+3\times(-5)\rightarrow -5=10$ award 2/2 (b) For $-5=(-5)^2+3\times(-5)\rightarrow -5=10 \rightarrow x=15$ award 1/2 ✓× 2. For $5^2+3\times5=40$ award 0/2 3. For $5^2+3\times(-5)=10$ award 0/2					
2.			**Ans:** 16 •[1] find quartiles •[2] calculate semi-interquartile range	•[1] 218, 250 •[2] 16	**2**
Notes: 1. Correct answer without working award 0/2 2. Accept quartiles indicated in the list or on a diagram for •[1]					
Commonly Observed Responses: 1. For $\frac{267-198}{2}=34\cdot5$ award 0/2					

Question			Generic scheme	Illustrative scheme	Max mark
3.			**Ans:** $\frac{22}{9}$ • [1] start simplification and know how to divide fractions • [2] consistent answer	• [1] $\frac{11}{6}\times\frac{4}{3}$ • [2] $\frac{22}{9}$ or $2\frac{4}{9}$	**2**

Notes:

1. Correct answer without working award 0/2

2. Do not penalise incorrect conversion of $\frac{22}{9}$ to a mixed number

Commonly Observed Responses:

1. $\frac{11}{6}\times\frac{4}{3}=\frac{44}{18}$ award 1/2 ✓×

2. $\frac{11}{6}\times\frac{3}{4}=\frac{11}{8}$ award 1/2 ×✓

3. $\frac{6}{11}\times\frac{3}{4}=\frac{9}{22}$ award 1/2 ×✓

Question	Generic scheme	Illustrative scheme	Max mark
4.	**Ans:** $2x^3-5x^2-10x+3$		**3**
	$\bullet^1$ start to expand	$\bullet^1$ evidence of any 3 correct terms eg $2x^3-8x^2+2x$	
	$\bullet^2$ complete expansion	$\bullet^2$ $2x^3-8x^2+2x+3x^2-12x+3$	
	$\bullet^3$ collect like terms which must include a term in x^3 and a negative coefficient	$\bullet^3$ $2x^3-5x^2-10x+3$	

Notes:

1. Correct answer with no working — award 3/3
2. For subsequent incorrect working, the final mark is not available

Commonly Observed Responses:

1. For eg $2x^3-8x^2+2x+3x^2+12x+3=2x^3-5x^2+14x+3$ — award 2/3 ✓×✓
2. For eg $2x^3+2x-12x+3=2x^3-10x+3$ — award 2/3 ✓×✓
3. For $2x^3+8x^2+2x+3x^2+12x+3=2x^3+11x^2+14x+3$ — award 1/3 ✓××

Question			Generic scheme	Illustrative scheme	Max mark
5.			**Ans:** $B(0,6,6), C(3,3,9)$ $\bullet^1$ Coordinate B $\bullet^2$ Coordinate C	$\bullet^1$ (0,6,6) $\bullet^2$ (3,3,9)	**2**

Notes:

1. The maximum mark available is 1/2 where
   (a) brackets are omitted
   (b) answers are given in component form

2. For (6,6,0) **and** (9,3,3) [repeated error] award 1/2 ×✓

Commonly Observed Responses:

1. For 0,6,6 and 3,3,9 award 1/2 ×✓
2. For $\begin{pmatrix}0\\6\\6\end{pmatrix}$ and $\begin{pmatrix}3\\3\\9\end{pmatrix}$ award 1/2 ×✓
3. For eg $\begin{pmatrix}0\\6\\0\end{pmatrix}$ and $\begin{pmatrix}3\\3\\9\end{pmatrix}$ award 0/2

Question	Generic scheme	Illustrative scheme	Max mark
6.	**Ans:** $y=-2x+4$		**3**
	Method 1: $y-b=m(x-a)$		
	$\bullet^1$ find gradient	$\bullet^1$ $-\frac{8}{4}$ or equivalent	
	$\bullet^2$ substitute gradient and a point into $y-b=m(x-a)$	$\bullet^2$ eg $y-(-2)=-\frac{8}{4}(x-3)$	
	$\bullet^3$ state equation in simplest form	$\bullet^3$ $y=-2x+4$ **or equivalent**	
	Method 2: $y=mx+c$		
	$\bullet^1$ find gradient	$\bullet^1$ $-\frac{8}{4}$	
	$\bullet^2$ substitute gradient and a point into $y=mx+c$	$\bullet^2$ eg $-2=-\frac{8}{4}\times 3+c$	
	$\bullet^3$ state equation in simplest form	$\bullet^3$ $y=-2x+4$ or equivalent	

Notes:

1. Correct answer without working award 3/3

2. BEWARE $\bullet^1$ is not available for $\frac{-2-6}{3-(-1)}=\frac{8}{-4}$ or $\frac{6-(-2)}{-1-3}=\frac{-8}{4}$

Commonly Observed Responses:

1. For a final answer of $y=-\frac{2}{1}x+4$ award 2/3 ✓✓×

2. $y=2x+8$ $[m=\frac{8}{4}\ (-1,6)]$ award 2/3 ×✓✓

3. $y=2x-8$ $[m=\frac{8}{4}\ (3,-2)]$ award 2/3 ×✓✓

4. $m=\frac{4}{4}=1\rightarrow y-6=1(x-(-1))\rightarrow y=1x+7$ award 2/3 ×✓✓

Question	Generic scheme	Illustrative scheme	Max mark
7.	**Ans:** 32 cm^2		**2**
	•[1] correct substitution into area of triangle formula	•[1] $\frac{1}{2}\times 12\times 8\times \frac{2}{3}$	
	•[2] calculate area	•[2] $32\left(cm^2\right)$	

Notes:

1. Correct answer without working — award 1/2

Commonly Observed Responses:

1. For $\frac{1}{2}\times 12\times 8\times \sin\frac{2}{3}=32$ — award 1/2 ×✓
2. For $\frac{1}{2}\times 12\times 8\times \sin\frac{2}{3}$ — award 0/2
3. For $\frac{1}{2}\times 12\times 8=48$ — award 0/2
4. For (a) $\frac{1}{2}\times 12\times 8\times 0\cdot\dot{6}=32$ or $\frac{1}{2}\times 12\times 8\times 0\cdot 666...=32$ — award 2/2
   (b) $\frac{1}{2}\times 12\times 8\times 0\cdot 67=32\cdot 16$ or $\frac{1}{2}\times 12\times 8\times 0\cdot 66=31\cdot 68$ — award 1/2 ×✓
   (c) $\frac{1}{2}\times 12\times 8\times 0\cdot 7=33\cdot 6$ or $\frac{1}{2}\times 12\times 8\times 0\cdot 6=28\cdot 8$ — award 0/2

Question	Generic scheme	Illustrative scheme	Max mark
8.	**Ans:** $x<5$		**3**
	•[1] expand bracket	•[1] $3x-6$	
	•[2] collect like terms	•[2] $-2x>-10$ or $10>2x$	
	•[3] solve for x	•[3] $x<5$ or $5>x$	

Notes:

1. Correct answer without valid working — award 0/3
   Treat guess and check as invalid working

Commonly Observed Responses

1. For $19+x>15+3x-6\rightarrow 2x>-10\rightarrow x>-5$ — award 1/3 ✓××
2. For $19+x>15+3x-2\rightarrow -2x>-6\rightarrow x<3$ — award 2/3 ×✓✓
3. For $19+x>18(x-2)\rightarrow 19+x>18x-36\rightarrow 55>17x\rightarrow \frac{55}{17}>x$ — award 2/3 ×✓✓
4. For (a) $19+x=15+3x-6\rightarrow -2x=-10\rightarrow x=5\rightarrow x<5$ — award 3/3
   (b) $19+x=15+3x-6\rightarrow -2x=-10\rightarrow x=5$ — award 2/3 ✓✓×

Question			Generic scheme	Illustrative scheme	Max mark
9.			**Ans:** 26° **Method 1** $\bullet^1$ calculate size of angle OBD $\bullet^2$ calculate size of angle ODB (ODB = OBD) $\bullet^3$ calculate size of angle CAB **Method 2** $\bullet^1$ calculate size of angle ABC $\bullet^2$ calculate size of angle OCB (OCB = 90 − ABC) $\bullet^3$ calculate the size of angle CAB	 $\bullet^1$ OBD = 32 $\bullet^2$ ODB = 32 $\bullet^3$ CAB = 26 $\bullet^1$ ABC = 32 $\bullet^2$ OCB = 58 $\bullet^3$ CAB = 26	**3**

Notes:

1. Check both methods and award the higher mark.
2. Full marks may be awarded for information marked on the diagram.
3. Where information is not marked on the diagram then working must clearly attach calculations to **named** angles.
4. For an answer of 26° with no relevant working — award 0/3
5. Where candidate uses triangle ABO, $\bullet^3$ is available for ABO = 90 and answer to CAB = 90 − AOB
   eg OBD = 32; AOB = 32; ABO = 90 and CAB = 58 — award 2/3 ✓×✓

Commonly Observed Responses:

Question	Generic scheme	Illustrative scheme	Max mark
10.	**Ans:** $b = \frac{Fc - t^2}{4}$ **or equivalent** •1 multiply by c •2 subtract t^2 •3 divide by 4	•1 $Fc = t^2 + 4b$ •2 $4b = Fc - t^2$ •3 $b = \frac{Fc - t^2}{4}$	**3**

Notes:

1. Correct answer without working 3/3

Commonly Observed Responses:

1. For $b = \frac{c \times f - t^2}{4}$ award 3/3
2. For $b = \frac{t^2 - Fc}{-4}$ award 3/3
3. For $b = \frac{Fc}{4} - \frac{t^2}{4}$ award 3/3

Question			Generic scheme	Illustrative scheme	Max mark
11.			**Ans:** $\frac{3-2a}{a^2}$ •[1] valid common denominator •[2] answer in simplest form	•[1] $\frac{}{a^2}$ or $\frac{}{a^3}$ or $\frac{}{a^2 \times a}$ •[2] $\frac{3-2a}{a^2}$	**2**

Notes:

1. Correct answer without working — award 2/2

2. For subsequent incorrect working, the final mark is not available
   eg $\frac{3-2\cancel{a}}{\cancel{a}^2} = \frac{3-2}{a} = \frac{1}{a}$ — award 1/2 ✓×

3. For $\frac{3}{a^2} - \frac{2}{a} = \frac{1}{a}$ — award 0/2

Commonly Observed Responses:

1. For $\frac{3a-2a^2}{a \times a^2}$ — award 1/2 ✓×

2. For $\frac{3}{a^2} - \frac{2a}{a^2}$ — award 1/2 ✓×

Question	Generic scheme	Illustrative scheme	Max mark
12.	**Ans:** $a=3, b=2$		**4**
	Method 1		
	$\bullet^1$ find $\overline{x}$	$\bullet^1$ $\overline{x}=4$	
	$\bullet^2$ find $\left(x-\overline{x}\right)^2$	$\bullet^2$ 9, 0, 4, 1, 4	
	$\bullet^3$ substitute into formula and start to evaluate	$\bullet^3$ $\sqrt{\frac{18}{4}}$	
	$\bullet^4$ find values of a and b	$\bullet^4$ $a=3, b=2$ or $\frac{3\sqrt{2}}{2}$	
	Method 2		
	$\bullet^1$ find $\sum x$ and $\sum x^2$	$\bullet^1$ $\sum x=20$ and $\sum x^2=98$	
	$\bullet^2$ substitute into formula	$\bullet^2$ $\sqrt{\frac{98-\frac{20^2}{5}}{5-1}}$	
	$\bullet^3$ start to evaluate	$\bullet^3$ $\sqrt{\frac{18}{4}}$	
	$\bullet^4$ find values of a and b	$\bullet^4$ $a=3, b=2$ or $\frac{3\sqrt{2}}{2}$	

Notes:

1. Correct answer without working — award 0/4
2. For $\frac{3\sqrt{2}}{2} \rightarrow a=3, b=\sqrt{2}$ with valid working — award 4/4
3. $\bullet^4$ is only available for simplifying $\sqrt{\frac{m}{n}}$ where m is **not** a perfect square

Commonly Observed Responses:

Question	Generic scheme	Illustrative scheme	Max mark
13.	**Ans:** (2·5, 5·5)		**3**
	•[1] evidence of scaling (match x or y coefficients)	•[1] eg $9x - 3y = 6$ $x + 3y = 19$	
	•[2] follow a valid strategy through to produce values for x and y	•[2] values for x and y	
	•[3] state correct x and y coordinates of P	•[3] $x = 2\cdot5, y = 5\cdot5$	

Notes:

1. Correct answer without working — award 0/3
2. For a solution obtained by guess and check — award 0/3

Commonly Observed Responses:

1. For $x = 2\cdot5, y = 5\cdot5 \rightarrow (5\cdot5, 2\cdot5)$ with valid working — award 3/3

Question			Generic scheme	Illustrative scheme	Max mark
14.	(a)		**Ans:** $a = 5$ •[1] state value of *a*	 •[1] 5	**1**
Notes: 1. Evidence may appear on the graph 2. Accept …$(x+5)^2$….. 3. Where **no answer** appears in (a), check (b) for evidence of $a=5$ eg $8 = (-3+5)^2 + b$					
Commonly Observed Responses:					
	(b)		**Ans:** $b = 4$ •[1] substitute (−3, 8) into equation •[2] state value of b	 •[1] $8 = (-3+5)^2 + b$ •[2] 4	**2**
Notes: 1. Correct answer without working award 2/2 1. Evidence may appear on the graph 2. An incorrect answer in (a) must be followed through (working must be shown) with the possibility of awarding 2/2.					
Commonly Observed Responses: 1. For (a) $a=3$ and (b) $b=8$ with or without working award (a) 0/1 and (b) 0/2					

Question	Generic scheme	Illustrative scheme	Max mark
15.	**Ans:** 6·5		**3**
	Method 1		
	•[1] find scale factor	•[1] $\frac{5}{7}$ or $\frac{7}{5}$	
	•[2] form equation	•[2] $(x=)\ \frac{5}{7}(x+2\cdot6)$ or $\frac{7}{5}x=x+2\cdot6$	
	•[3] find x	•[3] 6·5	
	Method 2		
	•[1] form equation	•[1] $\frac{x}{5}=\frac{x+2\cdot6}{7}$ or equivalent	
	•[2] start to solve	•[2] $7x = 5(x + 2.6)$ or equivalent	
	•[3] find x	•[3] 6·5	
	Method 3		
	•[1] state ratio	•[1] $5{:}2 \equiv x{:}\ 2{\cdot}6$ stated or implied by	
	•[2] start to solve	•[2] $2\cdot6\times\frac{5}{2}$	
	•[3] find x	•[3] 6·5	
	Method 4		
	•[1] state ratio	•[1] $\frac{2}{7}\text{PR}=2\cdot6$	
	•[2] start to solve	•[2] $\text{PR}=\frac{7}{2}\times2\cdot6\quad(=9\cdot1)$	
	•[3] find x	•[3] $(9\cdot1-2\cdot6=)\ 6\cdot5$	

Notes:

1. Correct answer without working — award 0/3

Commonly Observed Responses:

1. $\frac{5}{7}=\frac{x}{2\cdot6}\rightarrow x=\frac{13}{7}$ — award 1/3 ✓××

[END OF MARKING INSTRUCTIONS]