Course report 2019

Subject	Mathematics
Level	National 5

This report provides information on candidates' performance. Teachers, lecturers and assessors may find it useful when preparing candidates for future assessment. The report is intended to be constructive and informative and to promote better understanding. It would be helpful to read this report in conjunction with the published assessment documents and marking instructions.

The statistics used in this report have been compiled before the completion of any post-results services.

Section 1: comments on the assessment

The course assessment was accessible to the majority of candidates. Feedback suggested that it gave candidates a good opportunity to demonstrate the spread and depth of their knowledge of the subject at this level.

The examination largely performed as expected, but the overall level of demand was slightly higher than anticipated. The grade boundaries were adjusted to take account of this.

Question paper 1 (non-calculator)

Question paper 1 performed as expected, except for questions 5b, 7, 10a, 11, 13 and 15b, which candidates found more demanding than expected.

The majority of candidates made a good attempt at all questions apart from questions 13, 14 and 15b. Poor basic number skills resulted in some candidates not gaining marks in some questions.

Question paper 2

Question paper 2 performed as expected, except for questions 11 and 17, which candidates found more demanding than expected, and questions 15 and 19, which candidates found less demanding than expected.

The majority of candidates made a good attempt at all questions apart from questions 13, 16 and 17.

Section 2: comments on candidate performance

Areas that candidates performed well in

Question paper 1 (non-calculator)

Candidates performed well in the following areas:

Question 2 **Multiply a fraction by a mixed number**

Most candidates achieved full marks for $\frac{3}{8} \times \frac{12}{7} = \frac{9}{14}$.

However, some did not simplify $\frac{36}{56}$ correctly, or calculated 8×7 incorrectly.

Question 3 **Expand brackets and simplify**

Most candidates achieved full marks.

Question 5a **Calculate median and SIQR**

Most candidates found the median, although some found the mean. Most candidates knew how to find the SIQR but some were unable to carry out the calculations correctly; $8 - 3 \cdot 5 = 5 \cdot 5$ and $4 \cdot 5 \div 2 = 2 \cdot 21$ were common errors.

Question 8 **Simultaneous equations in context**

Nearly all candidates scored full marks in parts (a) and (b), although some inappropriately included units in their equations, for example $7c + 3g = 215\text{kg}$. Most candidates achieved 3 or 4 marks in part (c). Many candidates did not achieve the final mark for communication as they left their answer as $c = 20$ and $g = 25$, and did not state 'one bag of cement weighs 20kg and one bag of gravel weighs 25kg'.

Question paper 2

Candidates performed well in the following areas:

Question 1 **Appreciation**

Most candidates achieved full marks and used an efficient method to obtain the answer. There was little evidence of candidates using a year-by-year approach.

Question 2 **Magnitude of a 3D vector**

Most candidates achieved full marks but some incorrectly calculated: $\sqrt{6^2 + 27^2 + (-18)^2}$ as $\sqrt{36 + 729 - 324} = \sqrt{441} = 21$.

Question 3 **Area of triangle**

Most candidates achieved full marks but a few used the cosine rule to calculate the length of side QR.

Question 4 **Scientific notation calculation**

Many candidates achieved full marks. Most candidates were able to carry out a scientific notation calculation. Marks were lost by candidates who did not know how to calculate 8% of a quantity.

Common incorrect responses included:

- $3 \cdot 6 \times 10^{-6} \div 8 = 4 \cdot 5 \times 10^{-7}$
- $3 \cdot 6 \times 10^{-6} \div 8 \times 100 = 4 \cdot 5 \times 10^{-5}$
- $3 \cdot 6 \times 10^{-6} \div 108 \times 100 = 3 \cdot 3\ldots \times 10^{-6}$
- $3 \cdot 6 \times 10^{-6} \times 0 \cdot 92 = 3 \cdot 312 \times 10^{-6}$
- $3 \cdot 6 \times 10^{-6} \times 0 \cdot 8 = 2 \cdot 88 \times 10^{-6}$

Question 5 **3D coordinates**

Many candidates achieved full marks. Some responses were given as 2D coordinates and, in some cases, brackets were omitted.

Question 6 **Use quadratic formula to solve quadratic equation**

Many candidates achieved full marks. Almost all used the quadratic formula. Where marks were not awarded, it was usually for incorrect:

- substitution into the formula, for example $\dfrac{-9 \pm \sqrt{9^2 - 4 \times 3 \times 2}}{6}$ or $-9 \pm \dfrac{\sqrt{9^2 - 4 \times 3 \times (-2)}}{6}$
- calculation of the discriminant, for example $\sqrt{9^2 - 4 \times 3 \times (-2)} = 57$
- calculation of the roots, for example $\dfrac{-9 \pm \sqrt{105}}{6} = -10 \cdot 7, -7 \cdot 3$

Question 7 **Cosine rule**

Many candidates achieved full marks, although many did not realise that the smallest angle was opposite the shortest side and worked out two or all three of the angles before selecting the smallest one. Some candidates simply calculated the size of one of the larger angles.

Question 19 **Sine rule followed by trigonometry in right-angled triangle**

Most candidates achieved the first 3 marks for calculating the length of BK or BM. Some stopped at this point, believing they had found the height: some were unable to make further valid progress but a significant number continued to achieve full marks.

Alternative methods used to achieve the final 2 marks included:

- Equating alternative expressions for the area of triangle BKM, for example $\frac{1}{2} \times 350 \times 196 \cdot 2 \times \sin 52^\circ = \frac{1}{2} \times 350 \times \text{height}$
- Using right-angled triangle trigonometry and Pythagoras' theorem, for example in the right-angled triangle with hypotenuse BK:
- $\cos 52^\circ = \dfrac{a}{196 \cdot 2}$, followed by $\text{height} = \sqrt{196 \cdot 2^2 - a^2}$.

Areas that candidates found demanding

Question paper 1 (non-calculator)

The following questions proved challenging for many candidates

Question 7 **Change of subject**

Most candidates achieved partial credit in this question. Many did not:

- deal correctly with the $\frac{1}{2}$

  for example: $x = \frac{A}{\frac{1}{2}h} - y$ and $x = \frac{A-y}{\frac{1}{2}h}$ were common responses.

- expand the brackets correctly

  for example $A = \frac{1}{2}hx + hy$ and $A = \frac{1}{2}hx + y$ were common first steps.

Question 9 **Identify features of a quadratic function**

Most candidates achieved no mark for part (a); there were many 'no responses'. Common incorrect responses included: 4 and axis of symmetry = 4.

Most candidates achieved no mark for part (b)(i); many gave an answer of 4 instead of –4.

Most candidates achieved the mark for part (b)(ii), although some achieved this mark for giving the 'correct' answers to parts (i) and (ii) in reverse order.

Question 10 **2D vector pathway and components**

This topic is still proving to be difficult for candidates but there was a slight improvement in performance compared to similar questions in previous years. In part (a), some candidates identified a valid pathway but did not state the components of the resultant vector. Part (b) proved to be more demanding than part (a).

Question 12 **Surds: rationalise denominator and simplify**

Most candidates achieved partial credit in this question.
Many achieved the first mark for rationalising the denominator to obtain $\frac{\sqrt{80}}{40}$ or simplifying the denominator to obtain $\frac{\sqrt{2}}{2\sqrt{10}}$ but only a minority were able to progress correctly from there.

Question 13 **Interpret trigonometric graph**

Most candidates found this question challenging.
Some found the correct y coordinate but few found the correct x coordinate.
Common incorrect answers included $(45, \pm 3), (225, \pm 3)$ and $(-3, 135)$.

Question 14 **Linear equation with fractional coefficients**

Most candidates found this question challenging. Most were unable to correctly eliminate the denominators but some were able to achieve 1 or 2 marks for following through their working to obtain a consistent answer.

Question 15b **Construct and solve a quadratic equation**

Most candidates achieved no marks in this question; there were a significant number of ‘no responses’. Few realised that they had to solve a quadratic equation and therefore did not progress as far as the final 2 marks. Common errors included:

- using guess and check
- starting with $12t - 5t^2 = 17$
- not rearranging $12t - 5t^2 = \mp 17$ into $5t^2 - 12t \mp 17 = 0$ or equivalent.

Poor basic number skills resulted in many candidates dropping marks in the following questions:

Question 1 **Functional notation**

Most candidates knew to calculate $5 \times (-2)^3$ but 40 was a common answer.

Other answers often given were $5 \times \pm 6 = \pm 30$ and $5 \times \pm 16 = \pm 80$

Some candidates calculated $(5 \times -2)^3$ and gave answers of -1000 or 1000

Question 2 **Multiply a fraction by a mixed number**

This has been mentioned earlier in this report.

Question 4 **Length of arc**

Most candidates knew to calculate $\frac{240}{360} \times 3 \cdot 14 \times 60$ but many were unable to carry out the calculation correctly.

Some attempted to calculate $\frac{120}{360} \times 3 \cdot 14 \times 60$ or $\frac{240}{360} \times 3 \cdot 14 \times 30^2$ but were mostly unable to carry out the calculation correctly.

Question 5a **Calculate SIQR**

This has been mentioned earlier in this report.

Question 6a **Equation of line of best fit**

Common calculation errors included:

- incorrect evaluation of $\frac{14 - 8}{1 \cdot 5 - 3 \cdot 5}$
- incorrect calculation in expansion of brackets, for example $y - 8 = -3(x - 3 \cdot 5) \rightarrow y - 8 = -3x + 9 \cdot 5 \rightarrow y = -3x + 17 \cdot 5$

Question 6b **Substitute into equation of line of best fit**

Common calculation errors included:

- $\mathrm{F} = -3 \times 1 \cdot 1 + 18 \cdot 5 = -3 \cdot 1 + 18 \cdot 5 = 15 \cdot 4$
- (a) $\mathrm{F} = -3\mathrm{E} + 19 \rightarrow$ (b) $\mathrm{F} = -3 \times 1 \cdot 1 + 19 = -3 \cdot 3 + 19 = 16 \cdot 3$

Question 11 **Angle relationships**

Common errors included incorrect calculation of $360 \div 5$.

Question 15a **Evaluate a quadratic formula**

Most candidates achieved full credit for this question, but a common incorrect response was $12 \times 2 - 5 \times 2^2 = 24 - 100 = -76$.

Question paper 2

The following questions proved challenging for many candidates.

Question 11 **Converse of Pythagoras' theorem**

Few candidates achieved full marks. In many cases this was because they started by **assuming** that the triangle was right-angled. Some started with $BC^2 = 650^2 - 600^2 \rightarrow BC = 250$. Even when they correctly obtained 250 by using the perimeter of the triangle, some then stated that $600^2 + 250^2 = 650^2$, before they had calculated the values of $600^2 + 250^2$ and 650^2.
Candidates who used the cosine rule tended to achieve more marks than those who attempted to use the converse of Pythagoras' theorem.

Question 12b **Find angle at centre of sector**

There were a significant number of 'no responses' to this question.
Some candidates used πd instead of πr^2 or used $A = \frac{1}{2}ab\sin C$.

Candidates who started with $\frac{\text{angle}}{360} \times \pi r^2 = 2750$ were often unable to rearrange the equation to find the correct angle. Candidates who started with $\frac{\text{angle}}{360} = \frac{2750}{\pi r^2}$ had much more success in finding the correct angle since the resulting rearrangement was more straightforward.

Question 13 **Gradient and simplify algebraic fraction**

Most candidates achieved the first mark for $\frac{4p^2 - 9}{4p - 6}$ but could not proceed correctly from that point.

A lot of invalid cancelling was in evidence, for example $\frac{\cancel{4}p^2 - \cancel{9}^3}{\cancel{4}\cancel{p} - \cancel{6}^2} = \frac{p-3}{-2}$.

Another common response was $\frac{4p^2 - 9}{4p - 6} = \frac{-5p^2}{-2p} = 2 \cdot 5p$

Question 16 **Indices**

Most candidates achieved the first mark only.
Few knew to convert $\sqrt{a}$ to $a^{\frac{1}{2}}$.
A common response was $\frac{a^4 \times 3a}{\sqrt{a}} \times \frac{\sqrt{a}}{\sqrt{a}} = \frac{3a^5 \times \sqrt{a}}{a} = 3a^4 \times \sqrt{a}$.

Question 17 **Trigonometric Identity**

Most candidates made little progress towards a solution.
A common response from those who attempted to expand the bracket was $\sin x^2 + \sin x \cos x + \cos x \sin x + \cos x^2$.

Question 18 **Perpendicular bisector of a chord**

Candidates found this question more challenging than questions on this topic in previous years. Many candidates failed to identify a valid right-angled triangle but those who did usually achieved full marks. Many candidates added 15 to the circumference of the smaller circle, or calculated the sum of the circumferences of the two circles.

Section 3: preparing candidates for future assessment

The majority of candidates were well prepared to answer most questions. Working was usually displayed clearly and correct units were stated where appropriate.

The following advice may help prepare future candidates for the National 5 question papers:

- maintain and practise number skills (including mental) to prepare candidates for the non-calculator question paper. In paper 1, performance in number skills was disappointing, and cost many candidates valuable marks.
- maintain and practice basic algebraic skills, for example rearranging, factorising and simplifying. In both question papers, performance in basic algebraic skills was disappointing, and cost many candidates valuable marks.
- maintain and practise previously acquired skills. For example, many candidates seemed to have forgotten how to calculate a percentage of a quantity (paper 2 question 4) and the formula for the volume of a cylinder (paper 2 question 8).
- practise Converse of Pythagoras' Theorem questions. In paper 2 question 11, a significant number of candidates **assumed** that the triangle was right-angled and started by stating that $600^2 + 250^2 = 650^2$, before they had calculated the values of $600^2 + 250^2$ and 650^2.
- practise questions that require the communication of a reason or an explanation. Candidate performance in these types of questions is improving, but there are still many candidates who, for example, are unable to make valid comments when comparing data sets (for example paper 1 question 5b) or fail to achieve the final mark in simultaneous equations problems (for example paper 1, question 8c) as they do not communicate their final answer appropriately.
- practise questions involving two-dimensional vector pathways. Candidate performance in these types of questions has shown some improvement, but many candidates still achieved low marks in paper 1 question 10.
- Where questions involve angles in a diagram, encourage candidates to write the sizes of any angles they calculate in the appropriate place in the diagram. Calculations done elsewhere on the page and not clearly attached to any angle(s) are unlikely to gain marks.
- practise problem-solving skills where candidates are required to tackle questions that assess reasoning
- encourage candidates to avoid inappropriate premature rounding, which leads to inaccurate answers. For example, in paper 2 question 12a, a number of candidates lost a mark for rounding $\frac{5}{3}$ to 1·67 which leads to an incorrect answer of $2750 \div 1\cdot67^2 = 986$ cm^2 instead of 990 cm^2 .

Teachers and lecturers delivering the National 5 Mathematics course, and candidates undertaking the course, can consult the detailed marking instructions for the 2019 course assessment on SQA's website. The website also contains the marking instructions from previous years.

Grade boundary and statistical information:

Statistical information: update on courses

Number of resulted entries in 2018	41590

Number of resulted entries in 2019	41586

Statistical information: performance of candidates

Distribution of course awards including grade boundaries

Distribution of course awards	Percentage	Cumulative %	Number of candidates	Lowest mark
Maximum mark				
A	30.9%	30.9%	12847	74
B	18.1%	49.0%	7529	61
C	16.5%	65.5%	6865	49
D	14.6%	80.1%	6090	36
No award	19.9%	-	8255	-

General commentary on grade boundaries

SQA's main aim is to be fair to candidates across all subjects and all levels and maintain comparable standards across the years, even as arrangements evolve and change.

SQA aims to set examinations and create marking instructions that allow:

- a competent candidate to score a minimum of 50% of the available marks (the notional C boundary)
- a well-prepared, very competent candidate to score at least 70% of the available marks (the notional A boundary)

It is very challenging to get the standard on target every year, in every subject at every level.

Therefore, SQA holds a grade boundary meeting every year for each subject at each level to bring together all the information available (statistical and judgemental). The principal assessor and SQA qualifications manager meet with the relevant SQA head of service and statistician to discuss the evidence and make decisions. Members of the SQA management team chair these meetings. SQA can adjust the grade boundaries as a result of the meetings. This allows the pass rate to be unaffected in circumstances where there is evidence that the question paper has been more, or less, challenging than usual.

- The grade boundaries can be adjusted downwards if there is evidence that the question paper is more challenging than usual.
- The grade boundaries can be adjusted upwards if there is evidence that the exam is less challenging than usual.
- Where standards are comparable to previous years, similar grade boundaries are maintained.

Grade boundaries from question papers in the same subject at the same level tend to be marginally different year to year. This is because the particular questions, and the mix of questions, are different. This is also the case for question papers set by centres. If SQA alters a boundary, this does not mean that centres should necessarily alter their boundary in the question papers that they set themselves.