Course report 2022

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 appeals.

Grade boundary and statistical information

Statistical information: update on courses

Number of resulted entries in 2022	38295

Statistical information: performance of candidates

Distribution of course awards including grade boundaries

A	Percentage	36.8	Cumulative percentage	36.8	Number of candidates	14105	Minimum mark required	62
B	Percentage	17.9	Cumulative percentage	54.7	Number of candidates	6835	Minimum mark required	50
C	Percentage	15.0	Cumulative percentage	69.7	Number of candidates	5755	Minimum mark required	39
D	Percentage	14.0	Cumulative percentage	83.7	Number of candidates	5350	Minimum mark required	27
No award	Percentage	16.3	Cumulative percentage	N/A	Number of candidates	6250	Minimum mark required	N/A

You can read the general commentary on grade boundaries in appendix 1 of this report.

In this report:

- 'most' means greater than 70%
- 'many' means 50% to 69%
- 'some' means 25% to 49%
- 'a few' means less than 25%

You can find more statistical reports on the statistics page of SQA's website.

Section 1: comments on the assessment

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

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

Question paper 1 (non-calculator)

Question paper 1 performed as expected, except for questions 5(b), 6, 8(b), 9 and 15(b), which were more demanding than expected.

Question paper 2

Question paper 2 performed as expected, except for questions 3 and 5(b), which were more demanding than expected.

Section 2: comments on candidate performance

Question paper 1 (non-calculator)

Question 1 **Adding and multiplying fractions**

Candidates generally answered this question well, with many candidates scoring full marks.

Question 2 **Functional notation**

Most candidates substituted correctly into the function, but many were unable to carry out the evaluation correctly, particularly when finding the cube of –3.

Question 3 **Volume of a cone**

Most candidates substituted correctly into the formula for the volume of a cone, but many were unable to carry out the evaluation correctly.

Question 4 **Angle relationships**

Candidates generally answered this question well. Most candidates achieved partial credit and got at least as far as finding angle COE. Some did not recognise which angle they were calculating and did not achieve the final mark. ACE = 34 was a common final answer. Most candidates showed working on the diagram, but a few only wrote down working elsewhere on the page without attaching their calculations to named angles, and therefore did not achieve any marks.

Question 5a **Completing the square**

Candidates generally answered this question well. Most candidates got the correct bracket with the square but a few of them were unable to complete the process correctly.

Question 5b **Finding the turning point of a quadratic**

Only a few candidates gave the correct answer. Many of them did not realise that their answer to question 5(a) should have been used to get the answer to question 5(b). A few gave no response to this question or gave answers of (8, 15) or (–8, 15).

Question 6 **Finding the equation of a straight line**

Most candidates knew how to answer this question, but poor numeracy skills resulted in some of them only achieving partial credit. Common errors included incorrect evaluation of the following when finding the gradient:

$$\frac{7-(-1)}{-5-(-3)}$$

Another common error was incorrect calculation when expanding the brackets in the equation of the line, for example:

$$y-(-1) = -4(x-(-3)) \rightarrow y-1 = -4x+12 \rightarrow y = -4x+13$$

A few candidates substituted the x coordinates in place of the y coordinates, and vice versa, in the gradient formula and in the equation of the line.

Question 7 **Change of subject**

Candidates generally answered this question well, with many candidates scoring full marks. However, the presence of a squared term in the formula resulted in some candidates including a square root in their response.

Question 8 **Interpret trigonometric graph**

Most candidates answered part (a) correctly but only some answered part (b) correctly. Common responses to part (b) were 45, 1 and –3. A few candidates attempted to calculate 360 ÷ 45 in part (b) but got an answer of 7 or 9.

Question 9 **Cosine rule**

Many candidates achieved partial credit in this question. Common errors included incorrect substitution into the cosine rule, incorrect evaluation of chosen values, and failing to simplify or incorrectly simplifying the final answer.

Question 10 **Reverse percentage**

Many candidates achieved full marks in this question. A few knew how to answer the question but were unable to evaluate £16.10 ÷ 7 or £16.10 ÷ 70 correctly. Some calculated 30% of £16.10 and then added it on to £16.10.

Question 11 **Indices**

Most candidates achieved partial credit in this question; some candidates achieved full marks.

Candidates often lost marks for the incorrect application of:

$(m^a)^b = m^{ab}$ and $m^{-a} = \dfrac{1}{m^a}$

For example, common errors included $(m^{-2})^4 = m^2$ and $m^{-13} = -m^{13}$ *or* $m^{\frac{1}{13}}$

Question 12 **Division of algebraic fractions**

Many candidates achieved the first mark for knowing how to multiply the first fraction by the reciprocal of the second fraction. Some candidates cancelled correctly thereafter but multiplied the brackets out instead. Some candidates started by making a common denominator as if they were adding or subtracting the fractions.

Question 13 **Expanding brackets with surds**

Few candidates achieved full marks in this question, but some achieved partial credit. Many candidates did not multiply out the brackets correctly. In some cases this resulted from starting with:

$\sqrt{10}\left(\sqrt{8}\right) + 8\sqrt{5}$ or $\sqrt{2}\sqrt{5}\left(\sqrt{2}\sqrt{5} - \sqrt{2}\right) + 8\sqrt{5}$

and then multiplying out these brackets incorrectly. Other common errors included not recognising that $\sqrt{100} = 10$ or not expressing $\sqrt{20}$ in simplest form.

Question 14 **Sketching the graph of a quadratic**

Few candidates achieved full marks, some achieved partial credit and a few gave no response to this question. Some candidates were able to find the roots and/or the y-intercept but struggled to find the turning point and sketch the graph.

Question 15a **Finding an expression for the area of a triangle**

Some candidates gave an acceptable expression for the area of the triangle, but many did not use the basic formula for the area of a triangle. Common incorrect responses were:

$3x(x+12)$ and $\frac{3}{2}x(x+12)\sin C$

Question 15b **Constructing and solving a linear equation**

This question was challenging for many candidates. Few achieved full marks; some achieved partial credit and a few gave no response. Some did not equate the two areas but wrote down two equations — one for the triangle and another for the rectangle — and attempted to solve them independently. Of those who correctly equated the two areas, many were unable to deal with the fraction in the equation.

Question paper 2

Question 1 **Expanding brackets**

Candidates generally answered this question well, with many candidates scoring full marks.

Question 2 **Appreciation**

Candidates generally answered this question well, with many candidates scoring full marks.

Question 3 **Volume of a composite solid**

Few candidates achieved full marks in this question, although most achieved partial credit. A disappointing number of candidates could not recall the formula for the volume of a cuboid; some of the candidates who did recall the formula used 2.4 metres for the height rather than 2 metres. There was an increase in the number of candidates who either omitted units or stated incorrect units in their final answer than in previous years. A few candidates calculated the answer in cubic centimetres and then incorrectly converted into cubic metres by dividing by 100.

Question 4 **Construct and solve simultaneous equations in context**

Most candidates achieved full marks in parts (a) and (b) and achieved 3 or 4 marks in part (c).

Some candidates did not achieve the final mark for communication as they left their answer as, for example, $m = 0.8$ and $a = 0.35$, rather than stating 'a mango costs £0.80 and an apple costs £0.35.'

Question 5a **Calculate mean and standard deviation**

Most candidates achieved 3 or 4 marks in this question, with many achieving full marks.

Question 5b **Compare data using mean and standard deviation**

Few candidates achieved full marks in this question, although some achieved partial credit. Many responses showed that candidates did not have a clear understanding of the meaning of the terms ‘mean’ and ‘standard deviation’. Many responses did not include reference to the number of sit-ups. Common unacceptable responses included:

- The hockey team had a higher mean and lower standard deviation.
- The hockey team did more sit-ups.
- The hockey team’s results/scores were higher.
- The hockey team’s average sit-ups were better.
- The hockey team was more consistent.
- The hockey team’s sit-ups were more consistent.

Question 6 **Area of a triangle**

Most candidates achieved full marks in this question.

Question 7 **Using quadratic formula to solve a quadratic equation; rounding to two significant figures**

Most candidates achieved some marks in this question, with some achieving full marks. Those who achieved no marks often tried to factorise or rearrange the equation to obtain the solutions. Where candidates used the quadratic formula, they often lost marks for incorrect substitution into the formula, for example:

$$\frac{-2 \pm \sqrt{2^2 - 4 \times 4 \times 7}}{2 \times 4} \text{ or } -2 \pm \frac{\sqrt{2^2 - 4 \times 4 \times (-7)}}{2 \times 4}$$

or for incorrect calculation of the discriminant, for example:
$2^2 - 4 \times 4 \times (-7) = -108$.

Where candidates obtained a negative value for the discriminant, the negative sign was often ignored. A few candidates either did not round their final answer to two significant figures or rounded incorrectly.

Question 8 **Perpendicular bisector of a chord**

Candidates found this question less challenging than some questions on this topic in previous years. Candidates generally answered this well and many achieved full marks. Most candidates knew to use Pythagoras’ theorem but did not always use the correct form. For the final answer, some candidates incorrectly doubled the answer they obtained for the third side of the right-angled triangle instead of adding it to 2.9.

Question 9 **Trigonometric equation**

Many candidates achieved 2 or 3 marks in this question with some achieving full marks. A few candidates gave no response to this question. A common omission was to stop after finding the first solution. A few candidates rounded $\sin x$ to 0.7 or 0.6, and therefore obtained incorrect answers.

Question 10 **Finding angle at centre of circle given arc length**

This question was challenging for many candidates, but some achieved full marks. Many candidates started correctly but were often unable to rearrange their equation to find the correct angle. Other common errors included:

- calculating $\frac{69.4}{360} \times \pi \times 30$
- using $\frac{\text{angle}}{360} \times \pi \times 15^2$
- giving the size of the obtuse angle ACB rather than the reflex angle ACB as the final answer

Question 11 **3D Pythagoras' theorem**

This question was challenging for many candidates, but some achieved full marks. Many calculated the length of one of the face diagonals and then went no further. Some candidates did not know what to do, for example, some tried to find the volume of the cuboid.

Question 12 **Simplifying an algebraic fraction**

This question was challenging for many candidates, but some achieved full marks. Many did not recognise the common factor or difference of two squares, and did not attempt to factorise first, but incorrectly cancelled out individual terms in the numerator and denominator. For example, the following were common responses:

$$\frac{2a\cancel{b} + 6a}{b^{\cancel{2}} - 9} = \frac{2a + 6a}{b - 9} = \frac{8a}{b - 9} \text{ and } \frac{2a\cancel{b} + \cancel{6}^{2}a}{b^{\cancel{2}} - \cancel{9}_{3}} = \frac{2a + 2a}{b - 3} = \frac{4a}{b - 3}$$

Question 13 **Trigonometric identity**

This question was very challenging for most candidates and few achieved any marks. Most candidates did not realise they had to write the expression as two separate fractions before simplifying. A common incorrect response was:

$$\frac{\sin x + 2\cancel{\cos x}}{\cancel{\cos x}} = \sin x + 2$$

Another less frequent incorrect response was:

$$\frac{\sin x + 2\cos x}{\cos x} = \frac{\sin x}{\cos x} + 2\cos x = \tan x + 2\cos x$$

Question 14 **Sine rule followed by right-angled triangle trigonometry**

Many candidates achieved at least three marks in this question, with some achieving full marks and some achieving no marks. Many achieved the first three marks for calculating the length of AC or AD. Some opted to use the sine rule again rather than right -angled triangle trigonometry to obtain the final two marks. A few used strategies that were more complex than required to obtain the final two marks, for example, after finding AC using the sine rule to find AB and then using Pythagoras' theorem to find BC. A few candidates lost the opportunity to achieve one of the calculation marks because of inappropriate premature rounding in their intermediate calculations.

Section 3: preparing candidates for future assessment

Centres deserve credit for the preparation of candidates for the National 5 Mathematics course assessment. The majority of candidates were well prepared to answer most questions. Candidates usually displayed working clearly and stated correct units where appropriate.

Question papers 1 and 2 — non-calculator and calculator

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

- Maintain and practise number skills in preparation for the non-calculator question paper. In question paper 1, performance in number skills was disappointing, and cost some candidates valuable marks.
- Maintain and practise basic algebraic skills. For example, rearranging, factorising and simplifying. In both question papers, performance in basic algebraic skills was disappointing, and cost some candidates valuable marks.
- Consider teaching working with quadratic graphs of the form $y = (x + p)^2 + q$ along with completing the square. Many candidates did not realise the link between these different forms of expression (question paper 1, questions 5(a) and 5(b)).
- Maintain and practise previously acquired skills. For example, many candidates seemed to have forgotten the basic formula for the area of a triangle (question paper 1, question 15(a)) and the formula for the volume of a cuboid (question paper 2, question 3).
- Practise questions that require the communication of a reason or an explanation. There are still too many candidates who, for example, did not achieve the final mark in simultaneous equations problems (question paper 2, question 4(c)) as they did not communicate their final answer appropriately or were unable to make valid comments when comparing data sets (question paper 2, question 5(b)). In the case of question paper 2, question 5(b), the marking instructions contain examples of acceptable and unacceptable comments.
- Where questions involve angles in a diagram, encourage candidates to write sizes of any angles they calculate in the appropriate part of the diagram. Calculations done elsewhere on the page and not clearly attached to any angles are unlikely to achieve marks.
- Encourage candidates to avoid inappropriate premature rounding, as this leads to incorrect answers. For example, some candidates lost a mark in question paper 2, question 9 for rounding:

  $\sin x = \frac{2}{3}$ to $\sin x = 0.7$

  This leads to answers of $44.4°$ and $135.6°$ rather than the correct answers of $41.8°$ and $138.2°$.
- Practise problem solving skills as candidates will be required to tackle questions that assess reasoning.

Teachers and lecturers delivering the National 5 Mathematics course, and candidates undertaking the course, can consult the detailed marking instructions for the 2022 question papers on SQA’s website. The website also contains the marking instructions from previous years.

Appendix 1: general commentary on grade boundaries

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

For most National Courses, SQA aims to set examinations and other external assessments and create marking instructions that allow:

- a competent candidate to score a minimum of 50% of the available marks (the notional grade C boundary)
- a well-prepared, very competent candidate to score at least 70% of the available marks (the notional grade 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 for each course to bring together all the information available (statistical and qualitative) and to make final decisions on grade boundaries based on this information. Members of SQA's Executive Management Team normally chair these meetings.

Principal assessors utilise their subject expertise to evaluate the performance of the assessment and propose suitable grade boundaries based on the full range of evidence. SQA can adjust the grade boundaries as a result of the discussion at these meetings. This allows the pass rate to be unaffected in circumstances where there is evidence that the question paper or other assessment has been more, or less, difficult than usual.

- The grade boundaries can be adjusted downwards if there is evidence that the question paper or other assessment has been more difficult than usual.
- The grade boundaries can be adjusted upwards if there is evidence that the question paper or other assessment has been less difficult than usual.
- Where levels of difficulty 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 on year. This is because the specific questions, and the mix of questions, are different and this has an impact on candidate performance.

This year, a package of support measures including assessment modifications and revision support, was introduced to support candidates as they returned to formal national exams and other forms of external assessment. This was designed to address the ongoing disruption to learning and teaching that young people have experienced as a result of the COVID-19 pandemic. In addition, SQA adopted a more generous approach to grading for National 5, Higher and Advanced Higher courses than it would do in a normal exam year, to help ensure fairness for candidates while maintaining standards. This is in recognition of the fact that those preparing for and sitting exams have done so in very different circumstances from those who sat exams in 2019.

The key difference this year is that decisions about where the grade boundaries have been set have also been influenced, where necessary and where appropriate, by the unique circumstances in 2022. On a course-by-course basis, SQA has determined grade boundaries in a way that is fair to candidates, taking into account how the assessment (exams and coursework) has functioned and the impact of assessment modifications and revision support.

The grade boundaries used in 2022 relate to the specific experience of this year's cohort and should not be used by centres if these assessments are used in the future for exam preparation.

For full details of the approach please refer to the National Qualifications 2022 Awarding — Methodology Report.

