Course Report 2016

Subject	Mathematics
Level	National 5

The statistics used in this report have been compiled before the completion of any Post Results Services.

This report provides information on the performance of candidates which it is hoped will be useful to teachers, lecturers and assessors in their preparation of candidates for future assessment. It 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.

Section 1: Comments on the Assessment

Summary of the course assessment

The course assessment was found to be accessible to the majority of candidates. Feedback suggests that it gave candidates a good opportunity to demonstrate the spread and depth of their knowledge of the subject at this level. The course assessment performed as expected. As a result of this the grade boundaries were set at the notional values

Section 2: Comments on candidate performance

The majority of candidates made a good attempt at all questions apart from questions 7 (b), 8, 11, 12 (b) and 12 (c) in Paper 1, and question 16 in Paper 2. Some candidates scored very high marks, but others scored very low marks, and were perhaps inappropriately presented at this level. Most candidates wrote clearly, showed all appropriate working and stated correct units for their answers where required. However, poor basic number skills prevented many candidates from gaining some of the marks in non-calculator questions.

Areas in which candidates performed well

Component 1 — question paper: Paper 1 (Non-Calculator)

Question 2: **2D Vector components.** Most candidates scored full marks but many did not achieve the final mark due to poor basic numeracy, eg

$$\begin{pmatrix} 2 \\ -3 \end{pmatrix} + \begin{pmatrix} -5 \\ -1 \end{pmatrix} = \begin{pmatrix} -3 \\ -2 \end{pmatrix}$$

was a common error.

Question 4: **Construct and solve simultaneous equations.** Nearly all candidates scored full marks in parts (a) and (b). More candidates than previously scored full marks in part (c), but there are still many who did not achieve the final mark, which required correct **communication** of the answer to the problem. In these cases, the working usually stopped after finding the values $c = 1{\cdot}5$ and $d = 2{\cdot}2$, but did not continue to state that, eg a cloak required $1{\cdot}5$ m^2 and a dress required $2{\cdot}2$ m^2 of material.

Question 9: **Functional notation and rationalising the denominator of a surd**. Most candidates did well in this question.

Question 12 (a): **Construct an expression for the area of a rectangle.** Most candidates answered this question correctly.

Component 2 — question paper: Paper 2

Question 1: **Depreciation.** Most candidates scored full marks. Most were using a multiplier method rather than working through each year separately.

Question 6 (a): **Calculate mean and standard deviation of a data set**. Most candidates scored full marks.

Question 7: **Volume of a composite solid**. Most candidates scored three or more marks in this question. Where marks were dropped, it was usually for leaving the final answer in unrounded form, adding instead of subtracting the two volumes, incorrectly substituting diameters in place of radii into the volume formulae, or incorrectly substituting height = 10·5 into the volume formula for one of the cones.

Areas which candidates found demanding

Component 1 — question paper: Paper 1 (Non-Calculator)

Question 3: **Area of a sector of a circle.** Most candidates knew to calculate

$$\frac{45}{360} \times 3 \cdot 14 \times 20^2$$

but few were able to carry out the calculation correctly.

Question 5 (b): **Substitution into the equation of a line of best fit.** There was a disappointing response to this question. Common errors included:

- 20 × 12 calculated incorrectly
- substituting 1 year instead of 12 months into the equation

Question 6: **Use of discriminant.** Most candidates stated a conclusion which was consistent with the value they calculated for the discriminant, however a common error in calculating the discriminant was

$5^2 - 4 \times 7 \times (-1) = -3$.

Question 7 (a): **Three dimensional coordinates.** There was a disappointing response to this question. (10, 4, 0) was a common incorrect response.

Question 7 (b): **Pythagoras' theorem in three dimensions.** Many candidates failed to correctly apply Pythagoras' theorem twice. The majority calculated the distance from the apex of the pyramid (i) either to the midpoint of the edge on the *x*-axis ie

$$\sqrt{6^2 + 2^2} = \sqrt{40}$$

(ii) or to the midpoint of the side parallel to and nearest to the *y*-axis ie

$$\sqrt{6^2 + 3^2} = \sqrt{45},$$

and proceeded no further. Candidates who used position vectors to calculate

$|\overrightarrow{AV}|$

were able to achieve full credit. However, a knowledge of position vectors is not a requirement of the course.

Question 8: **Equation with fractional coefficients.** Most candidates expressed the left hand side of the equation as a single fraction but were unable to correctly eliminate the fraction from the equation and therefore made little progress towards a solution.

Question 11: **Trigonometric identity.** Most candidates made little progress towards a solution. Some wrote down

$\sin^2 x + \cos^2 x = 1$

And

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

but didn't know how to proceed from there.

Question 12 (b): **Construct a quadratic equation.** Most candidates were unable to find the correct expression for the area of the triangle; many appeared to have forgotten how to find the area of a triangle and were therefore unable to make much progress towards a solution. Many candidates attempted to solve the given equation in this part instead of in part (c).

Question 12 (c): **Solve a quadratic equation in a problem.** There was a disappointing response to this question. Some candidates used a guess and check method to obtain solutions. Many who did attempt to use a valid method did not achieve full credit for a number of reasons including:

- factorising incorrectly
- stating incorrect roots from a correctly factorised equation
- not rejecting the negative root
- not stating the length and breadth of the rectangle

Component 2 — question paper: Paper 2

Question 2: **Scientific notation calculation.** Common errors included:

- dividing the wrong way around
- multiplying instead of dividing

Question 3: **2D Vector pathway.** A significant number of candidates did not attempt this question and of those who did, many were unable to answer it correctly.

Question 4: **Factorising.** Most candidates were able to deal with the common factor but many were unable to deal with the subsequent difference of two squares. Common incorrect responses were $(3x - 8)(x + 6)$ and $(3x + 8)(x - 6)$.

Question 6 (b): **Interpret calculated statistics.** Although responses to this type of question continue to improve, many candidates are still making statements that fail to show a clear understanding of the **meaning** of the terms 'mean' and 'standard deviation'.

Common unacceptable responses included:

- Sophie's mean waiting time is more
- her waiting time is longer (*implying that **all** her waiting times are longer*)
- Sophie's standard deviation is less
- on average her waiting times are less varied
- her standard deviation is more consistent

Question 10: **Indices.** A significant number of candidates incorrectly stated that $(n^2)^3 = n^5$ but most went on to gain the mark for correctly multiplying the two terms. However, most were unable to deal with the negative power.

Question 11: **Areas of similar shapes.** Most candidates gained a mark for obtaining the linear scale factor but did not square it therefore obtaining an answer of £8·25.

Question 12: **Change of subject.** Many candidates could not deal appropriately with the square root. A common response was

$$L + p = \sqrt{4kt} \rightarrow \frac{L+p}{4t} = \sqrt{k} \rightarrow k = \left(\frac{L+p}{4t}\right)^2.$$

Question 13: **Add algebraic fractions.** Most candidates gained the first two marks for

$$\frac{3(x+1)+5(x-2)}{(x-2)(x+1)}$$

but then made subsequent errors eg

- incorrect (and unnecessary) expansion of the denominator $\frac{8x-7}{x^2-2}$
- invalid cancelling of terms $\frac{3\cancel{(x+1)}+5\cancel{(x-2)}}{\cancel{(x-2)}\cancel{(x+1)}} = \frac{3+5}{1} = 8$

Some candidates incorrectly cancelled terms subsequent to a correct answer eg

$$\frac{8\cancel{x}-7}{x^2-\cancel{x}-2} = \frac{8-7}{x^2-1-2} = \frac{1}{x^2-3}.$$

Question 14: **Trigonometric equation.** Most candidates gained the first mark for obtaining

$$\tan x = -\frac{9}{2}$$

but many were unable to proceed from there and find two valid solutions.

Common errors included:

- $\tan x = -\frac{9}{2} \rightarrow x = 180 - (-77 \cdot 5) = 257 \cdot 5$ and $x = 360 - (-77 \cdot 5) = 437 \cdot 5$
- $\tan x = \frac{9}{2} \rightarrow x = 77 \cdot 5$ and $x = 180 + 77 \cdot 5 = 257 \cdot 5$
- $2\tan x = -4 + 5 \rightarrow 2\tan x = 1 \rightarrow \tan x = \frac{1}{2} \rightarrow x = 26 \cdot 6$ and $x = 180 + 26 \cdot 6 = 206 \cdot 6$

Question 16: **Right-angled triangle trigonometry and cosine rule.** The few candidates who used the fact that

$\cos A = \frac{3}{4}$

in right-angled triangle ADE usually continued to score full marks for this question. The most common responses involved the use of Pythagoras' theorem to calculate:

- the length of BC in triangle BCD by incorrectly assuming angle BCD = 90º
- the length of DE in triangle ADE and then proceeding no further

Section 3: Advice for the preparation of future candidates

Centres deserve credit for the preparation of candidates for the National 5 Mathematics course assessment. The majority of candidates were well prepared in dealing with most questions, working was usually displayed clearly, and correct units were stated where appropriate.

Some advice that may help prepare candidates for the demands of the N5 examination:

- In Paper 1, performance in number skills was disappointing, and cost many candidates valuable marks. Centres should consider how best to maintain and practise number skills in preparation for the non-calculator paper in the course assessment.
- Centres should consider how best to maintain and practise previously-acquired skills. For example, many candidates seemed to have forgotten how to find the area of a triangle (Paper 1 Question 12 (b)) and how to apply simple right-angled triangle trigonometry (Paper 2 Question 16).
- There is evidence that candidate performance in questions which require the communication of a reason or explanation of a solution is improving, but centres should continue to consider how best to practise these types of questions as many candidates are still unable to make valid comments for example when comparing sets of data.
- Centres should consider how best to practise two-dimensional vector pathway questions. Many candidates could not correctly answer the relatively straightforward Question 3 in Paper 2.

- Centres should consider how best to practise ‘show that’ questions. For example, in Paper 1 Question 12 (b) many candidates interpreted ‘show that $x^2 - 2x - 8 = 0$ ’ as ‘solve $x^2 - 2x - 8 = 0$ ’.
- Centres should encourage candidates to avoid inappropriate premature rounding, which leads to inaccurate answers.
- Centres should consider how best to practise problem solving skills, which candidates require to tackle questions that assess reasoning.
- The SQA website contains the Marking Instructions for the 2016 course assessment (as well as previous years). All those teaching National 5 Mathematics, and candidates undertaking the course, will find further advice and guidance in these detailed Marking Instructions.

Grade Boundary and Statistical information:

Statistical information: update on Courses

Number of resulted entries in 2015	36475

Number of resulted entries in 2016	41780

Statistical information: Performance of candidates

Distribution of Course awards including grade boundaries

Distribution of Course awards	%	Cum. %	Number of candidates	Lowest mark
Maximum Mark -				
A	29.0%	29.0%	12131	63
B	16.9%	45.9%	7063	54
C	17.3%	63.2%	7218	45
D	8.6%	71.8%	3593	40
No award	28.2%	-	11775	-

General commentary on grade boundaries

- While SQA aims to set examinations and create marking instructions which will allow a competent candidate to score a minimum of 50% of the available marks (the notional C boundary) and 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.

- Each year, SQA therefore holds a grade boundary meeting for each subject at each level where it brings together all the information available (statistical and judgemental). The Principal Assessor and SQA Qualifications Manager meet with the relevant SQA Business Manager and Statistician to discuss the evidence and make decisions. The meetings are chaired by members of the management team at SQA.

- The grade boundaries can be adjusted downwards if there is evidence that the exam is more challenging than usual, allowing the pass rate to be unaffected by this circumstance.

- The grade boundaries can be adjusted upwards if there is evidence that the exam is less challenging than usual, allowing the pass rate to be unaffected by this circumstance.

- Where standards are comparable to previous years, similar grade boundaries are maintained.

- An exam paper at a particular level in a subject in one year tends to have a marginally different set of grade boundaries from exam papers in that subject at that level in other years. This is because the particular questions, and the mix of questions, are different. This is also the case for exams set in centres. If SQA has already altered a boundary in a particular year in, say, Higher Chemistry, this does not mean that centres should necessarily alter boundaries in their prelim exam in Higher Chemistry. The two are not that closely related, as they do not contain identical questions.

- 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.