National
Qualifications
SPECIMEN ONLY

S844/75/02

Applications of Mathematics
Paper 2

Marking Instructions

These marking instructions have been provided to show how SQA would mark this specimen question paper.

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General marking principles for National 5 Applications of 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 generic scheme and illustrative scheme. The generic scheme indicates the rationale for which each mark is awarded. The illustrative scheme covers methods which are commonly seen throughout the marking. 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 <u>always</u> 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.

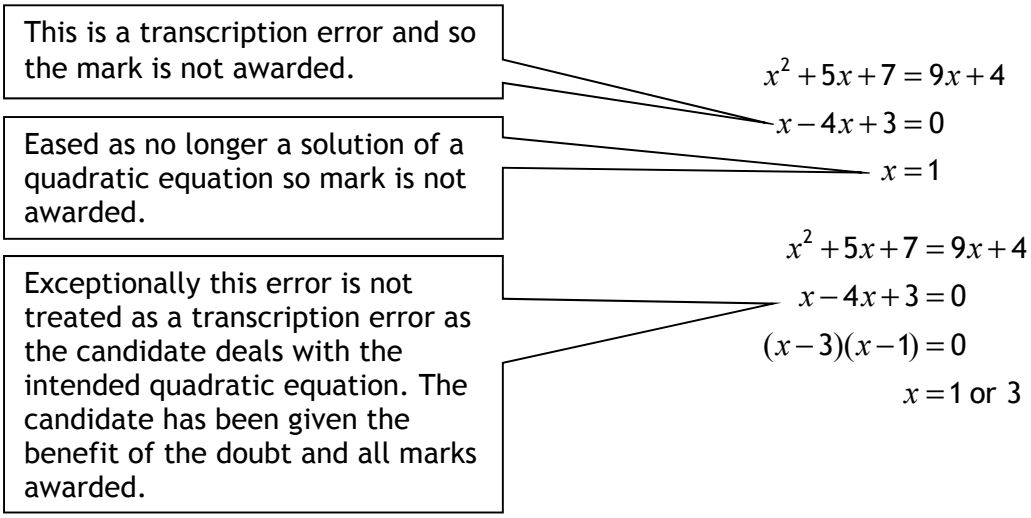
(f) Working subsequent to an error must be **followed through**, with possible credit for the subsequent working, provided that the level of difficulty involved is approximately similar. Where, subsequent to an error, the working for a follow through mark has been eased, the follow through mark cannot 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 $6 \times 6 = 12$ 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

$\frac{15}{0{\cdot}3}$ 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) 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

(n) 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.

(o) 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.

(p) 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.

(q) 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.

Marking instructions for each question

Question			Generic scheme	Illustrative scheme	Max mark
1			**Ans: (£)688 000** •[1] Strategy: identify multiplier •[2] Strategy: identify power •[3] Process: calculate value •[4] Communication: round answer to 3 significant figures	•[1] 0·959 •[2] …[3] •[3] 687939·7816 •[4] 688 000	**4**
2			**Ans: Correct amount marked on gauge** •[1] Process: calculate amount of fuel remaining, as a fraction •[2] Communication: mark on gauge consistent with working	•[1] 24/64 or equivalent •[2] Evidence	**2**

Question			Generic scheme	Illustrative scheme	Max mark
3	(a)	(i)	**Ans: ($\bar{x}$ =) 48·7** •1 Process: calculate mean	 •1 ($\bar{x}$ =) 48·7	1
		(ii)	**Ans: (*s* =) 1·24** •2 Process: calculate $(x-\bar{x})^2$ •3 Strategy: substitute into formula •4 Process: calculate standard deviation	 •2 0·81, 0·16, 2·25, 0·64, 3·24, 0·64 •3 $\sqrt{\frac{7\cdot74}{5}}$ •4 (*s* =) 1·24	
	(b)		**Ans: Two valid comments.** •1 Communication: comment regarding the mean •2 Communication: comment regarding standard deviation	 •1 On average, the athlete's times have increased training with the coach. •2 The athlete's times are more consistent after training with the coach.	2
4			**Ans: Pie chart constructed** •1 Strategy/process: interpret graph and state fraction for each type of car •2 Process: calculate angles •3 Process/communication: construct pie chart	 •1 $\frac{30}{150}, \frac{65}{150}, \frac{55}{150}$ or equivalent •2 72°, 156°, 132° •3 Pie chart completed with labels	3

Question			Generic scheme	Illustrative scheme	Max mark
5	(a)		**Ans: 252 (boxes)** •[1] Strategy: consider three options •[2] Process: find number of boxes for one option •[3] Process/communication: find at least one other option and state maximum	 •[1] evidence •[2] 210 or 210 or 252 •[3] 252	**3**
	(b)		**Ans: £2·49** •[1] Process: calculate total cost of sending boxes •[2] Process: calculate cost per handbag	 •[1] £1755 + 252 × £2·99 = £2508·48 •[2] £2508·48 ÷ 252 ÷ 4 = £2·49	**2**

Question			Generic scheme	Illustrative scheme	Max mark
6	(a)		**Ans: (£)4269·20** •[1] Process: calculate first rate National Insurance •[2] Process: calculate second rate National Insurance •[3] Process: calculate annual National Insurance contributions	 •[1] $0{\cdot}12 \times (42380 - 8060) = 4118{\cdot}40$ •[2] $0{\cdot}02 \times (49920 - 42380) = 150{\cdot}80$ •[3] $4118{\cdot}40 + 150{\cdot}80 = 4269{\cdot}20$	**3**
	(b)		**Ans: (£)2857·33** •[1] Process: calculate pension contribution •[2] Process: calculate annual net salary •[3] Process: calculate monthly net pay	 •[1] $0{\cdot}09 \times 49920 = 4492{\cdot}80$ •[2] $49920 - (4492{\cdot}80 + 4269{\cdot}20 + 6870{\cdot}04) = 34287{\cdot}96$ •[3] $(34287{\cdot}96 \div 12) = 2857{\cdot}33$	**3**
	(c)		**Ans: He will have enough.** •[1] Process: calculate surplus/deficit •[2] Communication: make conclusion	 •[1] $2857{\cdot}33 - (750 + 450 + 625 + 125 + 350) = 557{\cdot}33$ •[2] Yes. He will have enough.	**2**

Question			Generic scheme	Illustrative scheme	Max mark
7	(a)		**Ans: Route correctly drawn** •1 Process: calculate scale distances •2 Process/communication: correct bearing measured and correct length drawn •3 Process/communication: correct bearing measured and correct length drawn	 •1 $22 \div 5 = 4{\cdot}4$ cm $37 \div 5 = 7{\cdot}4$ cm •2 Bearing of 045°(±1°) measured correctly and 4·4 cm(±0·1 cm) correctly drawn •3 Bearing of 170°(±1°) measured correctly	**3**
	(b)		**Ans: 314 (°)** •1 Process: bearing consistent with diagram **Ans: 30·5(miles)** •2 Process: distance consistent with diagram	 •1 314 •2 6·1 cm so 30·5 miles	**2**
	(c)		**Ans: 20·26 mph** •1 Process: calculate total distance •2 Process: calculate decimal time •3 Process: calculate average speed	 •1 $30{\cdot}5 + 22 + 37 = 89{\cdot}5$ •2 8 hour 30 min − 4 hour 5 min = 4 hour 25 min $4\frac{25}{60} = 4{\cdot}416\ldots$ •3 $\frac{89{\cdot}5}{4{\cdot}416\ldots} = 20{\cdot}264\ldots$	**3**

Question			Generic scheme	Illustrative scheme	Max mark
8	(a)	(i)	**Ans: \$183**		**2**
			•[1] Strategy: identify the costs not included	•[1] \$32 and \$37	
			•[2] Process: calculate the cost for card 1	•[2] \$114 + 32 + 37 = \$183	
		(ii)	**Ans: \$157 supported by working**		**4**
			•[3] Strategy: identify the "missing" attraction and the two cheapest attractions	•[3] \$24, \$32 and \$30	
			•[4] Process: calculate the cost for card 2	•[4] \$71 + \$24 + \$32 + \$30 = \$157	
			•[5] Process: state cost of card 3	•[5] \$180	
			•[6] Communication: state the cheapest price	•[6] \$157	
	(b)		**Ans: £1 gives \$1·555 or \$1 gives £0·643**		**2**
			•[1] Strategy: evidence of knowing to divide	•[1] 157 ÷ 100·96 or 100·96 ÷ 157	
			•[2] Process: state rounded answer	•[2] £1 gives \$1·555 or \$1 gives £0·643	

Question			Generic scheme	Illustrative scheme	Max mark
9	(a)		**Ans: 9(m)** •[1] Strategy/process: use Pythagoras Theorem to calculate hypotenuse •[2] Process: calculate diameter	 •[1] 25 •[2] $25 - 16 = 9$	**2**
	(b)		**Ans: 118·2(m^2)** •[1] Strategy: triangle – semi circle •[2] Process: find the area of the pond •[3] Process: calculate the area to be covered with chips	 •[1] evidence •[2] $\frac{1}{2} \times \pi \times 4{\cdot}5^2 = 31{\cdot}808\ldots$ •[3] $150 - 31{\cdot}808\ldots = 118{\cdot}191\ldots$	**3**
	(c)		**Ans: (£)613·83** •[1] Process: Calculate weight of chips required •[2] Process: Calculate number of bags required •[3] Process: Calculate cost	 •[1] $118{\cdot}2 \div 20 \times 1000 = 5910$ •[2] $5910 \div 25 = 236{\cdot}4$, 237 bags •[3] $237 \times 2{\cdot}59 = 613{\cdot}83$	**3**

Question			Generic scheme	Illustrative scheme	Max mark
10	(a)		**Ans: 32 candles**		**3**
			•[1] Strategy: know how to use ratio	•[1] evidence of knowing how to scale up the ratio	
			•[2] Process: find total amount of wax used	•[2] $12000 + 4000 + 8000 = 24000\,cm^3$	
			•[3] Process: find number of candles	•[3] $24000 \div 729 = 32{\cdot}92... = 32$	
			Alternative Strategy:		
			•[1] Strategy: know how to use ratio	•[1] evidence of 3/6 of 729	
			•[2] Process: finds volume of red wax available and volume of red wax in candle	•[2] $12000\,cm^3$ and $364{\cdot}5$	
			•[3] Process: find number of candles	•[3] $12000 \div 364{\cdot}5 = 32{\cdot}92$ rounded to 32	
	(b)		**Ans: (£)2·43/2·42**		**3**
			•[1] Process: find cost of wax plus wicks	•[1] $3 \times 13{\cdot}75 + 32 \times 0{\cdot}18 = 47{\cdot}01$	
			•[2] Process: add 65%	•[2] $47{\cdot}01 \times 1{\cdot}65 = 77{\cdot}57$	
			•[3] Process: find selling price of 1 candle	•[3] $77{\cdot}57 \div 32 = 2{\cdot}424... = 2{\cdot}43$	

Question			Generic scheme	Illustrative scheme	Max mark
	(c)		**Ans: no supported by working**		**7**
			•[1] Strategy: knows how to find compound volume	•[1] evidence	
			•[2] Strategy: substitute into cylinder formula	•[2] $V = \pi \times 3{\cdot}5 \times 3{\cdot}5 \times 12$	
			•[3] Process: find volume of cylinder	•[3] 461·8 (or 461·58)	
			•[4] Strategy: substitute into cone formula	•[4] $V = \frac{1}{3}\pi \times 3{\cdot}5 \times 3{\cdot}5 \times 4$	
			•[5] Process: find volume of cone	•[5] 51·3	
			•[6] Process: find the number of candles that can be made	•[6] $461{\cdot}8 + 51{\cdot}3 = 513{\cdot}1$, $12000 \div 513{\cdot}1 = 23{\cdot}38$	
			•[7] Communication: valid conclusion	•[7] no he can't make 25 candles	

[END OF SPECIMEN MARKING INSTRUCTIONS]