National
Qualifications
2021
RESOURCE

2021 Mathematics
Paper 1 (Non-calculator)

National 5

Finalised Marking Instructions

These marking instructions have been prepared by examination teams for use by SQA appointed markers when marking external course assessments.

General marking principles for National 5 Mathematics

Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.

For each question, the marking instructions are generally in two sections:

- *generic scheme — this indicates why each mark is awarded*
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In general, you should use the illustrative scheme. Only use the generic scheme where a candidate has used a method not covered in the illustrative scheme.

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(b) If you are uncertain how to assess a specific candidate response because it is not covered by the general marking principles or the detailed marking instructions, you must seek guidance from your team leader.

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

(d) If a candidate's response contains an error, all working subsequent to this error must still be marked. Only award marks if the level of difficulty in their working is similar to the level of difficulty in the illustrative scheme.

(e) Only award full marks where the solution contains appropriate working. A correct answer with no working receives no mark, unless specifically mentioned in the marking instructions.

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

(g) If an error is trivial, casual or insignificant, for example 6 x 6 = 12, candidates lose the opportunity to gain a mark, except for instances such as the second example in point (h) below.

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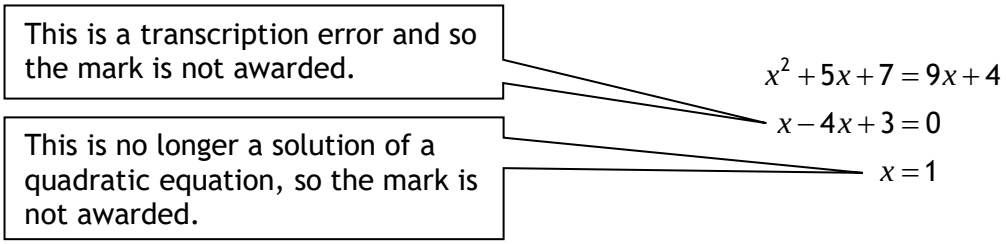

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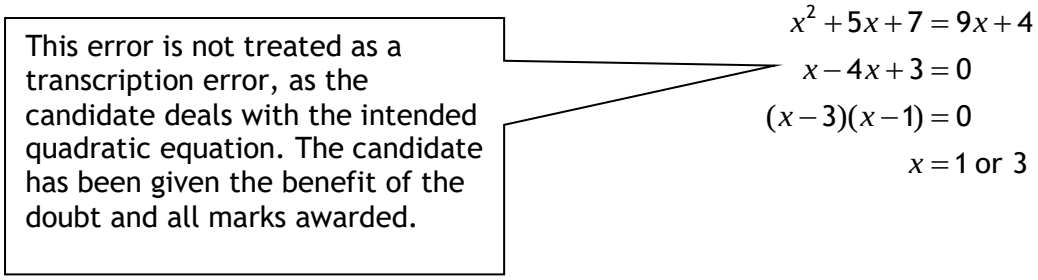

(i) Horizontal/vertical marking

If a question results in two pairs of solutions, apply the following technique, 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 $y=-7$

You must choose whichever method benefits the candidate, **not** a combination of both.

(j) In final answers, candidates should simplify numerical values as far as possible unless specifically mentioned in the detailed marking instruction. For example

$\frac{15}{12}$ 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.

(k) Do not penalise candidates for any of the following, unless specifically mentioned in the detailed marking instructions:

- working subsequent to a correct answer
- correct working in the wrong part of a question
- legitimate variations in numerical answers/algebraic expressions, for example angles in degrees rounded to nearest degree
- omission of units
- bad form (bad form only becomes bad form if subsequent working is correct), for example

  $(x^3 + 2x^2 + 3x + 2)(2x + 1)$ written as

  $(x^3 + 2x^2 + 3x + 2) \times 2x + 1$

  $= 2x^4 + 5x^3 + 8x^2 + 7x + 2$

  gains full credit

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

(l) In any 'Show that…' question, where candidates have to arrive at a required result, the last mark is not awarded as a follow-through from a previous error, unless specified in the detailed marking instructions.

(m) You must check all working carefully, even where a fundamental misunderstanding is apparent early in a candidate's response. You may still be able to award marks later in the question so you must refer continually to the marking instructions. The appearance of the correct answer does not necessarily indicate that you can award all the available marks to a candidate.

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(o) If candidates make multiple attempts using the same strategy and do not identify their final answer, mark all attempts and award the lowest mark. If candidates try different valid strategies, apply the above rule to attempts within each strategy and then award the highest mark.

For example:

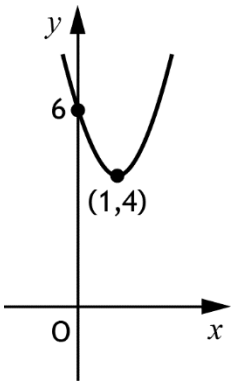
Strategy 1 attempt 1 is worth 3 marks.	Strategy 2 attempt 1 is worth 1 mark.
Strategy 1 attempt 2 is worth 4 marks.	Strategy 2 attempt 2 is worth 5 marks.
From the attempts using strategy 1, the resultant mark would be 3.	From the attempts using strategy 2, the resultant mark would be 1.

In this case, award 3 marks.

Marking instructions for each question

Question	Generic scheme	Illustrative scheme	Max mark
1.	•1 start process •2 solution	•1 $1^2+(-4)^2+8^2$ •2 9	**2**
2.	•1 correct common denominator •2 answer	•1 $5\frac{\cdots}{14}-1\frac{\cdots}{14}$ or $\frac{\cdots}{14}-\frac{\cdots}{14}$ •2 $4\frac{3}{14}$ or $\frac{59}{14}$	**2**
3.	•1 start expansion •2 complete expansion •3 collect like terms which must include a term in x^2	•1 $6x^2+18x-5x-15$ or $8x-2x^2$ •2 $6x^2+18x-5x-15+8x-2x^2$ •3 $4x^2+21x-15$	**3**
4.	•1 calculate angle POM •2 calculate angle ONM	•1 76 •2 38	**2**
5.	•1 find quartiles •2 calculate semi-interquartile range	•1 13, 23·5 •2 5·25	**2**
6.	•1 correct substitution into $y=kx^2$ •2 solve	•1 $-12=k\times 2^2$ •2 -3	**2**
7.	•1 correct scaling •2 consistent value for c or d •3 consistent values for c and d	•1 for example $\begin{matrix}15c+6d=12\\8c-6d=34\end{matrix}$ •2 $c=2$ or $d=-3$ •3 $c=2$ and $d=-3$	**3**
8.	•1 calculate discriminant •2 state nature of roots	•1 44 •2 two real and distinct roots	**2**

Question			Generic scheme	Illustrative scheme	Max mark
9.			•[1] simplify $\sqrt{50}$ •[2] simplify $\sqrt{45}$ •[3] express in simplest form	•[1] $5\sqrt{2}$ •[2] $3\sqrt{5}$ •[3] $4\sqrt{2}+3\sqrt{5}$	**3**
10.	(a)		**Method 1:** $y-b=m(x-a)$ •[1] find gradient •[2] substitute gradient and a point into $y-b=m(x-a)$ •[3] state equation in simplest form in terms of W and S **Method 2:** $y=mx+c$ •[1] find gradient •[2] substitute gradient and a point into $y=mx+c$ •[3] state equation in simplest form in terms of W and S	•[1] $\frac{60}{1200}$ •[2] for example $y-450=\frac{60}{1200}(x-6000)$ •[3] $W=\frac{1}{20}S+150$ or equivalent •[1] $\frac{60}{1200}$ •[2] for example $450=\frac{60}{1200}\times 6000+c$ •[3] $W=\frac{1}{20}S+150$ or equivalent	**3**
	(b)		•[4] calculate wage	•[4] 200	**1**
11.			•[1] expand brackets •[2] rearrange •[3] solve for x	•[1] $1-x-4>2x$ •[2] $-3x>3$ or $-3>3x$ •[3] $x<-1$ or $-1>x$	**3**
12.			•[1] evidence of $75\%=2400$ •[2] begin valid strategy •[3] complete calculation within a valid strategy	•[1] $75\%=2400$ •[2] $(25\%=)\frac{2400}{3}$ or $(1\%=)\frac{2400}{75}$ •[3] 3200	**3**

Question			Generic scheme	Illustrative scheme	Max mark
13.			•[1] state value of a •[2] state value of b	•[1] $a=2$ •[2] $b=3$	**2**
14.	(a)		•[1] state coordinates of B	•[1] $(3,0,-3)$	**1**
	(b)		•[2] correct substitution into volume of hemisphere formula •[3] calculate volume in terms of π	•[2] $\frac{1}{2}\times\frac{4}{3}\times\pi\times3^3$ •[3] 18π	**2**
15.			•[1] interpret index •[2] complete evaluation	•[1] $\sqrt{16^3}$ •[2] 64	**2**
16.			•[1] correct substitution •[2] evaluate $f(90)$	•[1] $4\sin(3\times90)$ •[2] -4	**2**
17.			•[1] coordinates of turning point correct •[2] sketch parabola with minimum turning point consistent with •[1] •[3] y-intercept correct	•[1] $(1,4)$ •[2] parabola with minimum turning point consistent with •[1] •[3] $(0,6)$ or 6 	**3**

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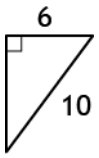
18.			$\bullet^1$ marshal facts and recognise right angled triangle	$\bullet^1$ 	**4**
			$\bullet^2$ consistent Pythagoras statement	$\bullet^2$ $10^2 - 6^2$	
			$\bullet^3$ calculate third side	$\bullet^3$ 8	
			$\bullet^4$ calculate length	$\bullet^4$ 48	
19.			$\bullet^1$ start to factorise	$\bullet^1$ $(2x \ \ 5)(3x \ \ 1)$	**3**
			$\bullet^2$ complete factorisation	$\bullet^2$ $(2x+5)(3x-1)$	
			$\bullet^3$ solve equation	$\bullet^3$ $-\frac{5}{2}$, $\frac{1}{3}$	

[END OF MARKING INSTRUCTIONS]

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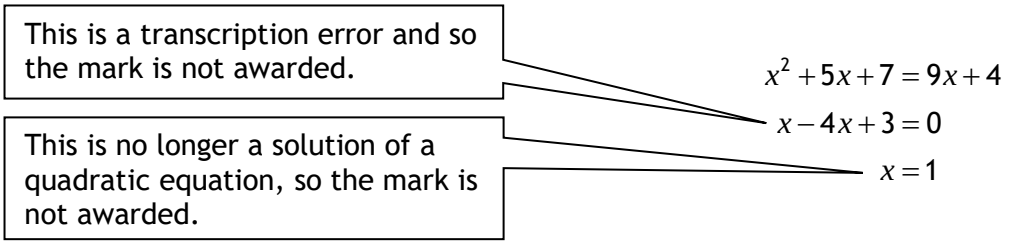

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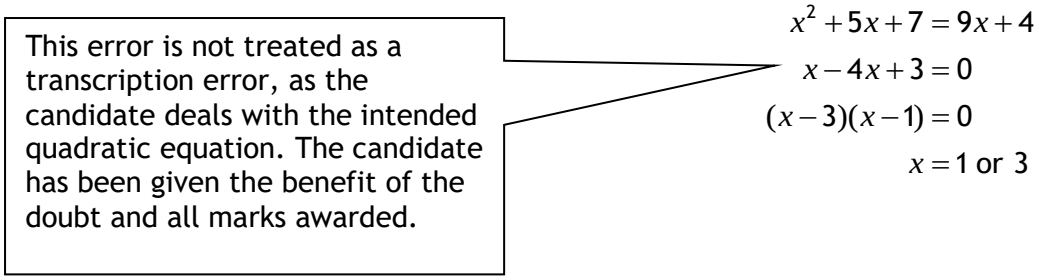

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1.	$\bullet^1$ know how to increase by 4% $\bullet^2$ know how to calculate price $\bullet^3$ carry out calculations correctly within a valid strategy	$\bullet^1$ $\times 1{\cdot}04$ $\bullet^2$ $250\,000 \times 1{\cdot}04^2$ $\bullet^3$ 270 400	**3**
2.	$\bullet^1$ correct method $\bullet^2$ answer	$\bullet^1$ $4{\cdot}2 \times 10^{17} \div \left(3 \times 10^8\right)$ $\bullet^2$ $1{\cdot}4 \times 10^9$	**2**
3.	$\bullet^1$ begin to factorise $\bullet^2$ factorise fully	$\bullet^1$ $3\left(a^2 - 25\right)$ $\bullet^2$ $3\left(a-5\right)\left(a+5\right)$	**2**
4.	$\bullet^1$ correct substitution into sine rule $\bullet^2$ rearrange equation $\bullet^3$ calculate angle	$\bullet^1$ $\dfrac{11{\cdot}3}{\sin \mathrm{Q}} = \dfrac{9{\cdot}8}{\sin 54}$ **OR** $\dfrac{\sin \mathrm{Q}}{11{\cdot}3} = \dfrac{\sin 54}{9{\cdot}8}$ $\bullet^2$ $\sin \mathrm{Q} = \dfrac{11{\cdot}3 \times \sin 54}{9{\cdot}8}$ $\bullet^3$ 68·9	**3**
5.	$\bullet^1$ state components of both vectors **OR** correct diagram $\bullet^2$ solution	$\bullet^1$ $\begin{pmatrix}5\\2\end{pmatrix}$ and $\begin{pmatrix}3\\-4\end{pmatrix}$ **OR** correct nose to tail diagram (must include arrows) $\bullet^2$ $\begin{pmatrix}2\\6\end{pmatrix}$	**2**

Question			Generic scheme	Illustrative scheme	Max mark
6.	(a)		**Method 1**	**Method 1**	**4**
			•[1] calculate mean	•[1] 31	
			•[2] calculate $\left(x-\bar{x}\right)^2$	•[2] 1, 16, 9, 4, 0, 4	
			•[3] substitute into formula	•[3] $\sqrt{\frac{34}{5}}$	
			•[4] calculate standard deviation	•[4] $2{\cdot}6\ldots$	
			Method 2	**Method 2**	
			•[1] calculate mean	•[1] 31	
			•[2] calculate $\sum x$ and $\sum x^2$	•[2] $\sum x = 186$ and $\sum x^2 = 5800$	
			•[3] substitute into formula	•[3] $\sqrt{\frac{5800-\frac{186^2}{6}}{5}}$	
			•[4] calculate standard deviation	•[4] $2{\cdot}6\ldots$	
	(b)		•[5] valid comment comparing means	•[5] for example on average, there were more passengers on Monday	**2**
			•[6] valid comment comparing standard deviations	•[6] for example the number of passengers was more consistent on Monday	
7.			•[1] calculate size of angle FHY	•[1] 68	**4**
			•[2] substitute into cosine rule	•[2] $3{\cdot}4^2+5{\cdot}7^2-2\times3{\cdot}4\times5{\cdot}7\times\cos 68$	
			•[3] calculate FY^2	•[3] $29{\cdot}530\ldots$	
			•[4] calculate FY	•[4] $5{\cdot}4\left(341\ldots\right)$	

Question			Generic scheme	Illustrative scheme	Max mark
8.			•[1] appropriate fraction for sector •[2] substitute into area of sector formula •[3] substitute into area of triangle formula •[4] know how to find area of segment •[5] carry out all calculations within a valid strategy **and** state correct units	•[1] $\frac{110}{360}$ •[2] $\frac{110}{360}\times\pi\times14^2\left(=188\cdot146\ldots\right)$ •[3] $\frac{1}{2}\times14\times14\times\sin110\left(=92\cdot089\ldots\right)$ •[4] for example evidence of sector area − area of triangle •[5] $96\left(\cdot056\ldots\right)$ cm^2	**5**
9.	(a)		•[1] start to rearrange •[2] state gradient	•[1] $4y=-3x+8$ **or** $3x-8=-4y$ **OR** $\frac{3}{4}x+y-\frac{8}{4}=0$ •[2] $-\frac{3}{4}$ or $-0\cdot75$	**2**
	(b)		•[3] state coordinates	•[3] $\left(0,2\right)$	**1**
10.			•[1] square •[2] multiply by 2 •[3] divide by 3	•[1] $d^2=\frac{3h}{2}$ •[2] $2d^2=3h$ •[3] $h=\frac{2d^2}{3}$	**3**

Question			Generic scheme	Illustrative scheme	Max mark
11.			•[1] correct use of Pythagoras •[2] calculate height •[3] substitute into volume of cone formula •[4] calculate the volume of the cone •[5] round volume to 2 significant figures	•[1] $h^2 = 14 \cdot 5^2 - 4^2$ •[2] $h = 13 \cdot 937\ldots$ •[3] $\frac{1}{3} \times \pi \times 4^2 \times 13 \cdot 937\ldots$ •[4] $233 \cdot 522\ldots$ •[5] 230	**5**
12.			•[1] know how to divide fractions •[2] cancel constants **or** terms in x •[3] express as single fraction in simplest form	•[1] $\frac{6x}{y} \times \frac{y+5}{2x^2}$ •[2] $\frac{3x}{y} \times \frac{y+5}{x^2}$ **or** $\frac{6}{y} \times \frac{y+5}{2x}$ •[3] $\frac{3(y+5)}{xy}$	**3**
13.			**Method 1** •[1] area scale factor •[2] know to multiply width by square root of area scale factor •[3] find width of large photograph (calculation must involve a root of the area scale factor) **Method 2** •[1] area scale factor •[2] know to divide width by square root of area scale factor •[3] find width of large photograph (calculation must involve a root of the area scale factor)	•[1] $\frac{500}{80}$ •[2] $12 \times \sqrt{\frac{500}{80}}$ •[3] 30 •[1] $\frac{80}{500}$ •[2] $12 \div \sqrt{\frac{80}{500}}$ •[3] 30	**3**

Question			Generic scheme	Illustrative scheme	Max mark
14.	(a)		•[1] substitute $h = 115$ into formula •[2] calculate $\cos x$ •[3] calculate first angle	•[1] $115 = 57 - 85\cos x°$ •[2] $-\frac{58}{85}$ •[3] $133 \cdot 027\ldots$	**3**
	(b)		•[4] calculate second angle	•[4] $226 \cdot 972\ldots$	**1**
15.	(a)		•[1] correct expression	•[1] $x+5$	**1**
	(b)		•[2] find expression for area •[3] equate to area and rearrange into required form	•[2] $x(x+5)$ •[3] $x^2+5x=20 \Rightarrow x^2+5x-20=0$ **OR** $x(x+5)-20=0 \Rightarrow x^2+5x-20=0$	**2**
	(c)		•[4] correct substitution into quadratic formula •[5] evaluate discriminant •[6] solve for x •[7] select positive value for x, correct to one decimal place	•[4] $\frac{-5 \pm \sqrt{5^2 - 4 \times 1 \times (-20)}}{2 \times 1}$ •[5] 105 •[6] $2 \cdot 6(2\ldots)$, $-7 \cdot 6(2\ldots)$ •[7] $2 \cdot 6$	**4**

Question			Generic scheme	Illustrative scheme	Max mark
16.			**Method 1** •[1] substitute for $\tan x$ •[2] expand and simplify **Method 2** •[1] expand bracket and substitute for $\tan x$ •[2] simplify	•[1] $\cos x\left(\frac{\sin x}{\cos x}+1\right)$ •[2] $\sin x+\cos x$ •[1] $\cos x\times\frac{\sin x}{\cos x}+\cos x$ •[2] $\sin x+\cos x$	**2**
17.			•[1] express $\overrightarrow{AG}$ in terms of $\overrightarrow{AC}$ and $\overrightarrow{CB}$ or express $\overrightarrow{CB}$ in terms of $\mathbf{u}$ and $\mathbf{t}$ •[2] express $\overrightarrow{AG}$ in terms of $\mathbf{u}$ and $\mathbf{t}$ •[3] express $\overrightarrow{AG}$ in simplest form	•[1] $\overrightarrow{AC}+\frac{1}{3}\overrightarrow{CB}$ or $\overrightarrow{CB}=-\mathbf{t}+\mathbf{u}$ •[2] $\mathbf{t}+\frac{1}{3}(-\mathbf{t}+\mathbf{u})$ •[3] $\frac{2}{3}\mathbf{t}+\frac{1}{3}\mathbf{u}$ or equivalent	**3**

[END OF MARKING INSTRUCTIONS]