N5 RELATIONSHIPS 1.3

This resource is to support pupils in passing the appropriate National 5 Assessment Standard. The questions and marking schemes used are from SQA past papers and as such test the topics in their entirety from grade A to C and *may* include other areas from the course.

In addition the questions from **Paper 1 (P1)** should be completed **without** the use of a calculator and questions from **Paper 2 (P2)** permit the use of a calculator.

Each Assessment Standard is used to ensure pupils have the minimum competency on the specified sub-skills for the National 5 course. As such each Assessment Standard will test grade C work on that specific topic.

This resource is divided into two sections:

- Section A has an example on each sub skill for the relevant Assessment Standard and the marking scheme for these questions
- Section B has extra practice questions on this Assessment Standard and the marking scheme for these questions

Unit Assessment Standard	<u>Sub skills</u>	Section A – Question Number
Relationships 1.3	solving a quadratic equation which has been factorised	Q1
Applying algebraic skills	solving a quadratic equation using the quadratic formula	Q2
to quadratic equations	using the discriminant to determine the number of roots	Q3

FORMULAE LIST

The roots of
$$ax^2 + bx + c = 0$$
 are $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Sine rule:	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
Cosine rule:	$a^{2} = b^{2} + c^{2} - 2bc\cos A \text{ or } \cos A = \frac{b^{2} + c^{2} - a^{2}}{2bc}$
Area of a triangle:	$A = \frac{1}{2}ab\sin C$
Volume of a sphere:	$V = \frac{4}{3}\pi r^3$
Volume of a cone:	$V = \frac{1}{3}\pi r^2 h$
Volume of a pyramid:	$V = \frac{1}{3}Ah$
Standard deviation:	$s = \sqrt{\frac{\Sigma(x-\overline{x})^2}{n-1}} = \sqrt{\frac{\Sigma x^2 - (\Sigma x)^2/n}{n-1}}$, where <i>n</i> is the sample size.

Section A

Section A

Q		Marks
1 P1	Solve the equation:	1
	(x + 3)(x - 2) = 0	
2	2. Solve the equation	4
P1	$3x^2 - 2x - 10 = 0.$	
	Give your answer correct to 2 significant figures.	
3 P1	Determine the nature of the roots of the equation $x^2 - 9x + 8 = 0$ using the discriminant.	3

Section A

Marking Scheme

• Ro	ots of equation: $x = -3$ and $x = 2$	
Question No	Give 1 mark for each •	Illustrations of evidence for awarding each mark
2	Ans: 2.2, -1.5	
	• method	substitution into quadratic formula
	 processing 	 √124
	solution	• 2.19, -1.52
	• rounding	• 2·2, -1·5
		4KU
Notes: <u>altern</u>	ative evidence for 3 rd and 4 th marks	
(i)	3 rd mark (one solution and rounding) 4 th mark (another solution and rounding)	$\begin{array}{rcccccccccccccccccccccccccccccccccccc$
(ii) (only the first mark is available for candidates w	who process to a negative discriminant
3	 correct substitution evaluate discriminant 	•1 $(-9)^2 - 4 \times 1 \times 8$ •2 49
	#2.2 interpret result	#2.2 two real distinct roots since $b^2 - 4ac > 0$

Section B

Section B

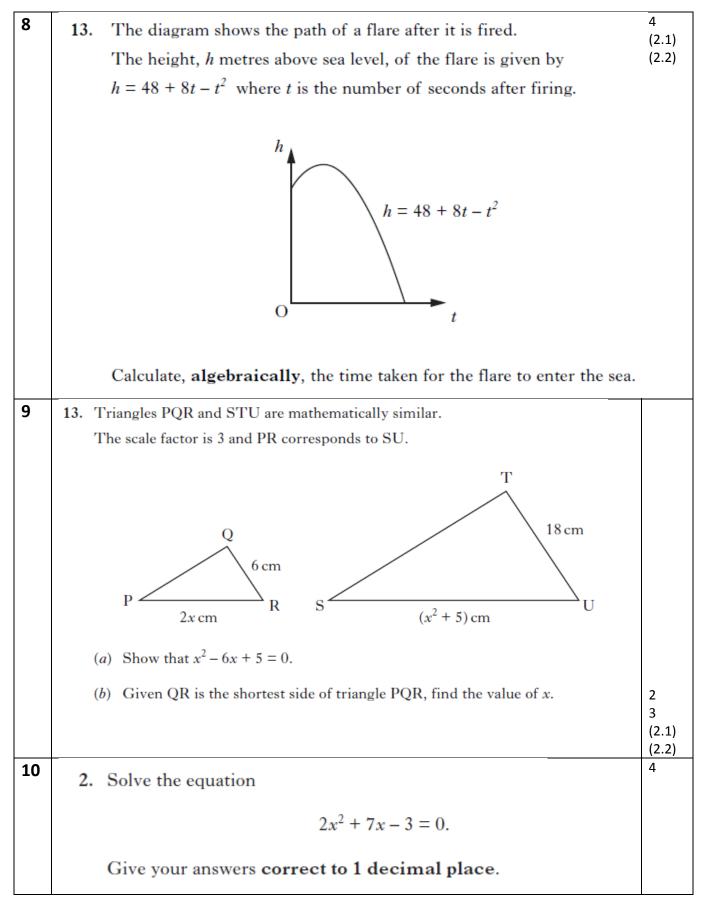
Paper 1 Questions

Q		Marks
1	7. Given $2x^2 - 2x - 1 = 0$, show that	4
	$x = \frac{1 \pm \sqrt{3}}{2}$	
2	4. Two functions are given below.	
	$f(x) = x^2 - 4x$	
	g(x) = 2x + 7	
	(a) If $f(x) = g(x)$, show that $x^2 - 6x - 7 = 0$.	2
	(b) Hence find algebraically the values of x for which $f(x) = g(x)$.	2

N5 - REL 1.3 - Remediation

Paper 2 Questions

Q			Marks
3	3.	Solve the quadratic equation $x^2 - 4x - 6 = 0$.	4
		Give your answers correct to 1 decimal place.	
4	10.	The weight, W kilograms, of a giraffe is related to its age, M months, by the formula $W = \frac{1}{4} \left(M^2 - 4M + 272 \right).$	4 (2.1) (2.2)
		At what age will a giraffe weigh 83 kilograms?	
5	4.	Use the quadratic formula to solve the equation,	4
		$3x^2 + 5x - 7 = 0.$	
		Give your answers correct to 1 decimal place.	
6	12.	A right-angled triangle has dimensions, in centimetres, as shown.	5 (2.1)
		$x = \begin{bmatrix} x + 8 \\ x + 7 \end{bmatrix}$	
		Calculate the value of <i>x</i> .	
7	3	Solve the equation	4
		$2x^2 + 3x - 7 = 0.$	
		Give your answers correct to 2 significant figures.	



Section B

MARKING SCHEME

Section B – Marking Scheme

Marking Scheme

Paper 1

Q				Marks
1	7	Ans: proof		
		starting proof	• $x = \frac{2 \pm \sqrt{(-2)^2 - 4(2)(-1)}}{2 \times 2}$	
		 processing 	 √12 	
		• starting to simplify	• $2\sqrt{3}$ • $\frac{1\pm\sqrt{3}}{2}$	
		final simplification	• $\frac{1\pm\sqrt{3}}{2}$	
			4RE	
	NOTES: (i) Fin	al mark can be awarded only if $2\sqrt{3}$ is explicit	itly stated	
2	4 (a)	Ans: proof		
2		forming equation	• $x^2 - 4x = 2x + 7$ • $x^2 - 6x - 7 = 0$	
		rearranging	$\bullet x^2 - 6x - 7 = 0$	
			2RE	
	NOTES:			
	(b)	Ans: $x = -1, x = 7$		
		factorising	• $(x+1)(x-7)$	
		solution	• -1,7	
			2RE	

N5 - REL 1.3 - Remediation

Paper 2

33Ans: -1.2, 5.2 • method• substitution into quadratic formula• processing • solution • solution • rounding• $\sqrt{40}$ • $\sqrt{40}$ NOTES: alternative evidence for 3^{nl} and 4^{th} marks (i) 3^{rl} mark (one solution and rounding) 4^{th} mark (another solution and rounding) $5.162 \rightarrow 5.2$ (ii) only the first mark is available for candidates who process to a negative discriminant410Ans: 10 years • substitution • substitution • factorisation • solution• $83 = \cdots$ • $M^2 - 4M - 60 = 0$ • $(M - 10)(M + 6) = 0$ • 10 ANOTES:	Q				Marks
• solution• -1.162, 5.162• rounding• -1.2, 5.2MOTES:alternative evidence for 3 rd and 4 th marks(i)3 rd mark (one solution and rounding) 4 th mark (another solution and rounding)-1.162 \rightarrow -1.2 5.162 \rightarrow 5.2(ii)only the first mark is available for candidates who process to a negative discriminant410Ans: 10 years • substitution•83 = ···•process • factorisation • solution• $M^2 - 4M - 60 = 0$ • $(M - 10)(M + 6) = 0$ • 10	3	3		substitution into quadratic formula	
• rounding• -1.2, 5.2• NOTES:atternative evidence for 3^{rd} and 4^{th} marks(i) 3^{rd} mark (one solution and rounding)-1.162 \rightarrow -1.2(ii) 3^{rd} mark (another solution and rounding)5.162 \rightarrow 5.2(ii) only the first mark is available for candidates who process to a negative discriminant410Ans: 10 years• substitution• $83 = \cdots$ • process• $M^2 - 4M - 60 = 0$ • factorisation• $(M - 10)(M + 6) = 0$ • solution• 10			 processing 	• \(\sqrt{40}\)	
Image: Constraint of the second state of the second st			• solution	• -1.162, 5.162	
alternative evidence for 3^{rd} and 4^{th} marks (i) 3^{rd} mark (one solution and rounding) 4^{th} mark (another solution and rounding) $-1.162 \rightarrow -1.2$ (ii) only the first mark is available for candidates who process to a negative discriminant 4 10 Ans: 10 years • substitution • • process • • factorisation • • solution • • solution •			• rounding		
(i) 3^{rd} mark (one solution and rounding) 4^{dh} mark (another solution and rounding) $-1.162 \rightarrow -1.2$ $5.162 \rightarrow 5.2$ (ii)only the first mark is available for candidates who process to a negative discriminant410Ans: 10 years • substitution•substitution• $83 = \cdots$ •process• $M^2 - 4M - 60 = 0$ • $(M - 10)(M + 6) = 0$ •solution• 10			ative oridonce for 2rd and 4th marks		
4 10 Ans: 10 years • $83 = \cdots$ • process • $M^2 - 4M - 60 = 0$ • $(M - 10)(M + 6) = 0$ • solution • 10 4R			3 rd mark (one solution and rounding)	$\begin{array}{ccc} -1.162 \rightarrow & -1.2 \\ 5.162 \rightarrow & 5.2 \end{array}$	
• substitution • process • factorisation • solution • $M^2 - 4M - 60 = 0$ • $(M - 10)(M + 6) = 0$ • 10 • $4R$		(ii)	only the first mark is available for candidates	who process to a negative discriminant	
• factorisation • solution • $(M-10)(M+6)=0$ • 10 • $4R$	4	10		• 83 = · · ·	
• solution • 10 4R			• process	$\bullet M^2 - 4M - 60 = 0$	
• 10 4R			factorisation	• $(M-10)(M+6) = 0$	
NOTES:			• solution	• 10 4 R	E
		NOTES:	1	1	
(i) if -6 is included in the final solution, the 4 th mark cannot be awarded		(i)	if -6 is included in the final solution, the	4 th mark cannot be awarded	
(ii) for an answer of 10 without working award 1/4		(ii)	for an answer of 10 without working	award 1/4	

5	4	Ans: -2.6, 0.9		
		• method	substitution into quadratic formula	
		 processing 	 √109 	
		solution	• -2·573, 0·907	
		• rounding	• -2·6, 0·9 4KU	
	NOTES: alterna	ative evidence for 3 rd and 4 th marks		
	(i) 3 4	e rd mark (one solution and rounding) th mark (another solution and rounding)	$\begin{array}{ccc} -2.573 \rightarrow & -2.6 \\ 0.907 \rightarrow & 0.9 \end{array}$	
	(ii) o	only the first mark is available for candidates w	ho process to a negative discriminant	
6	12	 Ans: x = 5 valid strategy starting to solve 	• $(x+8)^2 = x^2 + (x+7)^2$ • $x^2 + 16x + 64 = 2x^2 + 14x + 49$	
		 quadratic equation 	• $x^2 - 2x - 15 = 0$	
		factorising	• $(x-5)(x+3)$	
		 solution 	• <i>x</i> = 5	
			5RE	
	NOTES:			
	(i) For the third mark to be awarded the form must be $ax^2 + bc + c = 0$			

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7	3	Ans: -2.8, 1.3		
		• method	substitution into quadratic formula	
		 processing 	• \sqrt{65}	
		• solution	• -2.765, 1.265	
		• rounding	• - 2.8, 1.3	
			4K	U
	NOTES:			
	altern	ative evidence for 3 rd and 4 th marks		
	(i) 3^{rd} mark (one solution and rounding) 4^{th} mark (another solution and rounding) $1 \cdot 265 \rightarrow -2 \cdot 8$ $1 \cdot 265 \rightarrow -3 \cdot 1 \cdot 3$			
	(ii) (only the first mark is available for candidates w	ho process to a negative discriminant	
8	13	Ans: 12 seconds		
		strategy	• $48 + 8t - t^2 = 0$	
		• factorisation	• $(4+t)(12-t) = 0$	
		• roots	• -4,12	
		• solution	• 12	
			4	RE
	NOTES:			
	(i)) if due to error both roots are positive/negative, the last mark cannot be awarded		
	(ii)	for an answer of 12 without working	award 1/4	

N5 – REL 1.3 - Remediation

<u> </u>	1	1			
9	13 (a)	Ans: proof			
		beginning proof	• $\frac{2x}{x^2+5}$	$=\frac{6}{18}$ or $3 \times 2x = x^2 + 5$	
			 x² - 6 	x+5-0	
		 processing 	• x = 0.	2R	F
				2K	E
	NOTES:				
	(i)	working for part (a) may appear in part (b)			
	(b)	Ans: 5			
		correct use of algebraic strategy	• (x-1)((x-5)=0	
		 solving 	• $x=1$,	<i>x</i> = 5	
		solution	• x=5		
				3R	E
	NOTES:				
	(i)	for 5 with no working		award 0/3	
	(ii)	final answer must satisfy all given conditions			
	(iii)	working for part (b) may appear in part (a)			
	(iv)	accept use of quadratic formula			
10	2	Solve the equation			
		$2x^2 + 7x - 3 = 0$			
		Give your answers correct to 1 decimal place.			
		Ans: 0.4 or -3.9	4		
		• ¹ correct substitution into quadratic formula		$\bullet^1 \qquad \frac{-7 \pm \sqrt{7^2 - 4 \times 2 \times -4}}{4}$	-3
		• ² correct discriminant		• ² 73	
		• ³ unrounded solution		• ³ 0·385, -3·885	
		• ⁴ rounded solution	(KU)	• ⁴ 0.4, -3.9	
	Notes:				_
		alternative evidence for 3 rd and 4 th marks			
		rd mark (one solution and rounded)		$5 \rightarrow 0.4$	
	4	4 th mark (another solution and rounded)	- 3.8	$85 \rightarrow 3.9$	
	(i) (i	only the first mark is available for candidate	es who proc	cess to a negative discrimina	nt
	un	ndidates who do not give an unrounded nur lless $= 5.0 \times 10^{-3}$ where $3/4$ may h			s,
	the	e final answer is $0.4, -3.9$ where $3/4$ may b	e awarded		