

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

<u>Unit Assessment Standard</u>	<u>Sub skills</u>	Section A – Question Number
Relationships 1.3 Applying algebraic skills to quadratic equations	solving a quadratic equation which has been factorised	Q1
	solving a quadratic equation using the quadratic formula	Q2
	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: $a^2 = b^2 + c^2 - 2bc \cos A$ 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: $s = \sqrt{\frac{\sum(x - \bar{x})^2}{n-1}} = \sqrt{\frac{\sum x^2 - (\sum x)^2/n}{n-1}}$, where n is the sample size.

Section A

Section A

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

Section A

Marking **Scheme**

Section A - Marking Scheme								
1	<ul style="list-style-type: none"> Roots of equation: $x = -3$ and $x = 2$ 							
2	<table border="1"> <thead> <tr> <th>Question No</th> <th>Give 1 mark for each •</th> <th>Illustrations of evidence for awarding each mark</th> </tr> </thead> <tbody> <tr> <td>2</td> <td> <p>Ans: 2.2, -1.5</p> <ul style="list-style-type: none"> method processing solution rounding </td> <td> <ul style="list-style-type: none"> substitution into quadratic formula $\sqrt{124}$ 2·19, -1·52 2·2, -1·5 <p style="text-align: right;">4KU</p> </td> </tr> </tbody> </table>	Question No	Give 1 mark for each •	Illustrations of evidence for awarding each mark	2	<p>Ans: 2.2, -1.5</p> <ul style="list-style-type: none"> method processing solution rounding 	<ul style="list-style-type: none"> substitution into quadratic formula $\sqrt{124}$ 2·19, -1·52 2·2, -1·5 <p style="text-align: right;">4KU</p>	
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	<p>Notes:</p> <p><u>alternative evidence for 3rd and 4th marks</u></p> <p>(i) 3rd mark (one solution and rounding) 2·19 → 2·2 4th mark (another solution and rounding) -1·52 → -1·5</p> <p>(ii) only the first mark is available for candidates who process to a negative discriminant</p>							
3	<p>3</p> <ul style="list-style-type: none"> ¹ correct substitution ² evaluate discriminant <p>#2.2 interpret result</p>	<ul style="list-style-type: none"> ¹ $(-9)^2 - 4 \times 1 \times 8$ ² 49 <p>#2.2 two real distinct roots since $b^2 - 4ac > 0$</p>						

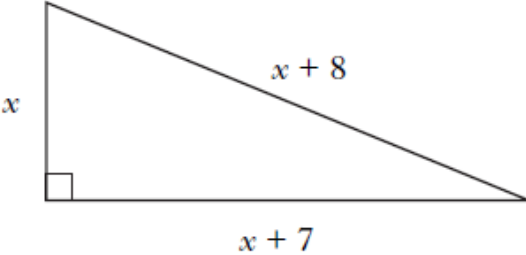
Section B

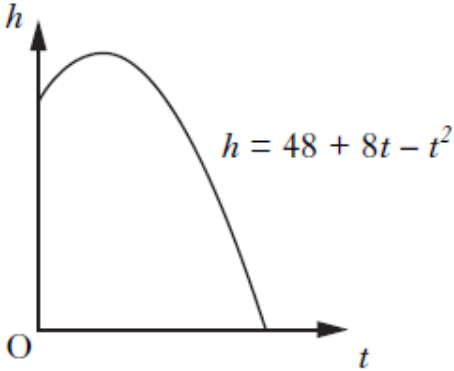
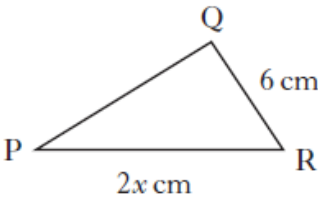
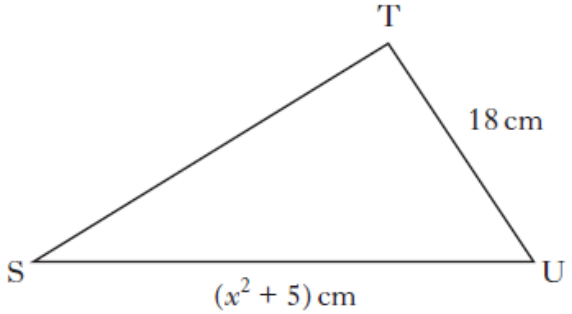
Section B

Paper 1 Questions

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

Paper 2 Questions

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

<p>8</p>	<p>13. The diagram shows the path of a flare after it is fired.</p> <p>The height, h metres above sea level, of the flare is given by $h = 48 + 8t - t^2$ where t is the number of seconds after firing.</p> <div style="text-align: center;">  </div> <p>Calculate, algebraically, the time taken for the flare to enter the sea.</p>	<p>4 (2.1) (2.2)</p>
<p>9</p>	<p>13. Triangles PQR and STU are mathematically similar.</p> <p>The scale factor is 3 and PR corresponds to SU.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div> <p>(a) Show that $x^2 - 6x + 5 = 0$.</p> <p>(b) Given QR is the shortest side of triangle PQR, find the value of x.</p>	<p>2 3 (2.1) (2.2)</p>
<p>10</p>	<p>2. Solve the equation</p> $2x^2 + 7x - 3 = 0.$ <p>Give your answers correct to 1 decimal place.</p>	<p>4</p>

Section B

MARKING

SCHEME

Section B – Marking Scheme

Marking Scheme

Paper 1

Q				Marks
1	7	<p>Ans: proof</p> <ul style="list-style-type: none"> • starting proof • processing • starting to simplify • final simplification 	<ul style="list-style-type: none"> • $x = \frac{2 \pm \sqrt{(-2)^2 - 4(2)(-1)}}{2 \times 2}$ • $\sqrt{12}$ • $2\sqrt{3}$ • $\frac{1 \pm \sqrt{3}}{2}$ <p style="text-align: right;">4RE</p>	
	<p>NOTES:</p> <p>(i) Final mark can be awarded only if $2\sqrt{3}$ is explicitly stated.</p>			
2	4 (a)	<p>Ans: proof</p> <ul style="list-style-type: none"> • forming equation • rearranging 	<ul style="list-style-type: none"> • $x^2 - 4x = 2x + 7$ • $x^2 - 6x - 7 = 0$ <p style="text-align: right;">2RE</p>	
	<p>NOTES:</p>			
(b)		<p>Ans: $x = -1, x = 7$</p> <ul style="list-style-type: none"> • factorising • solution 	<ul style="list-style-type: none"> • $(x+1)(x-7)$ • $-1, 7$ <p style="text-align: right;">2RE</p>	

9	13 (a)	<p>Ans: proof</p> <ul style="list-style-type: none"> • beginning proof • processing 	<ul style="list-style-type: none"> • $\frac{2x}{x^2 + 5} = \frac{6}{18}$ or $3 \times 2x = x^2 + 5$ • $x^2 - 6x + 5 = 0$ 	2RE
	<p>NOTES:</p> <p>(i) working for part (a) may appear in part (b)</p>			
	(b)	<p>Ans: 5</p> <ul style="list-style-type: none"> • correct use of algebraic strategy • solving • solution 	<ul style="list-style-type: none"> • $(x - 1)(x - 5) = 0$ • $x = 1, x = 5$ • $x = 5$ 	3RE
<p>NOTES:</p> <p>(i) for 5 with no working award 0/3</p> <p>(ii) final answer must satisfy all given conditions</p> <p>(iii) working for part (b) may appear in part (a)</p> <p>(iv) accept use of quadratic formula</p>				
10	2	<p>Solve the equation</p> $2x^2 + 7x - 3 = 0$ <p>Give your answers correct to 1 decimal place.</p> <p>Ans: 0.4 or -3.9</p> <ul style="list-style-type: none"> •¹ correct substitution into quadratic formula •² correct discriminant •³ unrounded solution •⁴ rounded solution 	4	<ul style="list-style-type: none"> •¹ $\frac{-7 \pm \sqrt{7^2 - 4 \times 2 \times -3}}{4}$ •² 73 •³ 0.385, -3.885 •⁴ 0.4, -3.9 <p>(KU)</p>
<p>Notes:</p> <p>alternative evidence for 3rd and 4th marks</p> <p>3rd mark (one solution and rounded) 0.385 → 0.4</p> <p>4th mark (another solution and rounded) - 3.885 → 3.9</p> <p>(i) only the first mark is available for candidates who process to a negative discriminant</p> <p>(ii) candidates who do not give an unrounded number cannot be awarded the last 2 marks, unless the final answer is 0.4, -3.9 where 3/4 may be awarded</p>				