

N5 RELATIONSHIPS 1.2

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 1.2 Applying algebraic skills to graphs of quadratic relationships	recognise and determine the equation of a quadratic function from its graph sketching a quadratic function identifying features of a quadratic function	Q1 ($y = kx^2$) Q2 Q3 (n shape) Q4 (u shape) Q5 ($y = (x+a)^2 + b$)

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: $V = \frac{4}{3}\pi r^3$

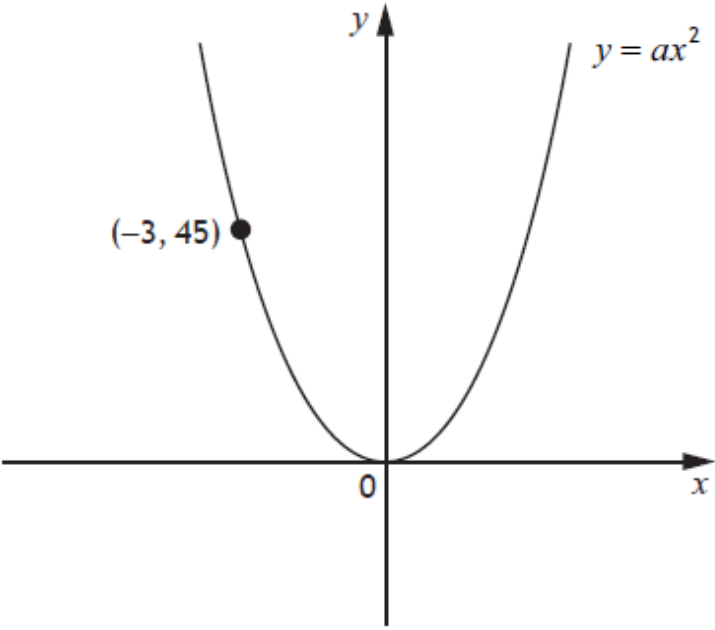
Volume of a cone: $V = \frac{1}{3}\pi r^2 h$

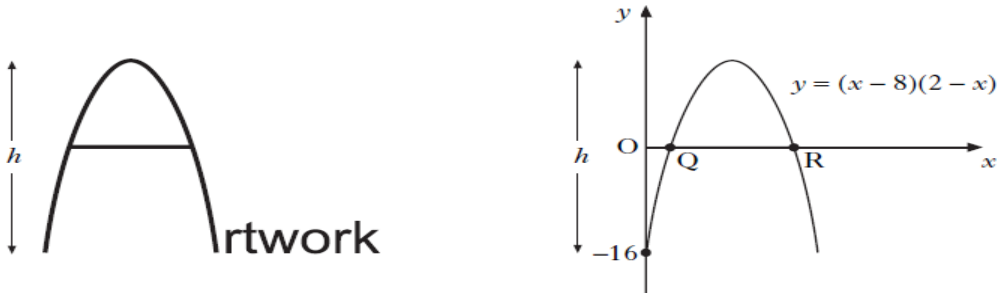
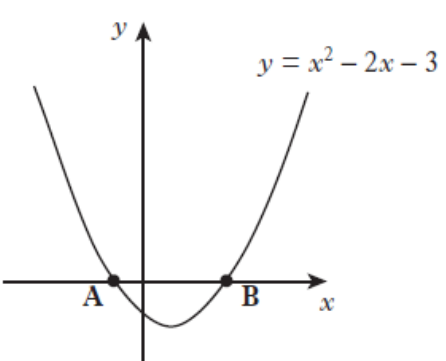
Volume of a pyramid: $V = \frac{1}{3}Ah$

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	<p>7. The diagram below shows part of the graph of $y = ax^2$</p>  <p>Find the value of a.</p>	2
2 P1	<p>Sketch the graph of $y = x^2 - 2x - 15$ below.</p> <p>Mark clearly where the graph crosses the axes and state the coordinates of the turning point.</p>	3

<p>3 P1</p>	<p>8. The curved part of the letter A in the <i>Artwork</i> logo is in the shape of a parabola. The equation of this parabola is $y = (x - 8)(2 - x)$.</p>  <p>(a) Write down the coordinates of Q and R.</p> <p>(b) Calculate the height, h, of the letter A.</p>	<p>2</p> <p>3</p>
<p>4 P1</p>	<p>10. The parabola with equation $y = x^2 - 2x - 3$ cuts the x-axis at the points A and B as shown in the diagram.</p>  <p>(a) Find the coordinates of A and B.</p> <p>(b) Write down the equation of the axis of symmetry of $y = x^2 - 2x - 3$.</p>	<p>4</p> <p>1</p>
<p>5 P1</p>	<p>A parabola has equation $y = (x - 2)^2 - 10$.</p> <p>(a) Write down the equation of its axis of symmetry.</p> <p>(b) Write down the coordinates of the turning point on the parabola and state whether it is a maximum or minimum.</p>	<p>3</p>

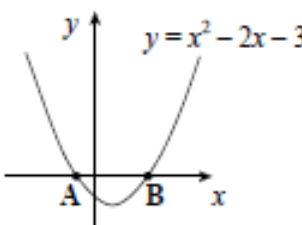
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Section A

MARKING

SCHEME

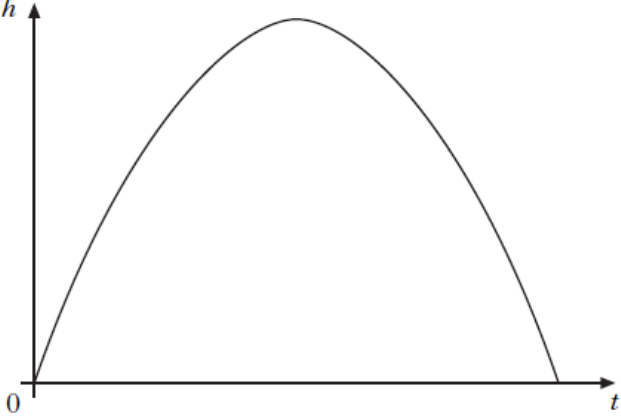
<u>Section A - Marking Scheme</u>				
1	Question	Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
	7.	Ans: $a = 5$ • ¹ know to substitute $(-3, 45)$ into $y = ax^2$ • ² solve equation for a	2	• ¹ $45 = a(-3)^2$ or equivalent • ² $a = 5$
Notes: 1. For a correct answer without working award 2/2 2. For $45 = a \times (-3) \rightarrow a = -15$ award 0/2				
2	• ¹ identify and annotate roots and y-intercept • ² identify and annotate turning point • ³ draw correct shape of graph	• ¹ 5 and -3 (0,-15) • ² (-1,-16) • ³ correctly annotated graph		
3	8 (a)	Ans: (2, 0), (8, 0) • coordinates of Q • coordinates of R	• (2, 0) • (8, 0)	2KU
	Notes: (i) for 2 and 8 award $\frac{1}{2}$ (ii) for (0, 2) and (0, 8) award $\frac{1}{2}$			
	(b)	Ans: 25 units • axis of symmetry • finding height above x axis • solution	• $x = 5$ • $y = 9$ • 25 units	3RE
	Notes: (i) for a final answer of 25, with or without working award $\frac{3}{3}$ (ii) for a final answer of 9, with or without working award $\frac{2}{3}$			

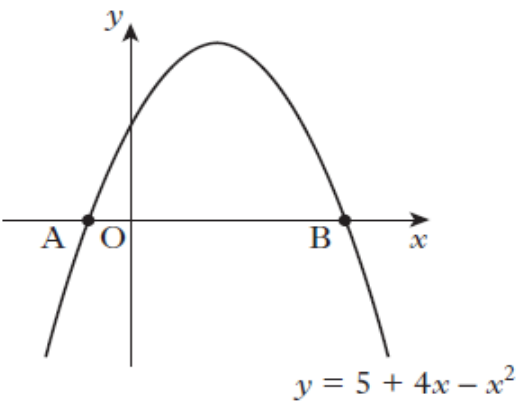
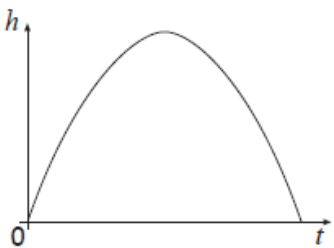
4	10	<p>The parabola with equation $y = x^2 - 2x - 3$ cuts the x-axis at the points A and B as shown in the diagram.</p> 			
	a	<p>Find the coordinates of A and B.</p> <p>Ans: A(-1,0), B(3,0)</p> <ul style="list-style-type: none"> •¹ equating to zero •² factorising •³ solving for x •⁴ co-ordinates 	4	<ul style="list-style-type: none"> •¹ $x^2 - 2x - 3 = 0$ •² $(x - 3)(x + 1) = 0$ •³ $x = -1$ or 3 •⁴ A(-1,0), B(3,0) 	
			(RE)		
<p>Notes:</p> <p>(i) equating to zero must appear prior to solving for x</p> <p>(ii) for correct coordinates with no working award 0/4</p> <p>(iii) candidates may draw graph – check page 15 on answer booklet</p>					
	10	b	<p>Write down the equation of the axis of symmetry of $y = x^2 - 2x - 3$.</p> <p>Ans: $x = 1$</p> <ul style="list-style-type: none"> •¹ calculation 	1	<ul style="list-style-type: none"> •¹ $x = 1$
		(KU)			
<p>Notes:</p> <p>(i) an answer of 1 is not sufficient to gain the mark</p>					
5	<ul style="list-style-type: none"> •¹ axis of symmetry •² turning point •³ nature 	<ul style="list-style-type: none"> •¹ $x = 2$ •² (2,-10) •³ minimum turning point 			

Section B

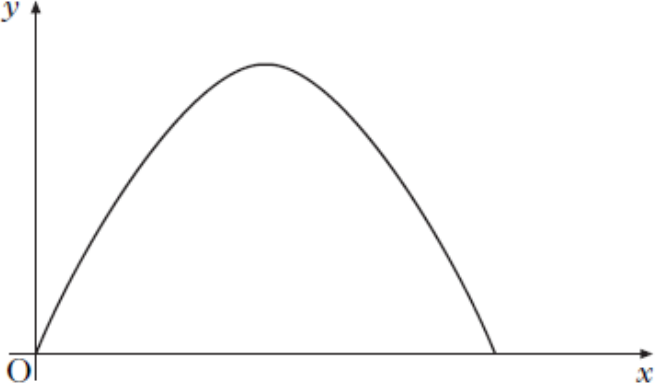
Section B

Paper 1 Questions

Q		Marks
1	<p>10. The diagram below shows the path of a rocket which is fired into the air. The height, h metres, of the rocket after t seconds is given by</p> $h(t) = -2t(t - 14).$  <p>(a) For how many seconds is the rocket in flight?</p> <p>(b) What is the maximum height reached by the rocket?</p>	2 (2.1) (2.2) 2 (2.1) (2.2)

<p>2</p>	<p>6. The diagram shows part of the graph of $y = 5 + 4x - x^2$.</p>  <p>A is the point $(-1, 0)$. B is the point $(5, 0)$.</p> <p>(a) State the equation of the axis of symmetry of the graph.</p> <p>(b) Hence, find the maximum value of $y = 5 + 4x - x^2$.</p>	<p>2 2</p>
<p>3</p>	<p>13. The diagram below shows the path of a small rocket which is fired into the air. The height, h metres, of the rocket after t seconds is given by</p> $h(t) = 16t - t^2$  <p>(a) After how many seconds will the rocket first be at a height of 60 metres?</p> <p>(b) Will the rocket reach a height of 70 metres? Justify your answer.</p>	<p>4 3 (2.1) (2.2)</p>

Paper 2 Questions

Q		Marks
4	<p>13. The profit made by a publishing company of a magazine is calculated by the formula</p> $y = 4x(140 - x),$ <p>where y is the profit (in pounds) and x is the selling price (in pence) of the magazine.</p> <p>The graph below represents the profit y against the selling price x.</p>  <p>Find the maximum profit the company can make from the sale of the magazine.</p>	

Section B

MARKING

SCHEME

Section B – Marking Scheme

Marking Scheme

Paper 1

Q				Marks
1	10 (a)	Ans: 14 seconds <ul style="list-style-type: none"> strategy solution 	<ul style="list-style-type: none"> $-2t(t-14)=0$ 14 <p style="text-align: right;">2RE</p>	
	NOTES: (i) for an answer of 14 with no working award 2/2 (ii) caution: an answer of 14 may be the result of incorrect working: ensure that working is valid			
	(b)	Ans: 98 metres <ul style="list-style-type: none"> method solution 	<ul style="list-style-type: none"> $(x=)7$ 98 <p style="text-align: right;">2RE</p>	
2	6 (a)	Ans: $x = 2$ <ul style="list-style-type: none"> strategy correct equation 	<ul style="list-style-type: none"> 2 $x = 2$ <p style="text-align: right;">2KU</p>	
	NOTES:			
	(b)	Ans: 9 <ul style="list-style-type: none"> substitution solution 	<ul style="list-style-type: none"> $y = 5 + 4(2) - 2^2$ 9 <p style="text-align: right;">2KU</p>	

3		Question	Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
13.	(a)		Ans: 6 seconds • ¹ construct an equation • ² rearrange and equate to zero • ³ correct factorisation • ⁴ solve equation and select correct value	4	• ¹ $16t - t^2 = 60$ • ² eg $t^2 - 16t + 60 = 0$ • ³ $(t - 6)(t - 10)$ • ⁴ $(t =) 6$
Notes: 1. Equating to zero must appear prior to solving equation e.g. $t^2 - 16t + 60 \rightarrow (t - 6)(t - 10) \rightarrow (t =) 6$ award 3/4 2. For the case in Note 1, if 6 is not stated explicitly award 1/4 3. For an answer of 6 without working award 0/4 4. Where a candidate substitutes into the formula (a) $h(6)=60$ and $h(10)=60 \rightarrow 6$ award 4/4 (b) $h(6)=60 \rightarrow 6$ award 2/4 (c) $h(6)=60$ award 1/4 (d) $h(10)=60 \rightarrow 10$ award 1/4					

Paper 2

Q				Marks
4	13	Ans: £19 600 • valid strategy • finding roots • finding midpoint • solution	• $4x(140 - x) = 0$ • 0, 140 • 70 • 19 600	4RE
Notes: (i) for the 1 st mark, the equation need not be explicit, thus 0, 140 alone is awarded the 1 st and 2 nd marks (ii) a statement of $x = 70$ leading to £19 600 may be awarded a maximum of $\frac{2}{4}$ (iii) any method involving trial and improvement receives no credit				