N5 RELATIONSHIPS 1.5

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	Sub skills	Section A – Question Number
Relationships 1.5 Applying trigonometric skills to graphs and identities	working with the graphs of trigonometric functions	Q1 (sin graph) Q2 (cos graph) Q3 (tan graph)
	working with trigonometric relationships in degrees	Q4

FORMULAE LIST

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

Sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$ or $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

Area of a triangle: $A = \frac{1}{2}ab\sin C$

Volume of a sphere: $V = \frac{4}{3}\pi r^3$
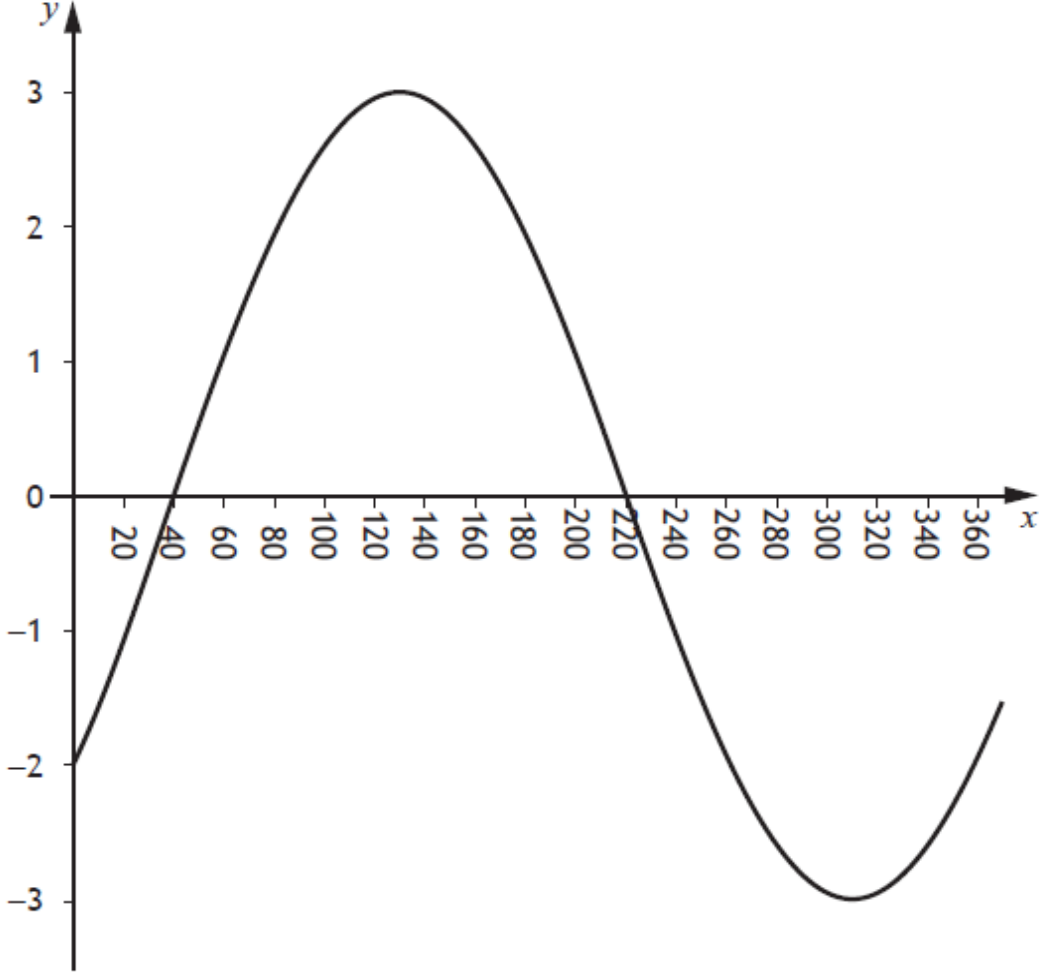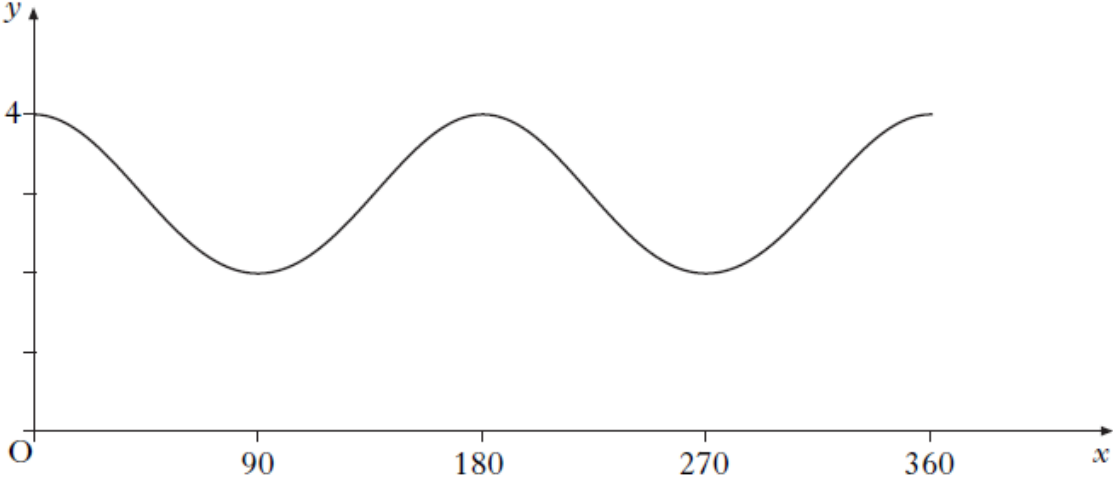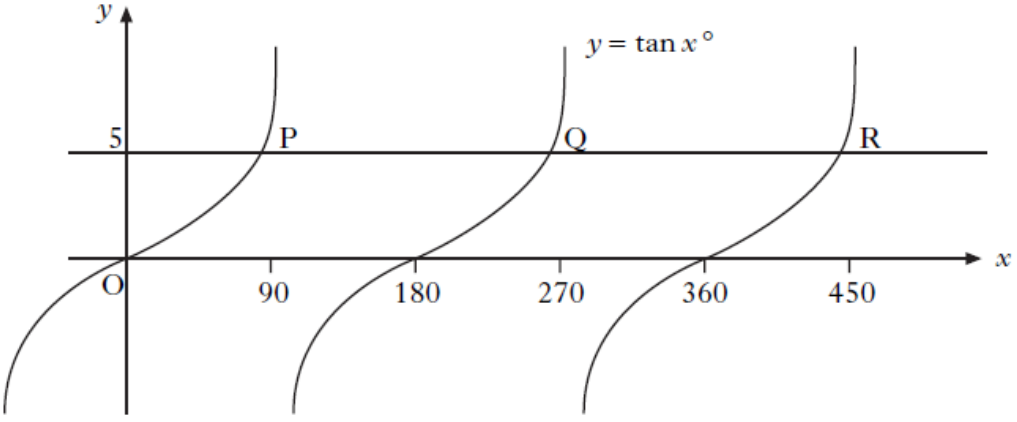
Volume of a cone: $V = \frac{1}{3}\pi r^2 h$

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

Standard deviation: $s = \sqrt{\dfrac{\Sigma(x - \bar{x})^2}{n-1}} = \sqrt{\dfrac{\Sigma x^2 - (\Sigma x)^2/n}{n-1}}$, where n is the sample size.

Section A

Section A

Q		Marks
1 **P1**	10. The graph of $y = a\sin(x+b)^\circ$, $0 \le x \le 360$, is shown below. Write down the values of a and b.	2

2
P1

13. Part of the graph of $y = \cos bx° + c$ is shown below.

Write down the values of b and c.

2

3
P2

12. The diagram shows part of the graph of $y = \tan x°$.

The line $y = 5$ is drawn and intersects the graph of $y = \tan x°$ at P and Q.

(a) Find the x-coordinates of P and Q.

3

(b) Write down the x-coordinate of the point R, where the line $y = 5$ next intersects the graph of $y = \tan x°$.

1

4
P2

10. Solve **algebraically** the equation

$$5 \cos x° + 4 = 0, \qquad 0 \le x < 360.$$

3

6

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 •
10.	Ans: $a = 3$, $b = -40$	2	
	•^{1} state value of a		•^{1} $a = 3$
	•^{2} state value of b		•^{2} $b = -40$

Notes:
1. For $y = 3\sin(x - 40)$ award 2/2
2. Accept $b = 320$

2

Question No	Give 1 mark for each •	Illustrations of evidence for awarding each mark
13	Ans: $b = 2$, $c = 3$	
	• value of b	• 2
	• value of c	• 3
		2KU

Notes:

(i)   for 2, 3   award $\frac{2}{2}$

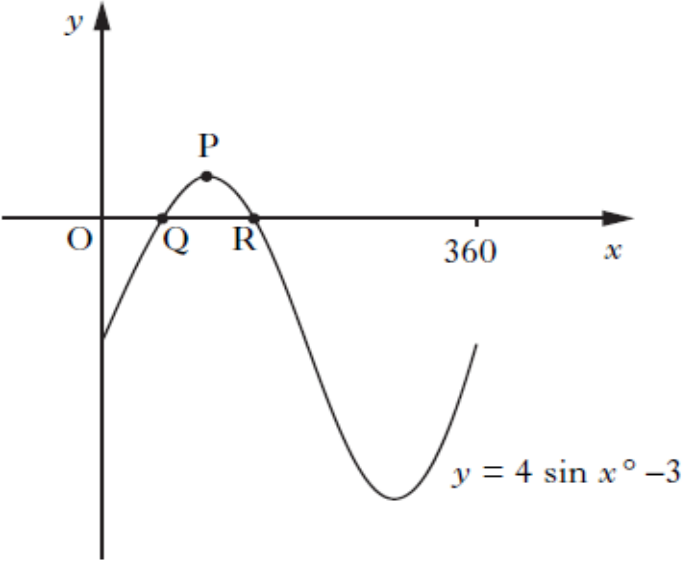(ii)   for $(b =) 3$, $(c =) 2$ award $\frac{0}{2}$

3	12 (a)	Ans: 78.7, 258.7		
		• equation	• $\tan x° = 5$	
		• first solution	• 78.7	
		• second solution	• 258.7 (first solution + 180)	**3RE**

Notes:

(i) for answers of 90 or 270, only the 1st mark is available

	(b)	Ans: 438.7		
		• solution	• 438.7	**1RE**

Notes:

(i) the solution must be consistent with a solution in part (a)

(ii) for 450, following from 90, 270 in part (a)   award $\frac{1}{1}$

4	Question No	Give 1 mark for each •	Illustrations of evidence for awarding each mark	
	10	Ans: $143 \cdot 1°$, $216 \cdot 9°$		
		• rearranging	• $\cos x° = -\dfrac{4}{5}$	
		• first solution	• $143 \cdot 1°$	
		• solution	• $216 \cdot 9°$	**3KU**

Notes:

(i) for a wrong negative value of $\cos x°$, a maximum of $\dfrac{2}{3}$ is available (2nd and 3rd marks)

(ii) for a wrong positive value of $\cos x°$, a maximum of $\dfrac{1}{3}$ is available (3rd mark)
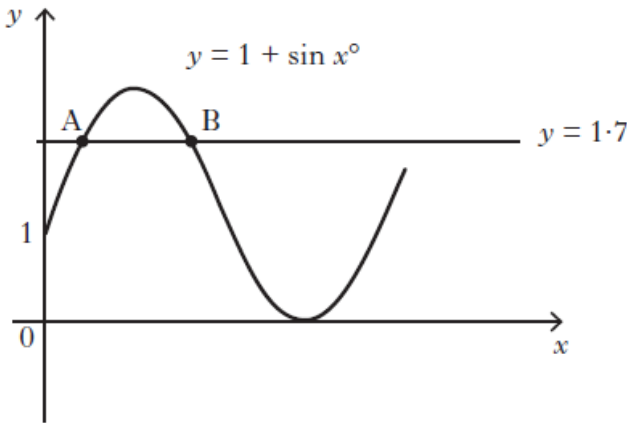
(iii) ignore any values outwith the given domain

Section B

Section B

No Paper 1 Questions

Paper 2 Questions

Q		Marks
1	**13.** The depth of water, D metres, in a harbour is given by the formula $$D = 3 + 1{\cdot}75 \sin 30\,h°$$ where h is the number of hours after midnight. (a) Calculate the depth of water at 5 am. (b) Calculate the maximum difference in depth of the water in the harbour. **Do not use a trial and improvement method.**	2 (2.1) (2.2) 2 (2.1) (2.2)
2	**12.** Part of the graph of $y = 4 \sin x° -3$ is shown below. The graph cuts the x-axis at Q and R. P is the maximum turning point. (a) Write down the coordinates of P. (b) Calculate the x-coordinates of Q and R.	 1 4

12

3

12. $f(x) = 3 \sin x°,$ $\qquad$ $0 \le x < 360$

   (*a*) Find $f(270)$.

1

   (*b*) $f(t) = 0\cdot6.$

4

      Find the two possible values of *t*.

4   **12.** Part of the graph of $y = 1 + \sin x°$ is shown in the diagram below.

4

The line $y = 1\cdot7$ is drawn. It cuts the graph of $y = 1 + \sin x°$ at A and B as shown.

Calculate the x-coordinates of A and B.

5   **12.** Solve the equation $11\cos x° - 2 = 3$, for $0 \le x \le 360$.

3

Section B

MARKING
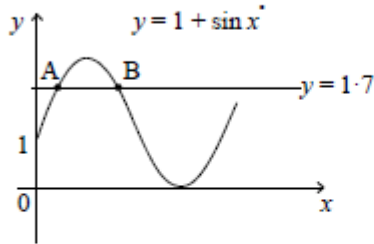
SCHEME

Section B – Marking Scheme

Marking Scheme

Paper 1

Q		Marks
	No questions	

Paper 2

Q		Marks
1	13 (a) Ans: 3·875 m • substitution • solution • $3 + 1 \cdot 75 \sin(30 \times 5)^\circ$ • 3·875 **2KU**	
	NOTES: (i) Accept $3 + 1 \cdot 75 \sin 30 \times 5$	
	(b) Ans: 3·5 m • beginning to solve • solution • 1·25 or 4·75 • 3·5 **2RE**	
	NOTES: (i) For two wrong substitutions calculated correctly the second mark is available (ii) For 3·5 without working award 1/2	

2	12 (a)	Ans: $(90, 1)$			
		• coordinates	• $(90, 1)$		
				1RE	
	(b)	Ans: $48\cdot6°, 131\cdot4°$			
		• strategy	• $4\sin x° - 3 = 0$		
		• processing	• $\sin x° = \dfrac{3}{4}$		
		• first solution	• $48\cdot6°$		
		• second solution	• $131\cdot4°$		
				4RE	

NOTES:

   (i) for an answer of $45°$ and $135°$ award 1/4

3	12 (a)	Ans: -3			
		• evaluating	• -3		
				1KU	

NOTES:

	(b)	Ans: $11\cdot5°, 168\cdot5°$			
		• equation	• $3\sin t° = 0\cdot6$		
		• beginning to solve	• $\sin t° = 0\cdot2$		
		• first solution	• $11\cdot5°$		
		• second solution	• $168\cdot5°$		
				4RE	

NOTES:

   (i) the 2nd angle must be consistent with the 1st angle

   (ii) candidates who start with $\sin t° = 0\cdot6$ may be awarded only the final two marks

| 4 | 12 | | Part of the graph of $y = 1 + \sin x^\cdot$ is shown in the diagram below. | | | | | | |

$y = 1 + \sin x^\cdot$

The line $y = 1\cdot7$ is drawn. It cuts the graph of $y = 1 + \sin x^\cdot$ at A and B as shown.

Calculate the x-coordinates of A and B.

Ans: $44\cdot4^\cdot$, $135\cdot6^\cdot$ 4

•		Evidence
$\bullet^1$	equating functions	$\bullet^1$ $1 + \sin x^\circ = 1\cdot7$
$\bullet^2$	processing	$\bullet^2$ $\sin x^\circ = 0\cdot7$
$\bullet^3$	first solution	$\bullet^3$ $44\cdot4^\cdot$
$\bullet^4$	second solution	$\bullet^4$ $135\cdot6^\cdot$

(RE)

Notes:

(i) candidates who obtain a negative value of sin x may still be awarded the last two marks for angles in the 3rd and 4th quadrants

(ii) candidates who give more than two answers cannot be awarded the last mark

(iii) caution $44\cdot4^\cdot + 90^\cdot = 134\cdot4^\cdot$
                 this is close to the correct answer

5

Question	Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
12.	Ans: $x^\circ = 63^\circ$, 297°	3	
	$\bullet^1$ rearrange equation		$\bullet^1$ $\cos x = \dfrac{5}{11}$
	$\bullet^2$ find one value of x		$\bullet^2$ $x = 63$
	$\bullet^3$ find another value of x		$\bullet^3$ $x = 297$

Notes:
1. The 2nd angle must be consistent with the first angle.
2. For $x = 1\cdot1, 358\cdot9$ (uses RAD), award 3/3 (with working), award 2/3 (without working)
3. For $x = 70, 290$ (uses GRAD), award 3/3 (with working), award 2/3 (without working)