education

Department:
Education
PROVINCE OF KWAZULU-NATAL

KZN INFORMAL TASK

GRADE 12

MATHEMATICS

TRIGONOMETRY

MARKS: **35**

TIME: **40 minutes**

This question paper consists of 5 pages

INSTRUCTIONS AND INFORMATION

1. This question paper consists of 3 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera, that you have used in determining your answers.
4. Answers only will NOT necessarily be awarded full marks.
5. Use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round-off answers to TWO decimal places, unless stated otherwise.
7. Answer sheets for QUESTION 2.2 is provided at the end of the question paper. Write you name in the spaces provided on the answer sheet and submit them together with your ANSWER BOOK.
8. Diagrams are NOT necessarily drawn to scale.
9. Number the answers correctly according the numbering system used in this question paper.
10. Write neatly and legibly.

QUESTION 1

1.1 If $\cos 12^\circ \sin 36^\circ = p$ and $\sin 12^\circ \cos 36^\circ = q$, Determine in terms of p and q the value of:

1.1.1 $\sin 48^\circ$ (3)

1.1.2 $\cos 66^\circ$ (3)

1.2 Prove that for any angle Y:

$$\frac{4\sin Y.\cos Y.\cos 2Y.\sin 15^\circ}{\sin 2Y(\tan 225^\circ - 2\sin^2 Y)} = \frac{\sqrt{6}-\sqrt{2}}{2}$$ (7)

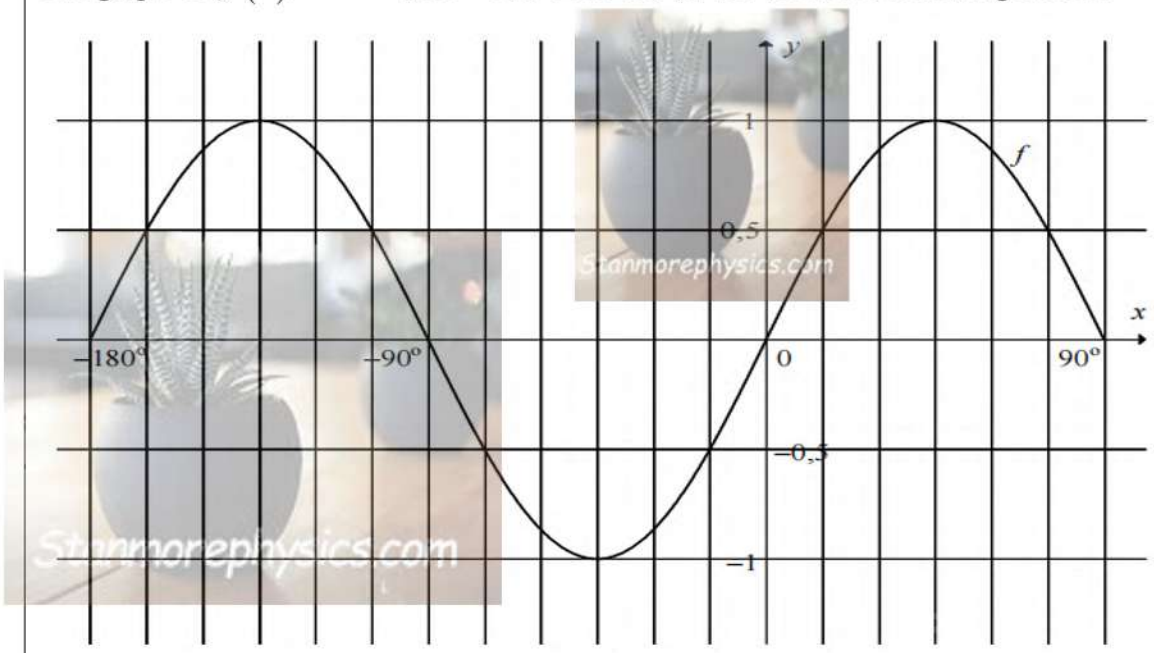
1.3 Determine the general solution of: (6)

$$6\cos x - 5 = \frac{4}{\cos x}$$

[19]

QUESTION 2

The graph of $f(x) = \sin 2x$, for $-180^\circ \le x \le 90^\circ$, is shown in the following sketch.



2.1 Determine the period of $f\left(\frac{3}{2}x\right)$ (2)

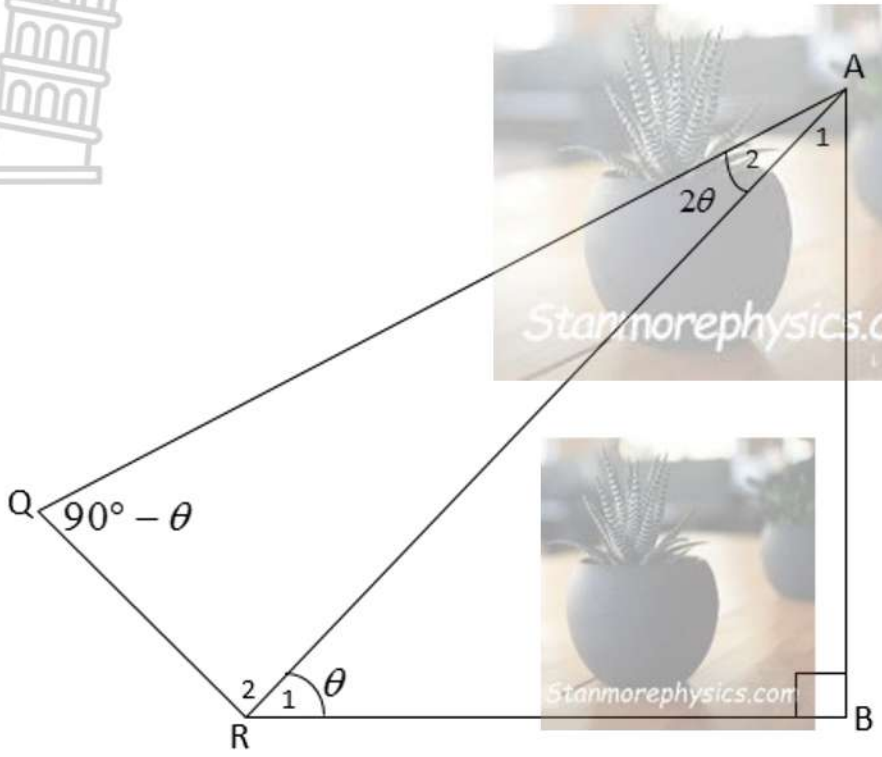
2.2 Draw the graph of $g(x) = \cos(x - 30^\circ)$ for $-180^\circ \le x \le 90^\circ$, on the same system of axes. Clearly label ALL the intercepts with the axes, turning points and coordinate of the end points. (4)

2.3 Describe the transformation that graph f has to undergo to form $y = \sin(2x + 60^\circ)$ (2)

[8]

QUESTION 3

An aerial view of a plot of land ABRQ shows that $\hat{R}_1 = \theta_1, \hat{A}_2 = 2\theta$ and $\hat{Q} = (90° - \theta)$.



3.1	If $QR = a$ express AB in terms of a	(6)
3.2	Show that area $\Delta AQR = \dfrac{a^2 \cos\theta}{4\sin\theta}$	(2)
		[8]

NAME:_____

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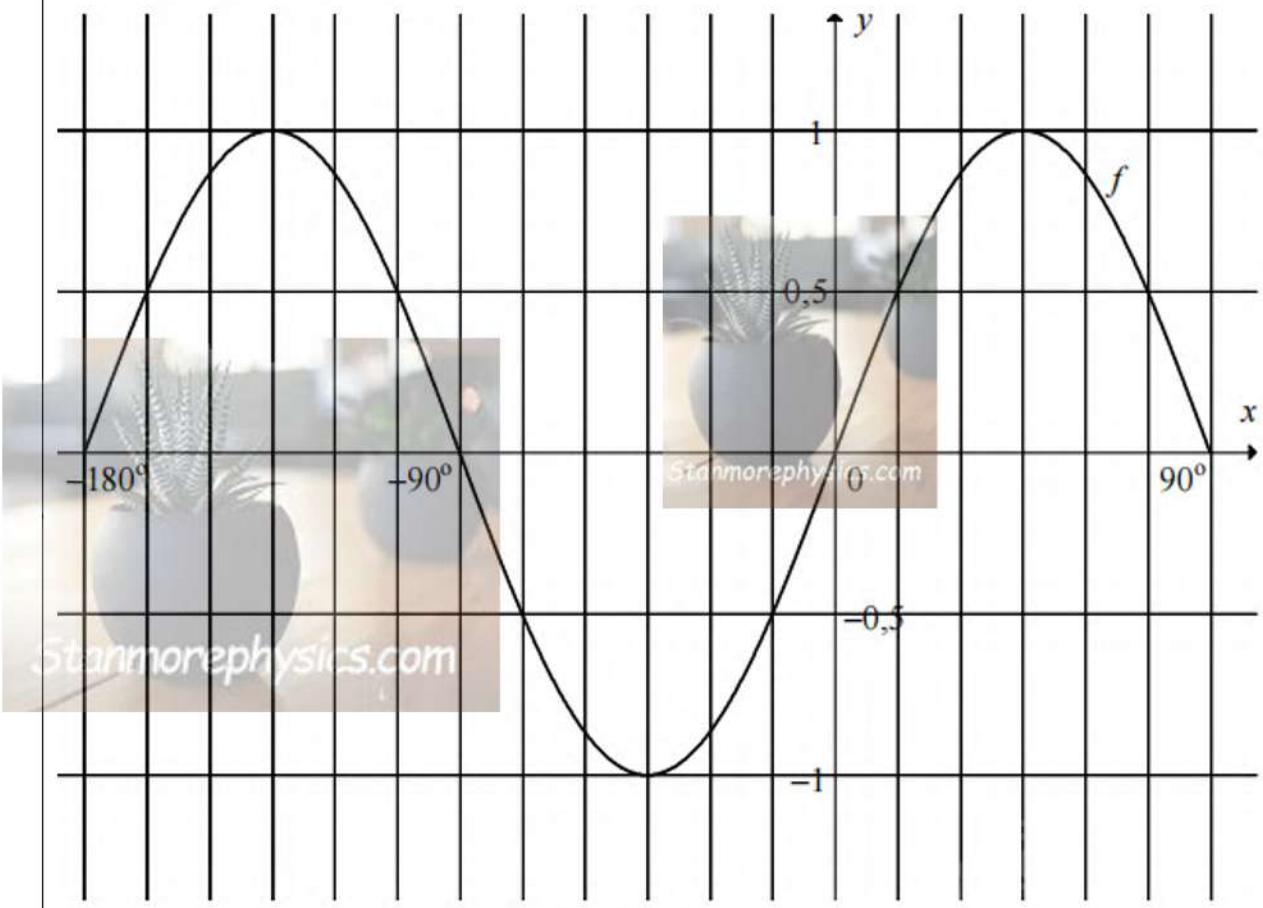
DIAGRAM SHEET

QUESTION 2.2



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MARKING GUIDELINE

MARKS: **35**

This paper consists of 4 pages

QUESTION 1

1.1.1	$\sin 48^\circ = \sin(36^\circ + 12^\circ)$ $= \sin 36^\circ \cos 12^\circ + \cos 36^\circ \sin 12^\circ$ $= p + q$	A✓ $48^\circ = 36^\circ + 12^\circ$ A ✓Expansion A ✓Answer (3)
1.1.2	$\cos 66^\circ = \cos(90^\circ - 24^\circ)$ $= \sin 24^\circ$ $\sin 24^\circ = \sin(36^\circ - 12^\circ)$ $= \sin 36^\circ \cos 12^\circ - \cos 36^\circ \sin 12^\circ$ $= p - q$	A ✓Reduction A ✓ $24^\circ = 36^\circ - 12^\circ$ A ✓Answer (3)
1.2	$= \dfrac{4\sin Y.\cos Y.\cos 2Y.\sin 15^\circ}{\sin 2Y(1-2\sin^2 Y)}$ $= \dfrac{4\sin Y\cos Y\cos 2Y\sin 15}{2\sin Y\cos Y.\cos 2Y}$ $= 2\sin 15^\circ$ $= 2\sin(45^\circ - 30^\circ)$ $= 2[\sin 45^\circ \cos 30^\circ - \cos 45^\circ \sin 30^\circ]$ $= 2\left[\dfrac{\sqrt{2}}{2}.\dfrac{\sqrt{3}}{2} - \dfrac{\sqrt{2}}{2}.\dfrac{1}{2}\right]$ $= 2\left[\dfrac{\sqrt{6}}{4} - \dfrac{\sqrt{2}}{4}\right]$ $= \dfrac{\sqrt{6}-\sqrt{2}}{2}$	A ✓ $2\sin Y\cos Y$ A ✓ $(1-2\sin^2 Y) = \cos 2Y$ A ✓ $2\sin 15^\circ$ A ✓ $45^\circ - 30^\circ = 15^\circ$ A ✓expansion A ✓ substitution CA✓ simplification (7)
1.3	$6\cos x - 5 = \dfrac{4}{\cos x}$ $6\cos^2 x - 5\cos x = 4$ $6\cos^2 x - 5\cos x - 4 = 0$ $(3\cos x - 4)(2\cos x + 1) = 0$ $3\cos x - 4 = 0 \quad or \quad 2\cos x + 1 = 0$ $\cos x \neq \dfrac{4}{3} \quad or \quad \cos x = -\dfrac{1}{2}$ $x = 120^\circ + k.360^\circ . k \in \mathbb{Z}$ $x = 240^\circ + k.360^\circ . k \in \mathbb{Z}$	A ✓ standard form A ✓ factors A ✓ answer and rejection A ✓ 240+k.360 A ✓ 120+k.360 A ✓ $k \in \mathbb{Z}$ (6)
		[19]

QUESTION 2

2.1

$$f\left(\frac{3}{2}x\right) = \sin 2\left(\frac{3}{2}x\right)$$
$$= \sin 3x$$
$$\therefore \text{Period} = \frac{360°}{3} = 120°$$

A ✓ $\sin 3x$

A ✓ $120°$ (2)

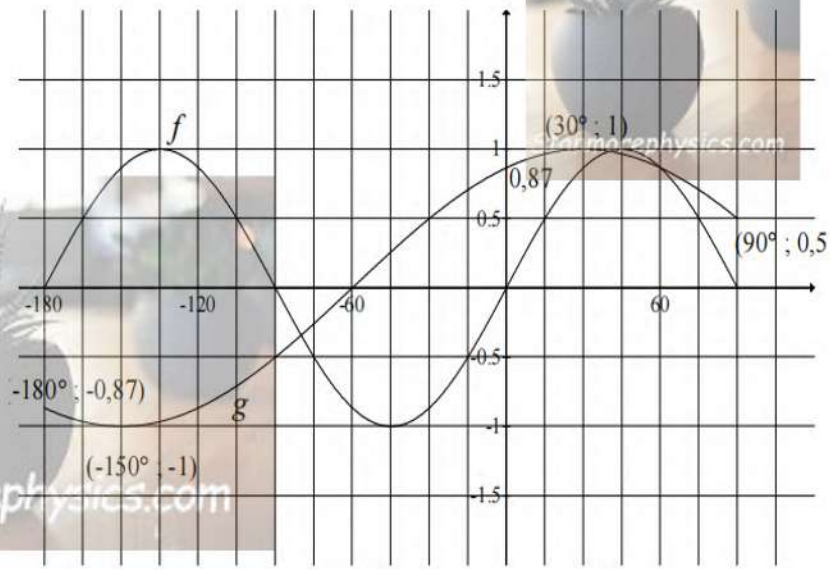
OR

$$f\left(\frac{3}{2}x\right) = \sin\left(\frac{3}{2}x\right)$$
$$= \sin 3x$$
$$= \sin(3x + 360°)$$
$$= \sin(x + 120°)$$
$$\therefore \text{Period} = 120°$$

A ✓ $\sin 3x$

A ✓ $120°$ (2)

2.2



A ✓ intercepts
A ✓ turning point
A ✓ end points
A ✓ shape

2.3

$y = \sin 2(x + 30°)$

$\therefore$ translation of $30°$ to the left

A ✓ translation $30°$
A ✓ to the left

[8]

QUESTION 3

3.1	*In* ΔAQR: $\frac{AR}{\sin Q} = \frac{a}{\sin A_2}$ $\frac{AR}{\sin(90^\circ - \theta)} = \frac{a}{\sin 2\theta}$ $\frac{AR}{\cos\theta} = \frac{a}{2\sin\theta\cos\theta}$ $AR = \frac{a}{2\sin\theta\cos\theta}$ $AR = \frac{a}{2\sin\theta}$ *In* ΔARB: $\frac{AB}{AR} = \sin\theta$ $AB = AR\sin\theta$ $AB = \frac{a}{2\sin\theta}\sin\theta$ $AB = \frac{a}{2}$	A✓ $\frac{AR}{\sin Q} = \frac{a}{\sin A_2}$ A✓ $\frac{AR}{\sin(90^\circ - \theta)} = \frac{a}{\sin 2\theta}$ A✓ $2\sin\theta\cos\theta$ A✓ $AR = \frac{a}{2\sin\theta}$ A✓ $\frac{AB}{AR} = \sin\theta$ A✓Answer (6)
3.2	$\hat{R}_2 = 90^\circ - \theta(sum\ of \angle \text{ of } \Delta AQR)$ $Area \text{ of } \Delta AQR = \frac{1}{2}.QR.AR\sin(90^\circ - \theta)$ $= \frac{1}{2}a.\frac{a}{2\sin\theta}.\cos\theta$ $= \frac{a^2\cos\theta}{4\sin\theta}$	A✓ $\hat{R}_2 = 90^\circ - \theta(sum\ of \angle \text{ of } \Delta AQR)$ A✓ Subst into the correct formula (2)
		[9]