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Province of the
EASTERN CAPE
EDUCATION

EC CURRICULUM: FET MATHEMATICS, MATHEMATICAL LITERACY AND TECHNICAL MATHEMATICS

NATIONAL SENIOR CERTIFICATE

GRADE 12

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MATHEMATICS TOPIC TEST 3 OF 2020: TRIGONOMETRY

MARKS: **40**

TIME: **48 Minutes Strictly!**

This question paper consists of 13 pages, including Information Sheet and ANSWER SHEETS.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 3 questions. Answer ALL questions in ANSWER SHEETS.

2. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answers.

3. Answers only will NOT necessarily be awarded full marks.

4. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.

5. If necessary, round off answers to TWO decimal places, unless stated otherwise.

6. Diagrams are NOT necessarily drawn to scale.

7. An information sheet with formulae is included at the end of the question paper.

8. Write neatly and legibly.

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QUESTION 1

1.1 Without using a calculator, write the following expressions in terms of $\sin 11°$:

1.1.1 $\sin 191°$ (1)

1.1.2 $\cos 22°$ (1)

1.2 Simplify $\cos(x-180°) + \sqrt{2}\sin(x+45°)$ to a single trigonometric ratio. (5)

1.3 Given: $\sin P + \sin Q = \frac{7}{5}$ and $\hat{P} + \hat{Q} = 90°$

Without using a calculator, determine the value of $\sin 2P$. (5)

[12]

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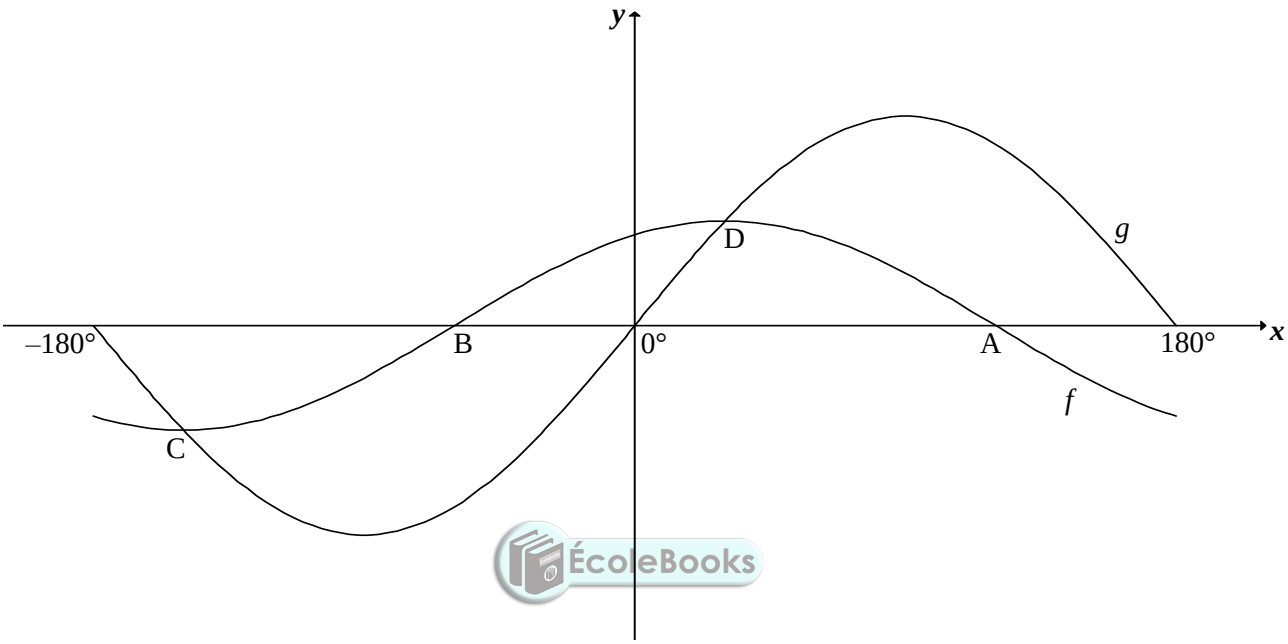
QUESTION 2

2.1 Determine the general solution of $\cos(x-30°) = 2\sin x$. (6)

2.2 In the diagram, the graphs of $f(x) = \cos(x-30°)$ and $g(x) = 2\sin x$ are drawn for the interval $x \in [-180°;180°]$. A and B are the x–intercepts of f. The two graphs intersect at C and D, the minimum and maximum turning points respectively of f.



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2.2.1 Write down the coordinates of:

(a) A (1)

(b) C (2)

2.2.2 Determine the values of x in the interval $x \in [-180°; 180°]$, for which:

(a) Both graphs are increasing (2)

(b) $f(x+10°) > g(x+10°)$ (2)

2.2.3 Determine the range of $y = 2^{2\sin x + 3}$ (5)

[18]

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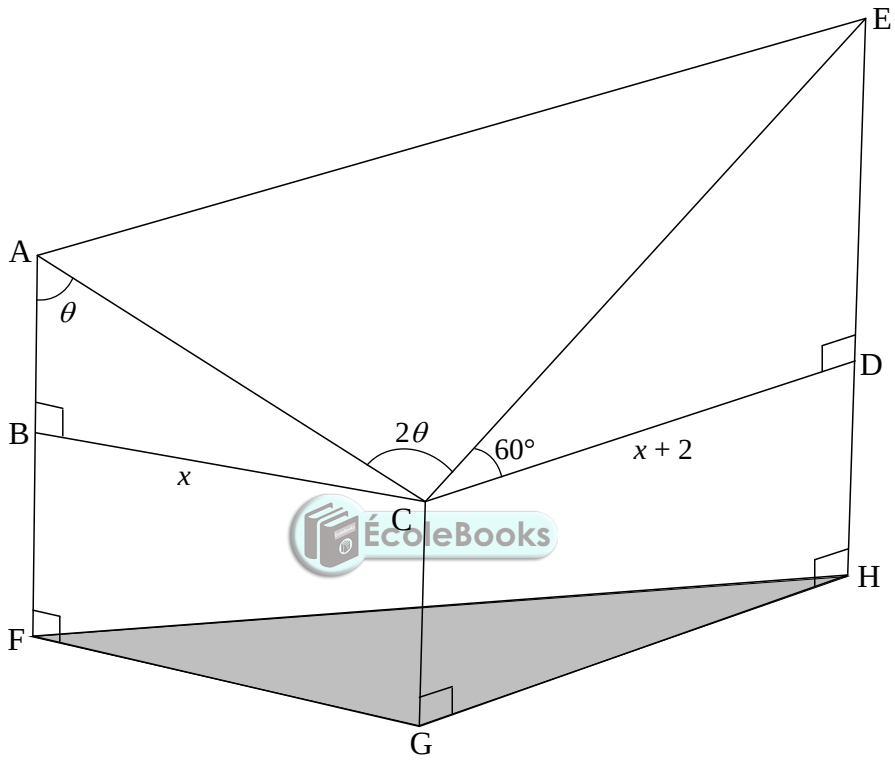
QUESTION 3

In the diagram below, CGFB and CGHD are fixed walls that are rectangular in shape and vertical to the horizontal plane FGH. Steel poles erected along FB and HD extend to A and E respectively. ΔACE forms the roof of an entertainment centre.

$BC = x$, $CD = x + 2$, $B\hat{A}C = \theta$, $A\hat{C}E = 2\theta$ and $E\hat{C}D = 60°$



3.1 Calculate the length of:

3.1.1 AC in terms of x and θ (2)

3.1.2 CE in terms of x (2)

3.2 Show that the area of the roof ΔACE is given by $2x(x+2)\cos\theta$. (3)

3.3 If $\theta = 55°$ and BC = 12 metres, calculate the length of AE. (3)

[10]

TOTAL: 40

INFORMATION SHEET: MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A = P(1+ni) \quad A = P(1-ni) \qquad A = P(1-i)^n \qquad A = P(1+i)^n$$

$$T_n = a + (n-1)d \qquad S_n = \frac{n}{2}\left[2a + (n-1)d\right]$$

$$T_n = ar^{n-1} \qquad S_n = \frac{a\left(r^n - 1\right)}{r-1} \;;\; r \neq 1 \qquad S_\infty = \frac{a}{1-r} \;;\; -1 < r < 1$$

$$F = \frac{x\left[(1+i)^n - 1\right]}{i} \qquad P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad \mathrm{M}\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c \qquad y - y_1 = m(x - x_1) \qquad m = \frac{y_2 - y_1}{x_2 - x_1} \qquad m = \tan\theta$$

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$$(x-a)^2 + (y-b)^2 = r^2$$

In ΔABC:

$$\frac{a}{\sin \mathrm{A}} = \frac{b}{\sin \mathrm{B}} = \frac{c}{\sin \mathrm{C}}$$

$$a^2 = b^2 + c^2 - 2bc.\cos A$$

$$\text{area } \Delta\mathrm{ABC} = \frac{1}{2}ab.\sin \mathrm{C}$$

$$\sin(\alpha + \beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta \qquad \sin(\alpha - \beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$$

$$\cos(\alpha + \beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta \qquad \cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$$

$$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases} \qquad \sin 2\alpha = 2\sin\alpha.\sin\alpha$$

$$\bar{x} = \frac{\sum x}{n} \qquad \sigma^2 = \frac{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}{n}$$

$$\mathrm{P(A)} = \frac{n(\mathrm{A})}{n(\mathrm{S})}$$

P(A or B) = P(A) + P(B) – P(A and B)

$$\hat{y} = a + bx \qquad b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

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QUESTION/*VRAAG* 1

	Solution/*Oplossing*	**Marks** ***Punte***
1.1.1		(1)
1.1.2		(1)
1.2		(5)

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	Solution/*Oplossing*	**Marks** ***Punte***
1.3		(5)
		[12]

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QUESTION/*VRAAG* 2

	Solution/*Oplossing*	**Marks** ***Punte***
2.1		(6)

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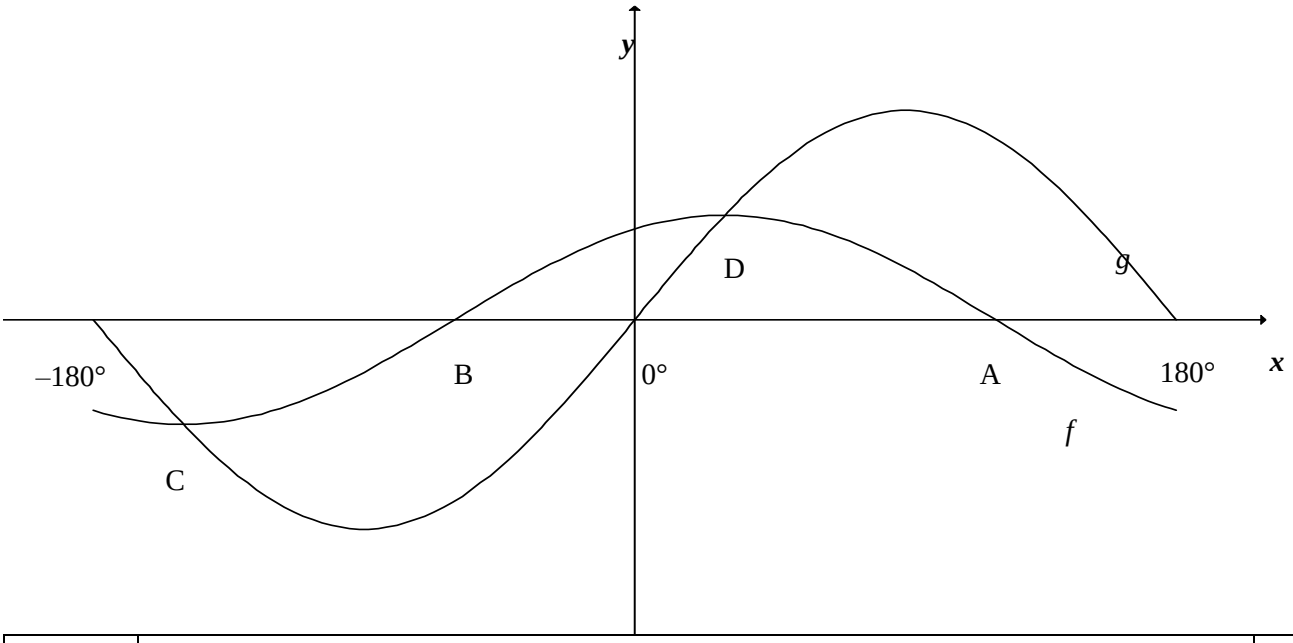
2.2



	Solution/*Oplossing*	**Marks** ***Punte***
2.2.1(a)		(1)
2.2.1(b)		(2)
2.2.2(a)		(2)
2.2.2(b)		(2)

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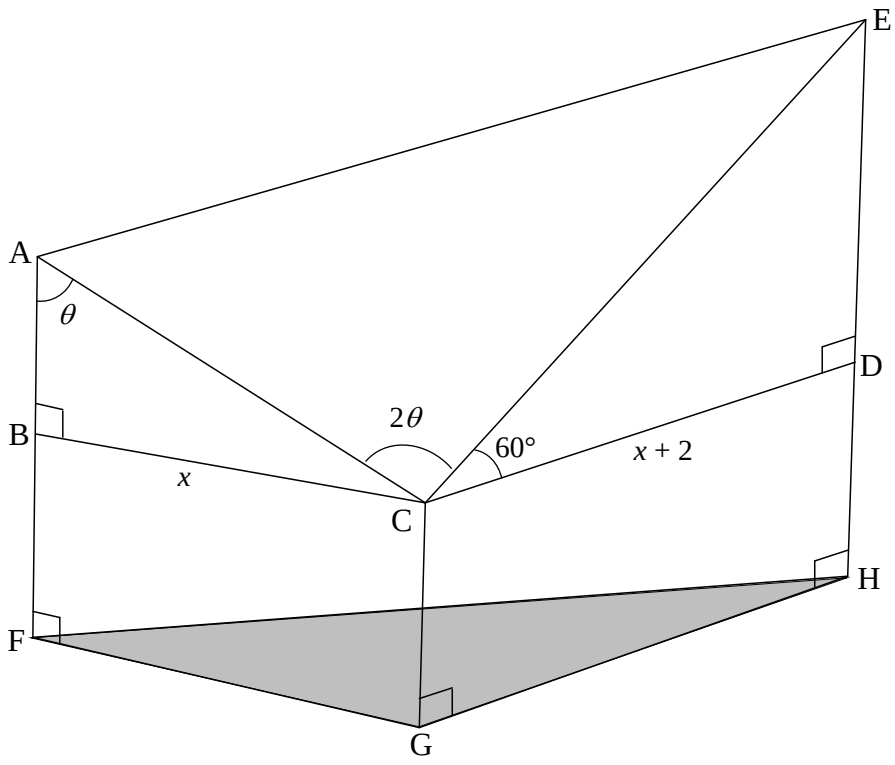
	Solution/*Oplossing*	**Marks** ***Punte***
2.2.3		(5)
		[18]

QUESTION/*VRAAG* 2



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	Solution/*Oplossing*	**Marks** ***Punte***
2.1.1		(2)
2.1.2		(2)

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	Solution/*Oplossing*	**Marks** ***Punte***
2.2		(3)
2.3		(3)
		[10]

TOTAL: 40