



Province of the
EASTERN CAPE
EDUCATION



**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

JUNE 2023

**MATHEMATICS P2
(DEAF)**

MARKS: 150

TIME: 3 hours

This question paper has 14 pages and an answer book of 22 pages.

INSTRUCTIONS AND INFORMATION

Read the instructions.

1. This question paper has 10 **questions**.
2. **Answer ALL** the questions.
Write in the SPECIAL ANSWER BOOK.
3. **Show ALL calculations, diagrams, graphs, etc.** which you have **used in your answers**.
4. **Answers only** will **NOT** always get **full marks**.
5. You **may use** a prescribed **calculator**.
Some questions will **tell** you **NOT** to use a **calculator**.
6. **Round off** answers correct to **TWO decimal places**.
Some questions will **tell** you **how to round off**.
7. **Diagrams** are **NOT** always drawn to **scale**.
8. An **information sheet** with formulae is **included** at the **end** of the question paper.
9. Write **neatly**.
Your work must be **easy to read**.

QUESTION 1

Between 05:00 and 06:00 on New Year's Day, 11 minibus taxis were stopped at a roadblock between King William's Town and East London. The data set represents the number of passengers per minibus taxi.

18	26	25	18	16	12	10	8	18	17	8
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- 1.1 Calculate the mean number of passengers per taxi. (2)
 - 1.2 Calculate the standard deviation for this data set. (2)
 - 1.3 Taxis having a number of passengers with one standard deviation above the mean could be regarded as overloaded. How many taxis were overloaded? (2)
 - 1.4 If the number of passengers in a taxi is one standard deviation below the mean, the trip could be regarded as uneconomical. Calculate the percentage of taxis that are in this category. (2)
- [8]**

QUESTION 2

Working dads help working moms with housework.

The table below represents the number of hours spent per week in doing household work.

Hours	Number of dads
$0 < x \leq 5$	1
$5 < x \leq 10$	18
$10 < x \leq 15$	24
$15 < x \leq 20$	25
$20 < x \leq 25$	18
$25 < x \leq 30$	12
$30 < x \leq 35$	1
$35 < x \leq 40$	1

- 2.1 Complete the frequency table in the SPECIAL ANSWER BOOK and draw an ogive of the data on the grid provided. (4)
 - 2.2 Use the graph to find an approximate_(estimated) median value. (2)
 - 2.3 Write down the modal class. (1)
 - 2.4 Calculate the approximate_(estimated) mean. (2)
 - 2.5 Compare the mean, median and mode values. Explain what this means for the set of data. (3)
- [12]**

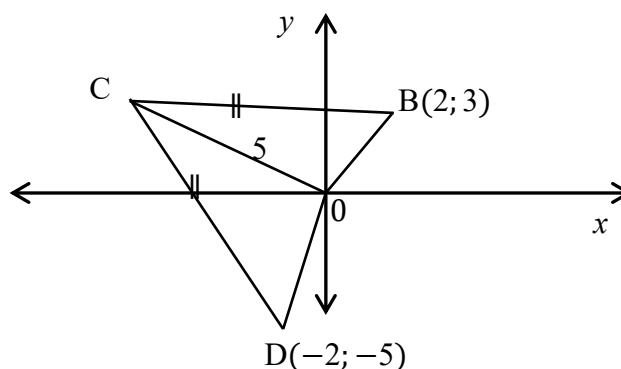
QUESTION 3

- 3.1 The **straight-line** $y = 3x - 3$ is **perpendicular** to the **straight line** which cuts the y -axis at $(0; 10)$ and passes through the **point** $(4; \frac{p}{2})$.
Determine the value of p . (3)

- 3.2 The **distance between** the **origin** and **point** $P(-2; p - 1)$ is **$2p$ units**.
Calculate the value of p . (5)

3.3 **Diagram**

The **diagram below** shows **quadrilateral OBCD**.
 It has **vertices** $O(0; 0)$, $B(2; 3)$, C and $D(-2; -5)$.
 The **length** of OC is **5 units** and $BC = DC$.



- 3.3.1 **Determine the gradient of BD .** (2)
- 3.3.2 **Determine the equation of the perpendicular bisector from C to BD in the form $y = mx + c$.** (3)
- 3.3.3 **Determine the equation of the circle centred at O and passing through C .** (2)
- 3.3.4 **Determine the y -coordinate of point C .** (6)

[21]

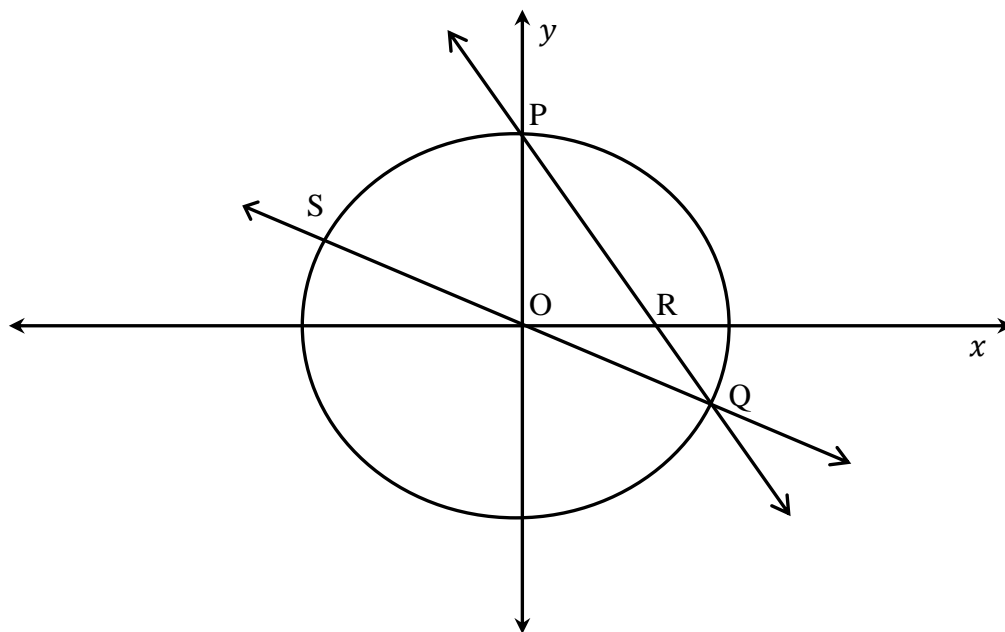
QUESTION 4

Diagram

In the **diagram** below, circle $x^2 + y^2 = 16$ intersects the **straight-line PQ**.

It is defined by $2x + y = 4$ at **P** and **Q**.

R is the **x-intercept** of **PQ**.



- 4.1 **Show** that the **coordinates** of **P** and **Q** are $(0 ; 4)$ and $(3,2 ; -2,4)$ **respectively**. (7)
- 4.2 **QO** produced **cuts** the **circle** at **S**. **Determine** the **coordinates** of **S**. (2)
- 4.3 **Determine** the **equation** of the **circle** with the **centre** at **R** and **touches** the **y-axis**. (4)
- 4.4 **Determine** the **distance** between the **centres** of the **circles** $x^2 + y^2 = 16$ and $(x - 6)^2 + y^2 - y = 12$. (5)

[18]

QUESTION 5

5.1 **Do NOT use a calculator.**

If $5 \cos \theta - 3 = 0$; $180^\circ < \theta < 360^\circ$ and $17 \sin \alpha = 8$; $90^\circ < \alpha < 270^\circ$.

Determine the value of $\tan \alpha + \tan \theta$.

(6)

5.2 **Given $\cos 42^\circ = p$.**

Determine each of the following in terms of p :

5.2.1 $\sin 48^\circ$

(2)

5.2.2 $\sin(-2202^\circ)$

(2)

5.2.3 $\cos 84^\circ$

(2)

5.3 **Do NOT use a calculator.**

Determine the value of:

$$\frac{\tan 300^\circ + \cos(90^\circ + x)}{\sin(180^\circ - x) + 2 \cos(-30^\circ)}$$

(6)

5.4 **Prove the following identity:** $\frac{1 - \sin 2x}{\cos 2x} = \frac{\cos x - \sin x}{\cos x + \sin x}$

(5)

5.5 **Determine the general solution of $\cos x - \sin x = \sqrt{2}$.**

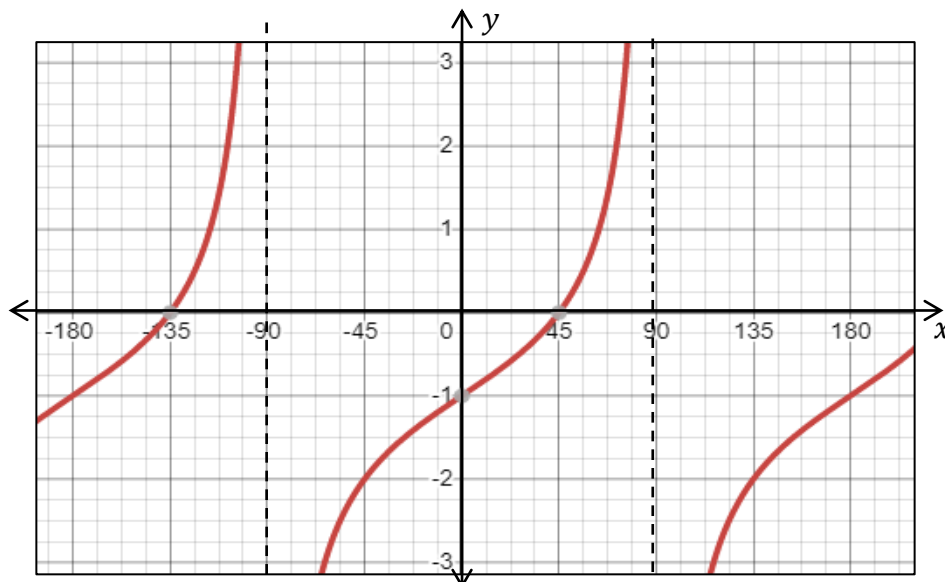
(5)

[28]

QUESTION 6

Diagram

Graph with function $f(x) = \tan x - 1$ is **drawn** for the interval $[-180^\circ; 180^\circ]$.



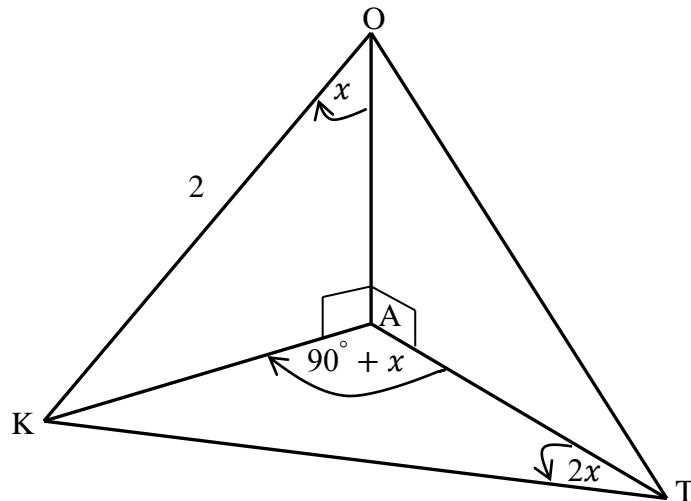
- 6.1 **Draw the function** $g(x) = \cos 2x$ **in your SPECIAL ANSWER BOOK.**
Use the **same set of axes.** (3)
- 6.2 **Write down the period of** g . (1)
- 6.3 **Write down the new equation in the form of** $h(x) = \dots$ **if** f **is moved 3 units up.** (1)
- 6.4 **Use the graphs to determine the value(s) of** x **for which** $\cos 2x \leq \tan x - 1$ **for the interval** $[-180^\circ; 0^\circ]$. (3)
- 6.5 **Use the graph to solve the following equation:** $\cos B + 1 = \tan \frac{1}{2}B$. (4)
- [12]

QUESTION 7

Diagram:

OA is a **vertical tower** and the **points K** and **T** are in the **same horizontal plane** as **A**, the **foot** of the **tower**.

$\widehat{AOK} = x$, $\widehat{KAT} = 90^\circ + x$, $\widehat{KTA} = 2x$ and $OK = 2$ units.



7.1 Express **AK** in terms of a **trigonometric function value** of x in **two different ways** and hence or otherwise **determine the length KT**. (5)

7.2 Show that: $AT = \frac{\cos 3x}{\cos x}$ (2)

7.3 Simplify $\frac{\cos 3x}{\cos x}$ to a **trigonometric function** of $\sin x$. (4)

[11]

QUESTION 8

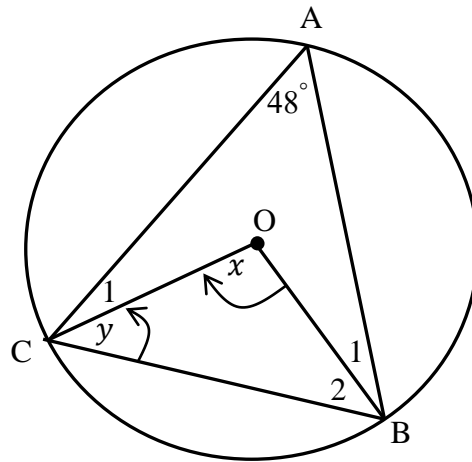
8.1 Diagram:

O is the **centre** of the **circle**.

A, B and **C** are **points on** the **circle**.

$$\widehat{CAB} = 48^\circ$$

$$\widehat{COB} = x \text{ and } \widehat{C_2} = y.$$



Determine the size of:

Give reasons.

$$8.1.1 \quad x \quad (2)$$

$$8.1.2 \quad y \quad (2)$$

8.2 Diagram:

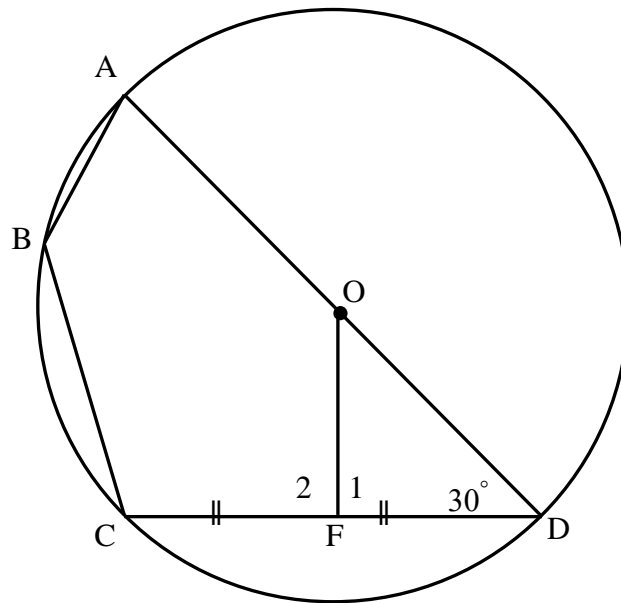
O is the **centre** of the **circle**.

It passes through **A**, **B**, **C** and **D**.

AOD is a **straight-line**.

F is the **midpoint** of **chord CD**.

$\widehat{ODF} = 30^\circ$.



Determine the size of:

Give reasons.

8.2.1 $\widehat{F_1}$ (2)

8.2.2 \widehat{ABC} (2)

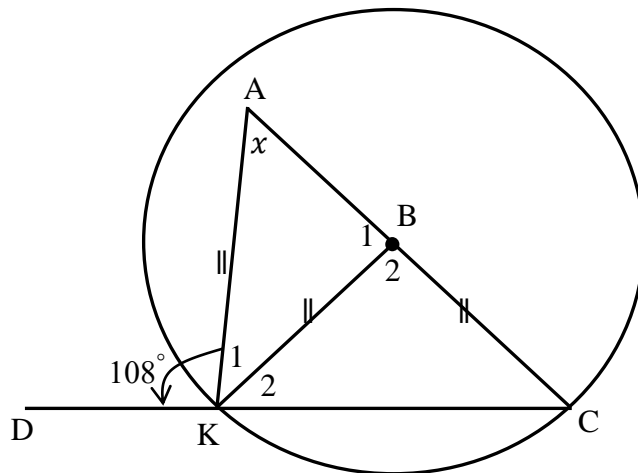
8.3 **Diagram:**

B is the **centre** of the **circle**.

$AK = KB = BC$.

$\widehat{AKD} = 108^\circ$.

$\widehat{A} = x$.

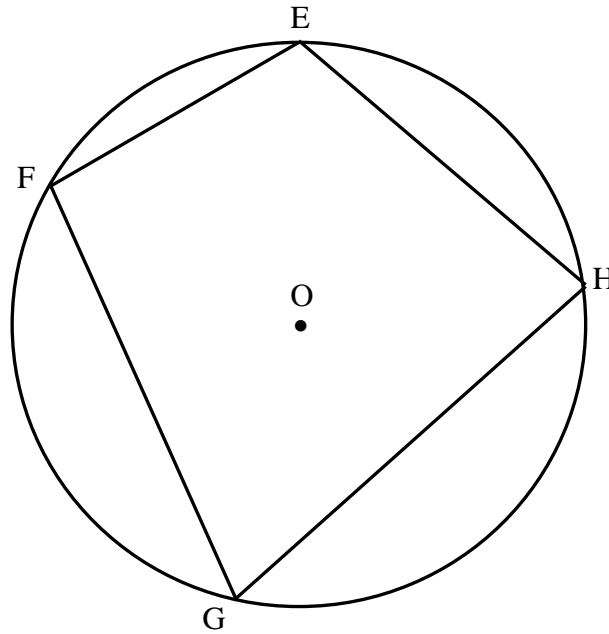


8.3.1 **Express** \widehat{B}_1 **in terms of** x . (2)

8.3.2 **Show that** $\widehat{C} = \frac{x}{2}$. (3)

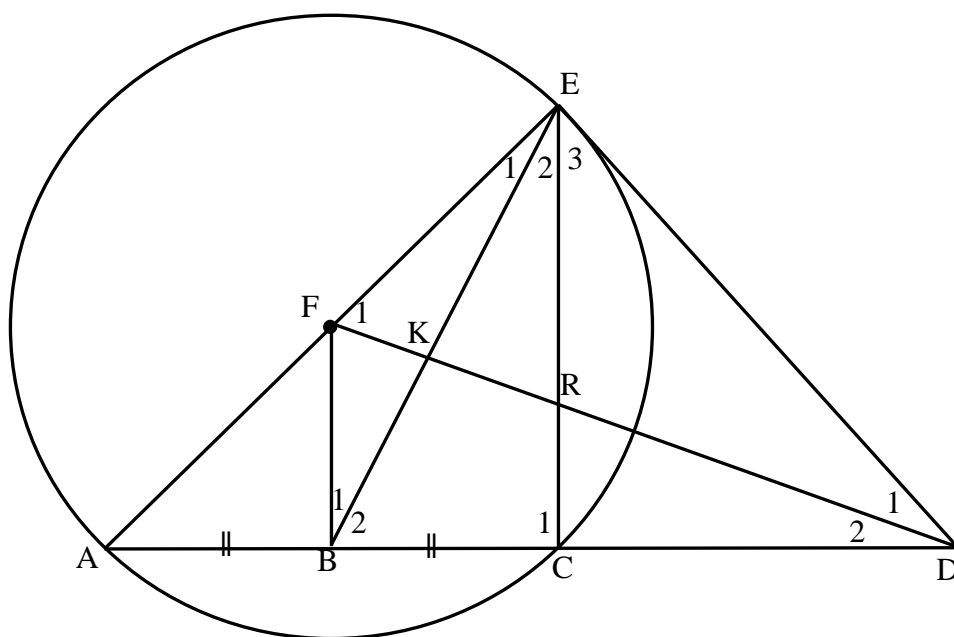
8.3.3 **Solve for** x . (4)

[17]

QUESTION 9**Diagram:****O** is the **centre** of the **circle**.**E, F, G** and **H** are on the **circumference** of the **circle**.**Prove the theorem** that $\widehat{E} + \widehat{G} = 180^\circ$.**[6]**

QUESTION 10

Diagram:

ED is a **tangent** to the **circle** passing through **A**, **C** and **E**.**F** is the **centre** of the **circle**.**AC** is **extended** to meet **ED** at **D**.**FB** bisects **AC**.**Straight-lines FD, BE and EC are drawn.****Prove that:****Give reasons.**

10.1 EFBD is a cyclic quadrilateral (4)

10.2 $\triangle BCE \sim \triangle FED$ (6)10.3 $BC = \frac{FA \cdot CE}{ED}$ (3)10.4 $BC = \frac{AC \cdot FE}{AE}$ (4)**[17]****TOTAL: 150**

INFORMATION SHEET: MATHEMATICS

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

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

$$A = P(1 - i)^n$$

$$A = P(1 + i)^n$$

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

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

$$T_n = a + (n - 1)d$$

$$S_n = \frac{n}{2} (2a + (n - 1)d)$$

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1}; \quad r \neq 1$$

$$S_\infty = \frac{a}{1 - r}; \quad -1 < r < 1$$

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

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c \quad y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

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

$$\text{In } \triangle ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

$$\text{area } \triangle ABC = \frac{1}{2} ab \sin C$$

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

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

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

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

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

$$\sin 2\alpha = 2\sin \alpha \cos \alpha$$

$$\bar{x} = \frac{\sum x}{n} \quad \sigma^2 = \frac{\sum (x_i - \bar{x})^2}{n}$$

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

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$\hat{y} = a + bx$$

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$