Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

JUNE 2023

TECHNICAL MATHEMATICS P2 (DEAF)

MARKS: **150**

TIME: **3 hours**

This question paper has 16 pages, a 2-page information sheet and a special answer book.

INSTRUCTIONS AND INFORMATION

Read the **instructions**. **Answer** the **questions**.

1. This question paper has **11 questions**.

2. **Answer ALL** the **questions**.
   Write in the **SPECIAL ANSWER BOOK**.

3. **Show ALL calculations**, **diagrams**, **graphs**, etc. that you used in your calculations.

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 to **TWO decimal places**.
   Some questions will **tell** you **how** to **round off**.

7. **Diagrams** are **NOT** always drawn to **scale**.

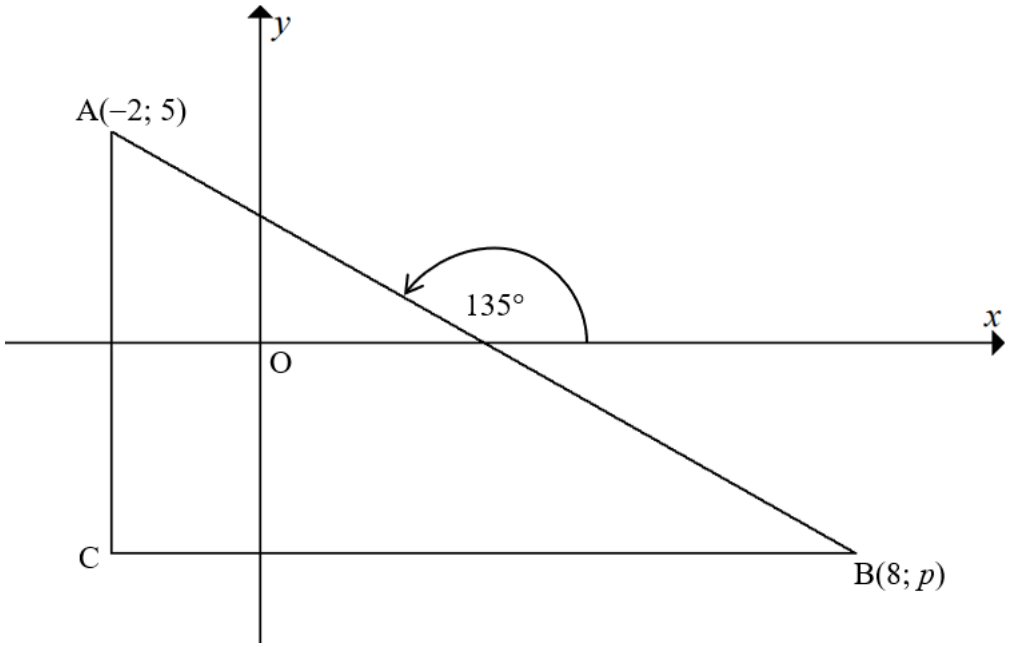
8. An **information sheet** with formulae is at the **end** of the **question paper**.

9. Write **neatly**.
   Your **answers** must be **easy** to **read**.

QUESTION 1

Diagram:

In the **diagram** below **ABC** is a **triangle** with **vertices** A(−2; 5); B(8; *p*) and C.
The **inclination angle** of **AB** is 135°.
AC is **parallel** to the *y*-axis.
BC is **parallel** to the *x*-axis.



1.1 **Determine** the **gradient** of **AB**. (2)

1.2 **Show** that $p = -5$. (3)

1.3 **Determine** the **coordinates** of **M**, the **midpoint** of **AB**. (2)

1.4 **Write** down the **equation** of **BC**. (1)

1.5 **Write** down the **coordinates** of **C**. (2)

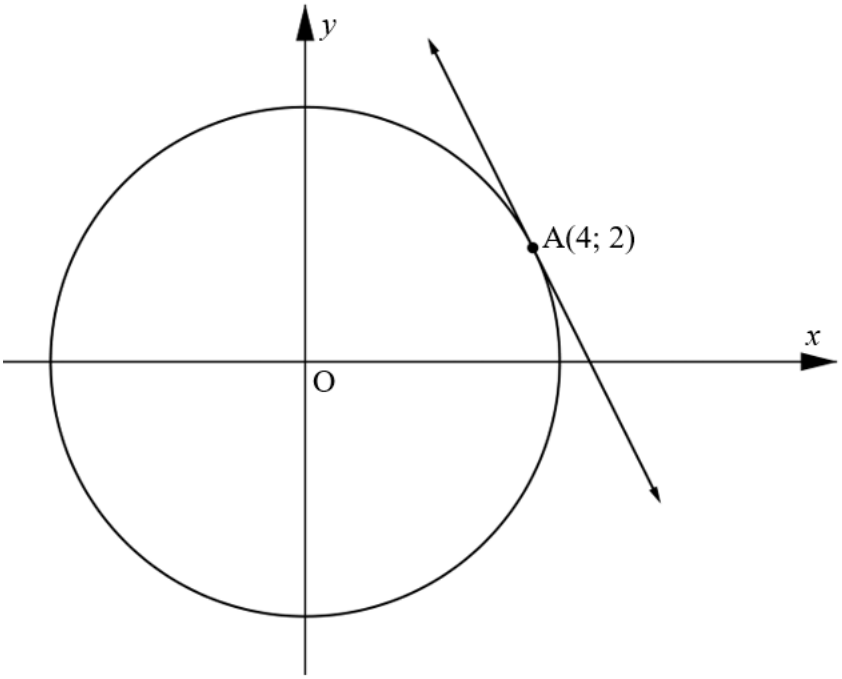
1.6 **Show** that $CM \perp AB$. (3)

1.7 **Determine** the **equation** of the **straight-line parallel** to **CM** and which **passes through point A**. (3)
[16]

QUESTION 2

2.1 **Diagram**:

The **diagram below** shows the **circle** with **equation** $x^2 + y^2 = 20$.
A is a **contact point** of a **tangent** to the **circle**.



2.1.1 **Write** down the **radius** of the **circle** in **simplified surd form**. (1)

2.1.2 **Determine** the **equation** of the **tangent** to the **circle** at **point A** in the **form** $y = ...$ (4)

2.1.3 **Write** down the coordinates of **another point** where the **line AO intersects** with the **circle**. (2)

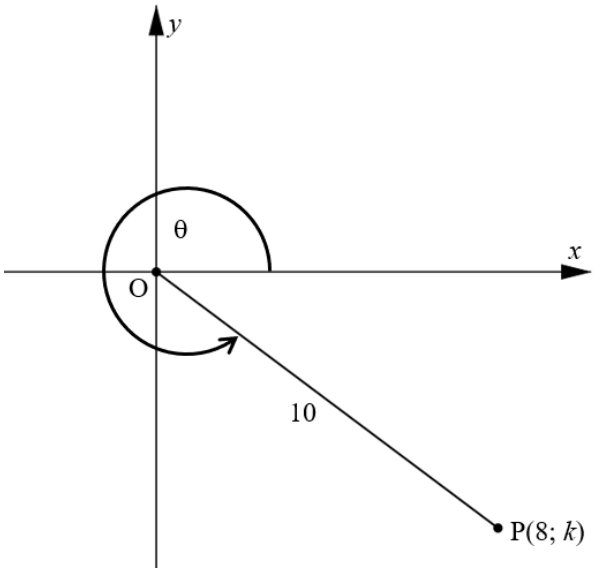
2.2 **Draw** the **graph** of $\frac{x^2}{16} + \frac{y^2}{25} = 1$.

Show ALL the **intercepts** with the **axes**. (3)
[10]

QUESTION 3

3.1 **Diagram**:

In the **diagram**, $P(8;k)$ is a **point** on the **Cartesian plane**.
OP forms a **reflex angle** q with the **positive** ***x***-axis.
OP is **equal** to **10 units**.



Do **NOT** use a **calculator**.
Determine the **value** of:

3.1.1 $\cos\theta$ (1)

3.1.2 k (3)

3.1.3 $\dfrac{\tan\theta}{\text{cosec}\theta}$ (3)

3.2 **Determine** the **values** of x, if $3\cos x - 1 = -1,5 \quad \text{for } x \in [0°;360°]$ (4)
[11]

QUESTION 4

4.1 **Simplify**:

$$(1+\cos x)(1-\cos x) \quad (2)$$

4.2 **Simplify**:

$$\frac{\cos^2(2\pi - x)\tan^2 x}{\sin(180° + x)\operatorname{cosec}(180° - x)} \quad (6)$$

4.3 **Prove that**:

$$\cot x + \tan x = \operatorname{cosec} x \cdot \sec x \quad (4)$$

[12]

QUESTION 5

Given the **functions defined** by $f(x)=\cos 2x$ and $g(x)=\sin(x-30°)$ for $x\in[0°;180°]$.

5.1 **Write** down the **period** of *f*. (1)

5.2 **Write** down the **amplitude** of *g*. (1)

5.3 **On** the **same axes** given in your **SPECIAL ANSWER BOOK** draw the **graphs** of *f* and *g*.
Show the **turning points**, **endpoints**, and the **intercepts** with the **axes**. (8)

5.4 Use **graphs** to **determine** for which **values** of *x* is:

5.4.1 $f(x)\leq 0$ (2)

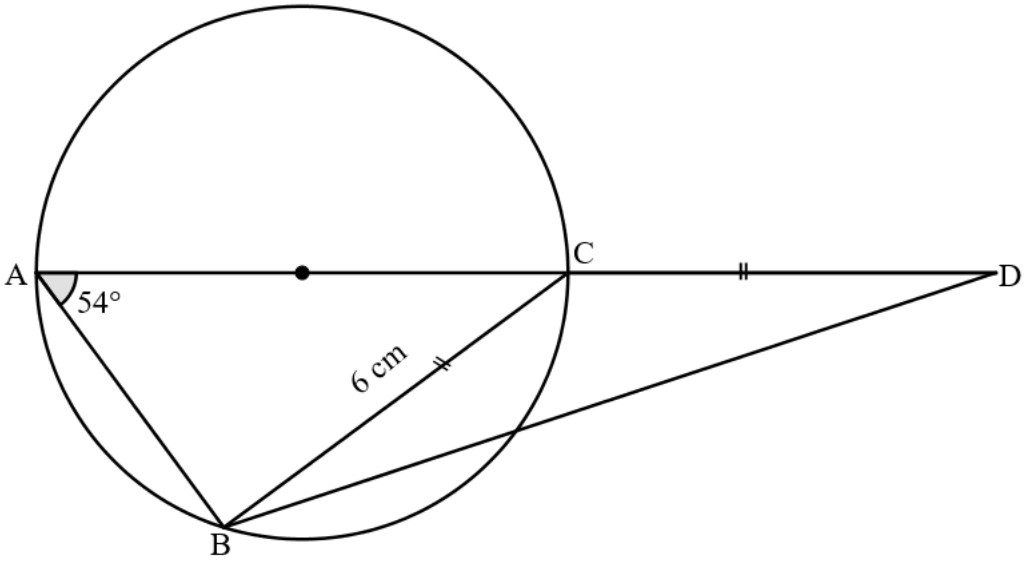
5.4.2 $f(x).g(x)\geq 0$ in the **second quadrant** (2)
[14]

QUESTION 6

6.1 **Write** down the **cosine rule** for ΔPQR. (1)

6.2 **Diagram**:

AC is the **diameter** of the **circle ABC**.
AC is produced to D such that DC = CD = 6 cm.
$\hat{A} = 54°$



Determine:

6.2.1 The **size** of $A\hat{B}C$, **stating** a **reason** (2)

6.2.2 The **size** of $B\hat{C}D$, **stating** a **reason** (2)

6.2.3 The **length** of **BD** (4)

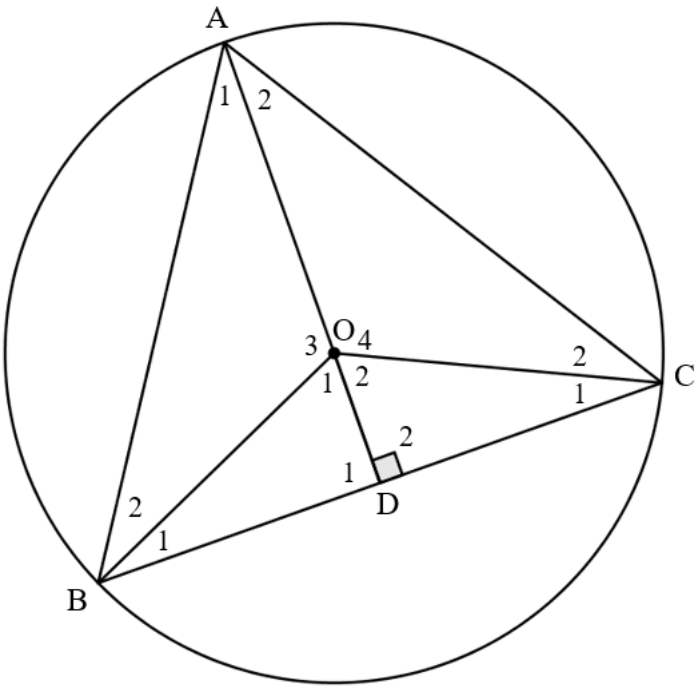
6.2.4 The **length** of the **diameter**, AC (2)

6.2.5 The **area** of ΔABC (3)
[14]

QUESTION 7

Diagram:

ABC is a **circle** with **centre** O.
OD = 3 cm, BC = 11 cm and $OD \perp BC$.
BO, AO and OC are **joined**.



7.1 **Determine** the **length** of **BD**.
State a **reason**. (2)

7.2 **Calculate** the **length** of **OB**. (2)

7.3 **Show** that $\Delta ABD \equiv \Delta ACD$. (4)

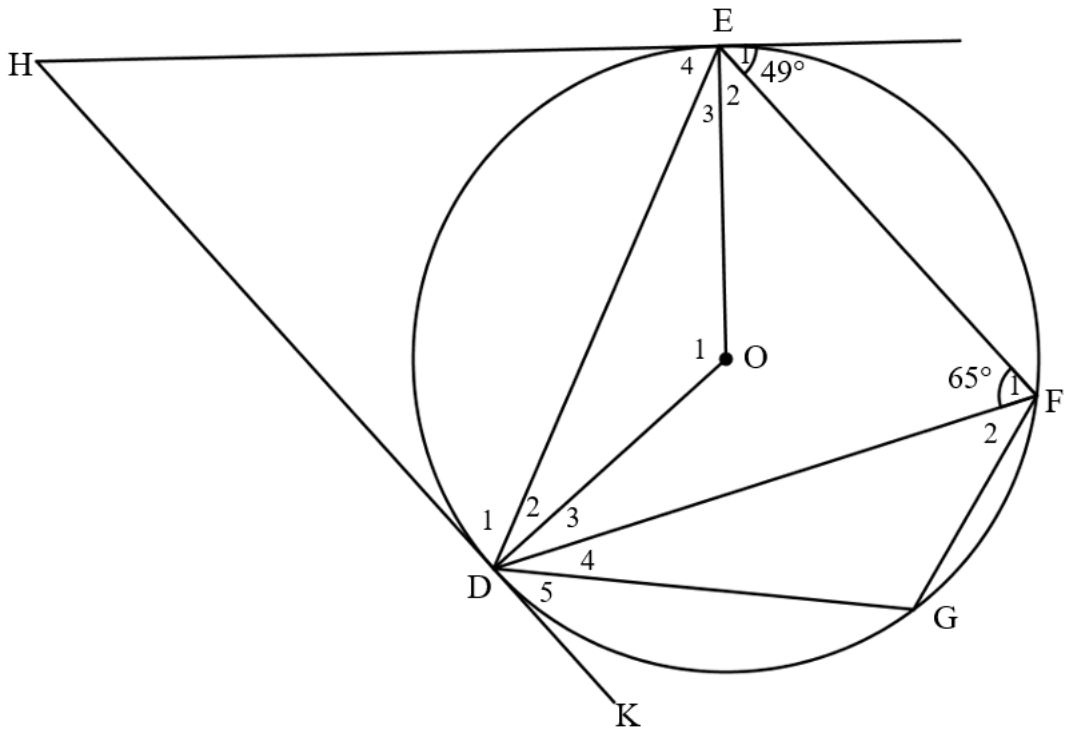
7.4 **Calculate** the **size** of $\hat{B}_1$. (2)

7.5 **Calculate** the size $\hat{A}$.
State reasons. (4)
[14]

QUESTION 8

Diagram:

A **circle** with **centre** O is given.
HE and HD are **tangents** to the **circle.**
$\hat{E}_1 = 49°$ and $\hat{F}_1 = 65°$.



8.1 **Give** a **reason** why HD = HE. (1)

8.2 **Determine**, stating **reasons**, the **size** of the **angles**:

8.2.1 $\hat{D}_1$ (2)

8.2.2 $\hat{D}_2$ (2)

8.2.3 $D\hat{E}F$ (2)

8.2.4 $\hat{G}$ (2)

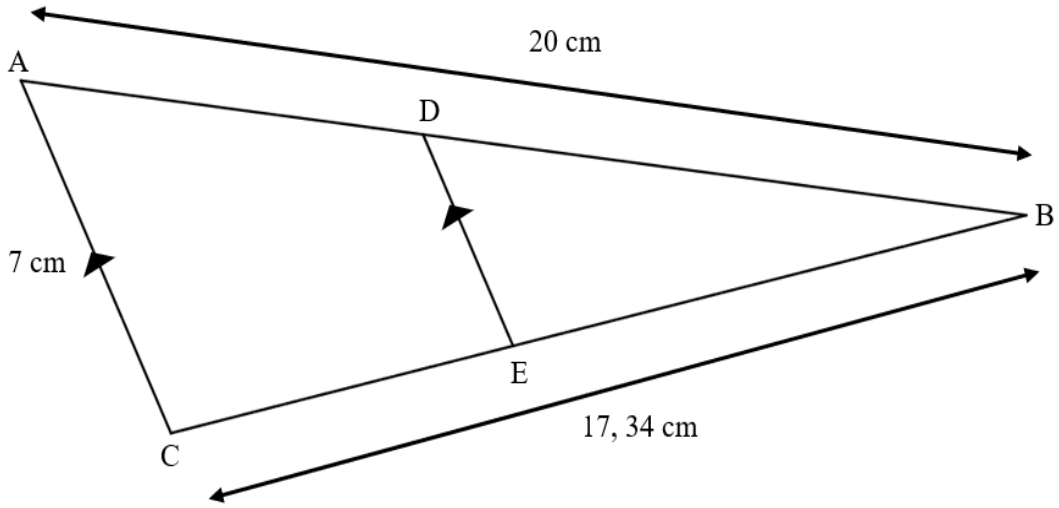
8.2.5 $F\hat{D}K$ (2)

8.3 Give **reasons**, whether **EHDF** is **cyclic**. (3)
[14]

QUESTION 9

Diagram:

In ΔABC , **AB** = 20 cm,
BC = 17,34 cm
AC = 7 cm
D and **E** are **points** on the **sides** of the **triangle** such that DE ∥ AC.
AD : DB = 2 : 3



9.1 **Determine** the **lengths** of **AD** and **DB**.
Give reasons. (3)

9.2 **Calculate** the **length** of **BE**. (3)

9.3 **Prove** that ΔBDE ||| ΔBAC.
Give reasons. (3)

9.4 **Determine** the **length** of **DE**. (3)
[12]

QUESTION 10

A **wheel** with a **diameter 250 mm**, has a **circumferential velocity(speed)** of **108 kilometres per hour.**

10.1 **Convert** 108 km/h to m/s. (2)

10.2 **Determine** the **rotational frequency** of the **wheel** in **seconds**. (5)

10.3 **Determine** the **angular velocity(speed)** of the **wheel** in **seconds**. (3)

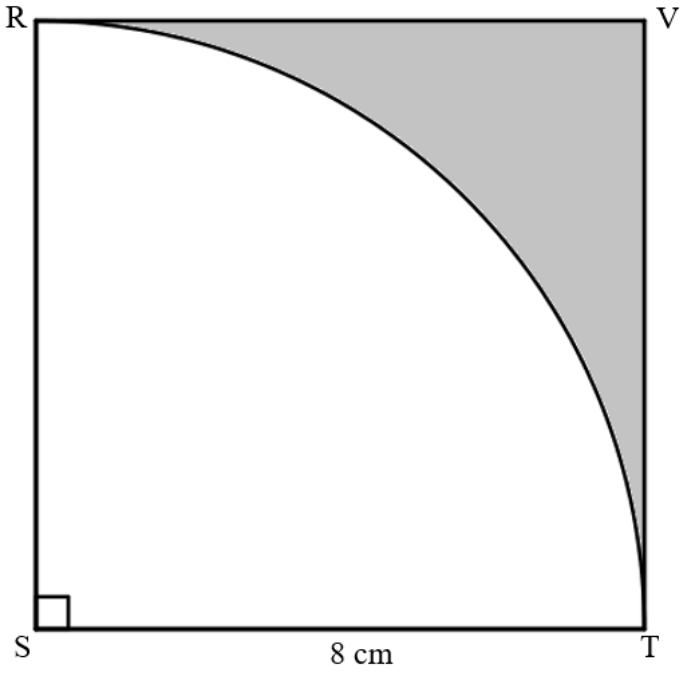
10.4 **Determine** the **distance, in km**, a **point** on the **wheel** will **cover** in **10 minutes**. (3)

10.5 **Determine how long** it will take the **wheel** to make **20 revolutions**. (2)
[15]

QUESTION 11

11.1 **Diagram:**

RSTV is a **square** with sides 8 cm.
RT is an **arc** of the **sector** RST. (2)



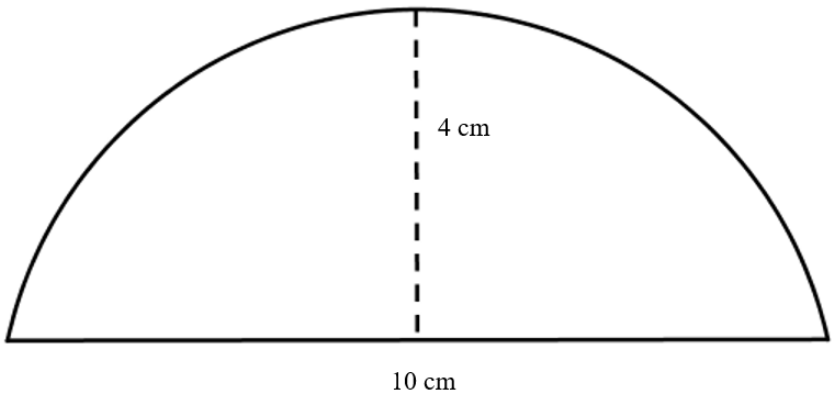
11.1.1 **Determine** the **length** of **arc RT**. (3)

11.1.2 **Determine** the **area** of **sector RST**. (3)

11.1.3 **Calculate** the **area** of the **shaded area**. (3)

11.2 **Diagram**:

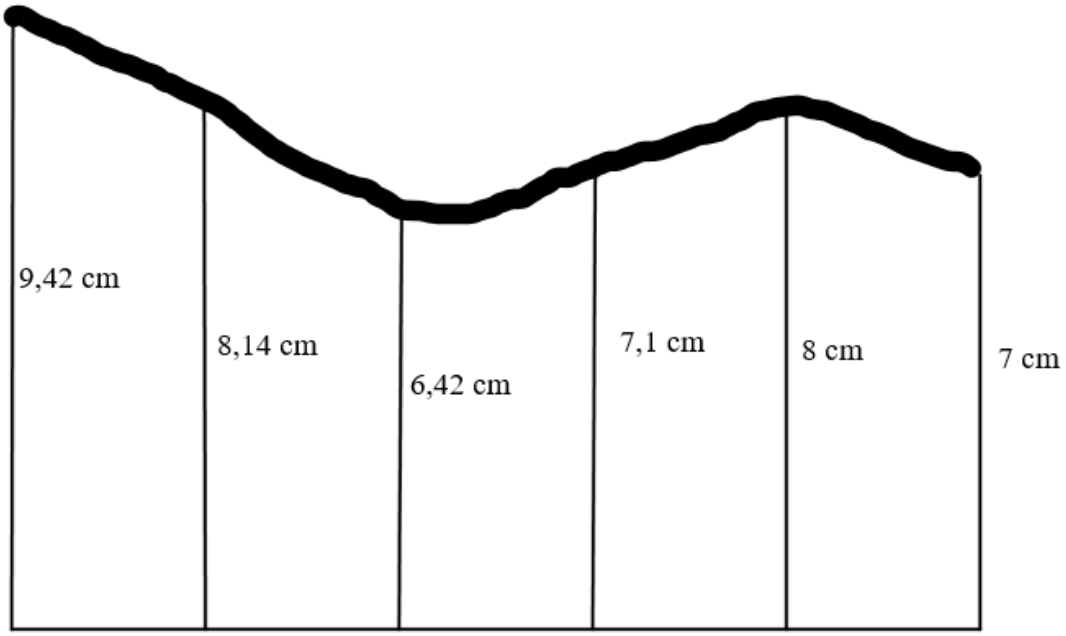
The **diagram below** is a **minor segment** of a **circle**.
The **height** is 4 cm and **chord** 10 cm.



Determine the **length** of the **radius** of the **circle**. (5)

11.3 **Diagram:**

The **ordinates** in the **irregular figure** are 9,42; 8,14; 6,42; 7,1; 8 and 7 cm.
It is **shown** in the **diagram** below.
The **area** of the **irregular figure** is **113,61 cm^2**.



Determine the **width** of the **equal parts** on the **horizontal axis**. (4)
[18]

TOTAL: 150

INFORMATION SHEET

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

$$a^x = b \Leftrightarrow x = \log_a b \qquad a > 0\ ,\ a \neq 1 \text{ en } b > 0$$

$$A = P(1 + ni) \qquad A = P(1 - ni)$$

$$A = P(1 + i)^n \qquad A = P(1 - i)^n \qquad i_{eff} = \left(1 + \frac{i^m}{m}\right)^m - 1$$

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

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C \quad , \quad n \neq -1 \qquad \int kx^n dx = k \cdot \frac{x^{n+1}}{n+1} + C \quad , \quad n \neq -1$$

$$\int \frac{1}{x} dx = \ln(x) + C, \quad x > 0 \qquad \int \frac{k}{x} dx = k \cdot \ln(x) + C, \quad x > 0$$

$$\int a^x dx = \frac{a^x}{\ln a} + C \quad , \quad a > 0 \qquad \int ka^{nx} dx = k \cdot \frac{a^{nx}}{n \ln a} + C \quad , \quad a > 0$$

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

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

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

In ΔABC:

$$\frac{a}{\sin \text{A}} = \frac{b}{\sin \text{B}} = \frac{c}{\sin \text{C}} \qquad a^2 = b^2 + c^2 - 2bc\cos \text{A} \qquad \text{Area} = \frac{1}{2}ab.\sin \text{C}$$

$$\sin^2\theta + \cos^2\theta = 1 \qquad \tan^2\theta + 1 = \sec^2\theta \qquad 1 + \cot^2\theta = \text{cosec}^2\theta$$

$\pi rad = 180°$

Angular velocity = $\omega = 2\pi n$ where n = rotation frequency

Angular velocity = $\omega = 360°n$ where n = rotation frequency

Circumferential velocity = $v = \pi Dn$ where D = diameter and n = rotation frequency

Circumferential velocity = $v = \omega r$ where ω = Angular velocity and r = radius

Arc length $s = r\theta$ where r = radius and θ = central angle in radians

$\text{Area of a sector} = \frac{rs}{2}$ where r = radius and s = arc length

$\text{Area of a sector} = \frac{r^2\theta}{2}$ where r = radius and θ = central angle in radians

$4h^2 - 4dh + x^2 = 0$ where h = height of segment, d = diameter of the circle and x = length of chord

$A_T = a\left(m_1 + m_2 + m_3 + \ldots + m_{n-1}\right)$ where a = width of equal parts, $m_1 = \frac{o_1 + o_2}{2}$ and n = number of ordinates

OR

$A_T = a\left(\frac{o_1 + o_n}{2} + o_2 + o_3 + o_4 + \ldots + o_{n-1}\right)$ where a = width of equal parts, $o_i = i^{th}$ ordinate and n = number of ordinates