Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2022

TECHNICAL MATHEMATICS P2 (DEAF)

MARKS: 150

TIME: 3 hours

This question paper has 16 pages, including a 2-page information sheet.

INSTRUCTIONS

Read the following instructions carefully before answering the questions.

1. This question paper has 10 questions.

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

3. **Show ALL calculations, diagrams, graphs**, et cetera that you used in **working out answers**.

4. **Answers only** will **NOT always** be awarded **full marks**.

5. You **may use** a prescribed **calculator**.
   Some questions will **tell** you **how** to **round off**.

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

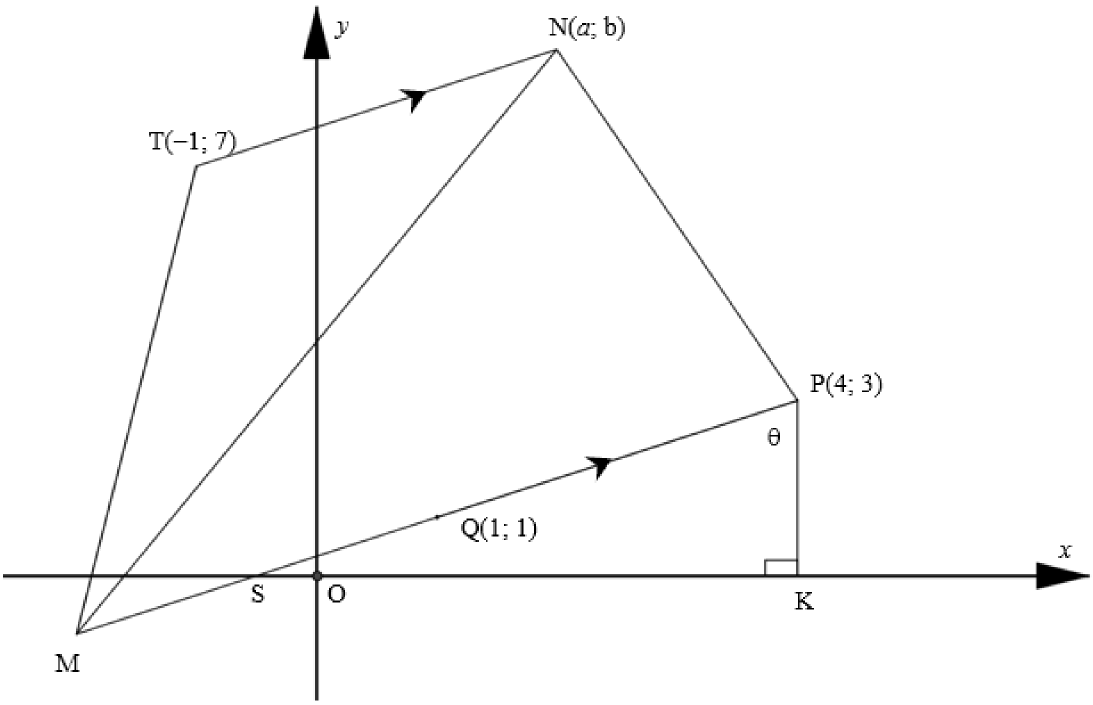
7. **Diagrams** are **NOT** always drawn to **scale**.

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

9. Write neatly.

QUESTION 1

In the diagram below M, T(-1;7), N$(a;b)$ and P(4;3) are vertices of a trapezium MTNP having TN||MP. Q(1;1) is the midpoint of MP. PK is a vertical line with $S\hat{P}K = \theta$.
The equation of NP is $y = -3x + 15$.



1.1 **Write** the **coordinates** of K. (2)

1.2 **Determine** the **coordinates** of M. (6)

1.3 **Determine** the **gradient** of PM. (3)

1.4 **Calculate** the **size** of θ. (5)

1.5 Hence, or otherwise, **determine** the **length** of PS. (3)

1.6 **Determine** the **coordinates** of N. (7)

[26]

QUESTION 2

2.1 **Determine** the **value** of the following:

2.1.1 $51{,}5\ cos18°.sin58°$ (1)

2.1.2 $\dfrac{1{,}28cot32{,}3°.tan81{,}5°}{sec16{,}1°.cosec41{,}8°}$ (2)

2.2 Consider $5cos\theta = 3$ and $0° < \theta < 90°$.

Determine the value of the following, **WITHOUT** the use of a **calculator,** but **with** the aid of a **diagram**:

2.2.1 $sin\theta.sec\theta$ (5)

2.2.2 $\dfrac{tan\theta}{cot\theta}$ (3)

2.2.3 **Determine** the **size** of θ, with the **use** of a **calculator**. (3)

2.3 **Solve** for $\theta \in [0°;360°]$, **rounded** off to ONE **decimal digit**.

$3\,sin\,\theta = -1{,}026$ (5)

[19]

QUESTION 3

3.1 **Complete** the following **identities**:

3.1.1 $1 - \sin^2 x = \ldots$ (1)

3.1.2 $\sec^2 x - \tan^2 x = \ldots$ (1)

3.2 **Simplify:** $\dfrac{sin(\pi - \theta).tan\theta.sin270°}{cos(2\pi - \theta).tan(\pi - \theta)}$ (5)

3.3 **Prove** the **identity**: $\sin x + \cot x \,.\, \cos x = \text{cosec } x$ (4)

[11]

QUESTION 4

Given $f(x) = \sin x + 2$ and $g(x) = 3\cos x$ for $x \in [0°;360°]$.

4.1 **Use** the set of **axes** in the SPECIAL ANSWER BOOK to **draw sketch graphs** of the **curves** of f and g for $x \in [0°;360°]$. Clearly **show** ALL **intercepts** with the axes, coordinates of all turning points and end points of both curves. (6)

4.2 **Use** the **graphs** drawn in QUESTION 4.1, or otherwise, to **determine** the following:

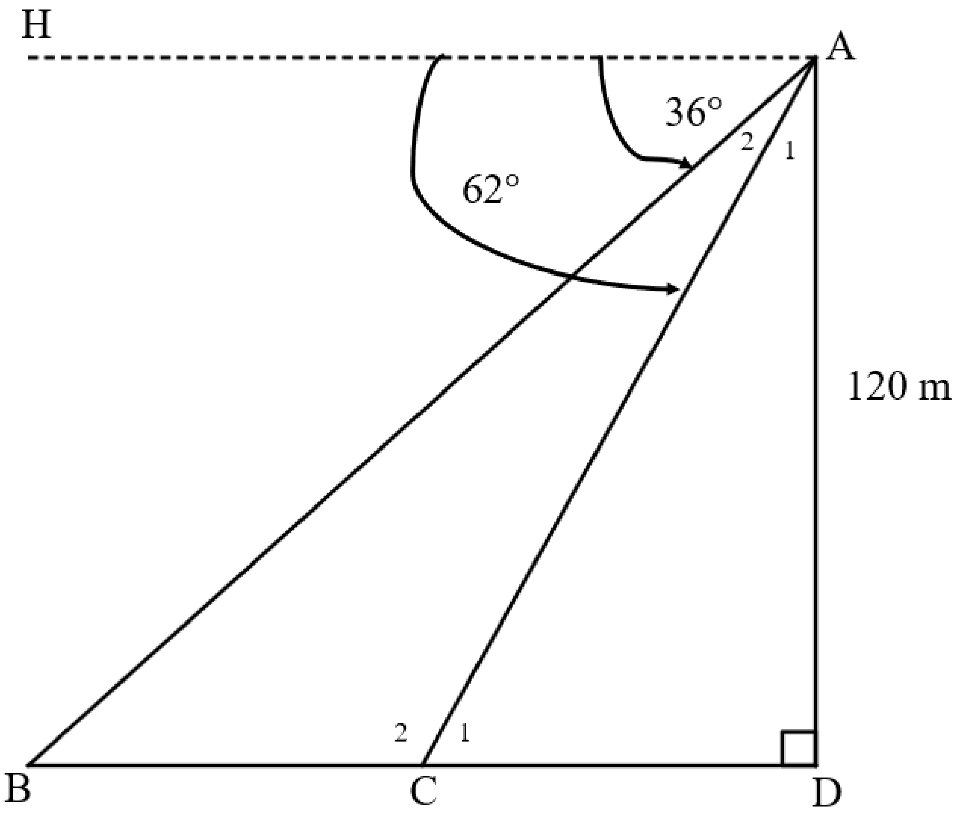
4.2.1 The **amplitude** of g (1)

4.2.2 The **value(s)** of $x \in [0°;360°]$ for which $g(x) \leq 0$. (2)

[9]

QUESTION 5

From the top of a cliff, 120 m above sea level, a person at point **A** notices two ships in the distance (at points **B** and **C** respectively). The angles of depression in the direction of the two ships are 36° and 62° respectively. The diagram below represents the above scenario.



5.1 **Write** the **size** of $\hat{B}$. (2)

5.2 **Write** the **size** of $\hat{C}_1$. (1)

5.3 **Determine** the **length** of AC. (3)

5.4 Hence, **determine** the **distance between** the **two ships** (BC). (5)

5.5 **Determine** the **area** of ΔABC. (3)

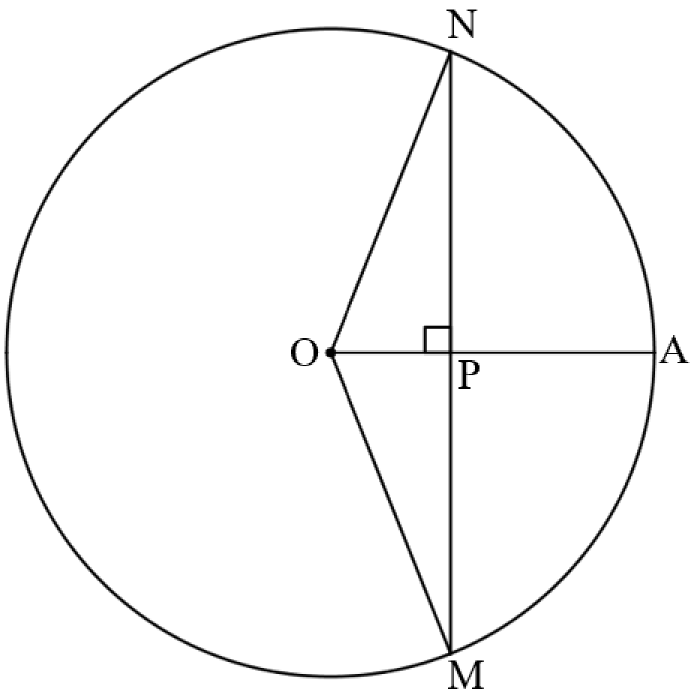
[14]

QUESTION 6

6.1 **Complete** the following **statement**:

"The line drawn from the centre of a circle perpendicular to the chord … the chord." (1)

6.2 The diagram below shows a circle with centre O. OPA ⊥ MPN; MN = 48 units and OP = 7 units.



Determine, **stating reasons**, the **length** of PA. (7)

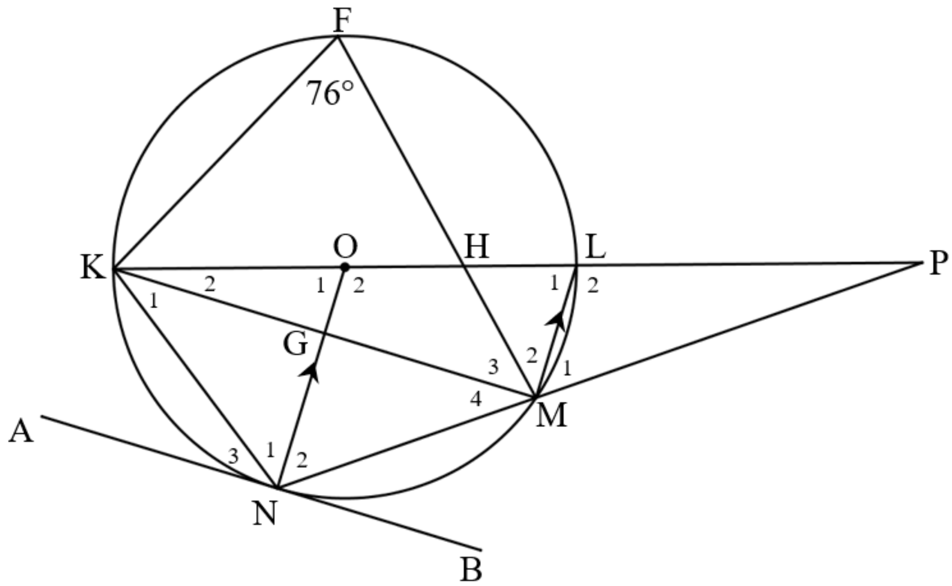
[8]

QUESTION 7

7.1 **Complete** the following **statement**:

"The angle subtended by the diameter at the circumference of the circle is …" (1)

7.2 O is the centre of a circle, diameter KL and line NM are produced to meet at P. ON ∥ LM. ANB is a tangent to the circle at N and $\hat{F} = 76°$.



Use the d**iagram** above to **identify(find) angles** that are **related** to the following angles. **Find** the **sizes** of these **angles**. Give **reasons** for **answers**.

7.2.1 $\hat{L}_1$ (2)

7.2.2 $\hat{O}_1$ (2)

7.2.3 $\hat{M}_4$ (2)

7.2.4 $\hat{N}_3$ (2)

7.2.5 $\hat{N}_1 + \hat{N}_2$ (2)

7.2.6 $\hat{N}_1 + \hat{N}_3$ (2)

7.2.7 $\hat{M}_2 + \hat{M}_3$ (2)

7.2.8 $\hat{M}_1$ (2)

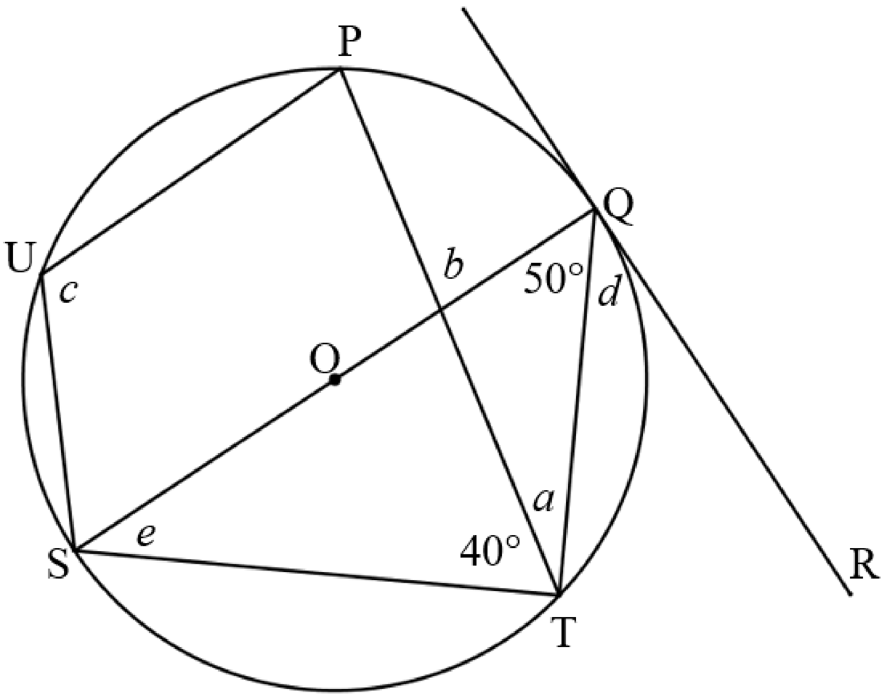
[17]

QUESTION 8

8.1 **Complete** the following **statement:**

"The angle between the tangent to a circle and the chord drawn from the point of contact is … to the angle in the alternate segment." (1)

8.2 **Refer** to the **diagram** below. RQ is a tangent to the circle QTSUP with centre O. SOQ and PT are straight lines. $P\hat{T}S = 40^\circ$ and $S\hat{Q}T = 50^\circ$.



Determine, with reasons, the following:

8.2.1 *A* (2)

8.2.2 *B* (2)

8.2.3 *C* (2)

8.2.4 *D* (2)

8.2.5 *E* (2)

[11]

QUESTION 9

9.1 If the area of a sector is 8,5 cm^2 and the radius is 2,1 cm.

Calculate the following:

9.1.1 The angle of the sector to the nearest degrees (4)

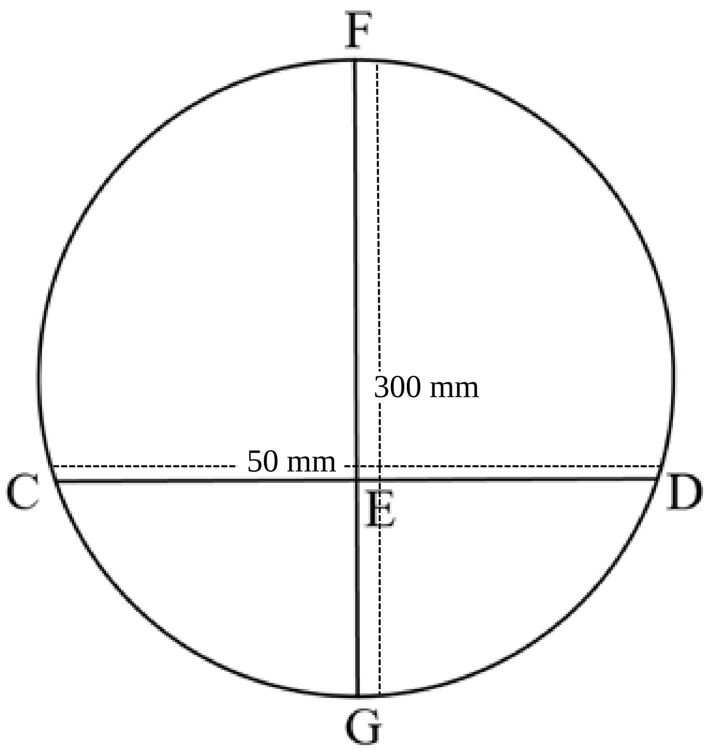
9.1.2 The arc length of the sector (3)

9.2 The diameter of a wheel is 80 mm and it turns at 21 revolutions per second.

9.2.1 **Calculate** the **circumferential velocity** of the **wheel**, to the nearest integer. (3)

9.2.2 **Calculat**e the **angular velocity** of the **wheel**, to the nearest integer. (3)

9.3 In the diagram below, FG is the diameter of the circle, with length of 300 mm. CD is a chord of the circle with a length of 50 mm. CD divides the circle into two segments.

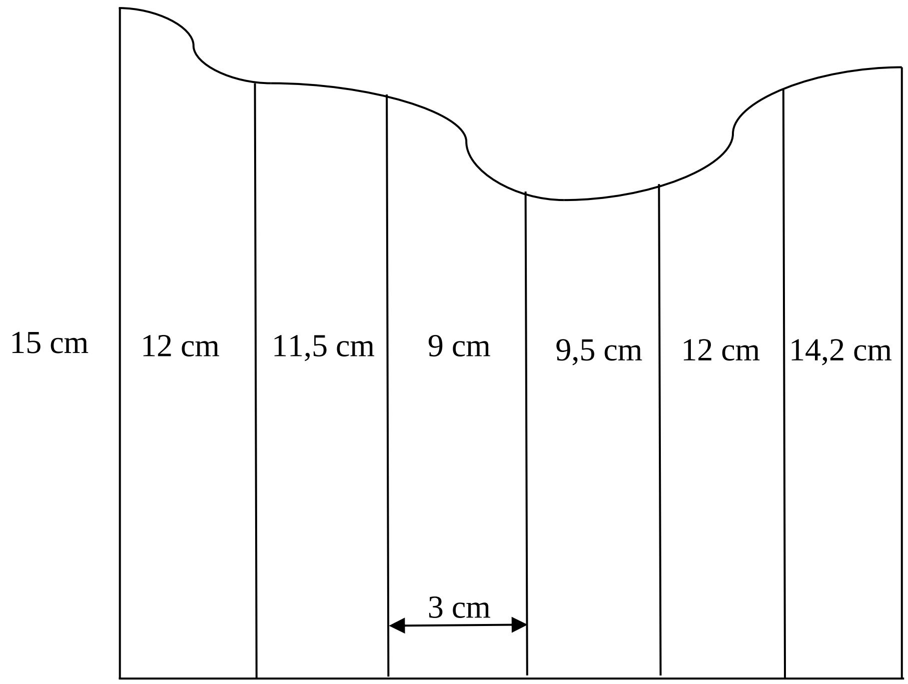


Determine the **heigh**t of the **larger segment** in cm. (8)

[21]

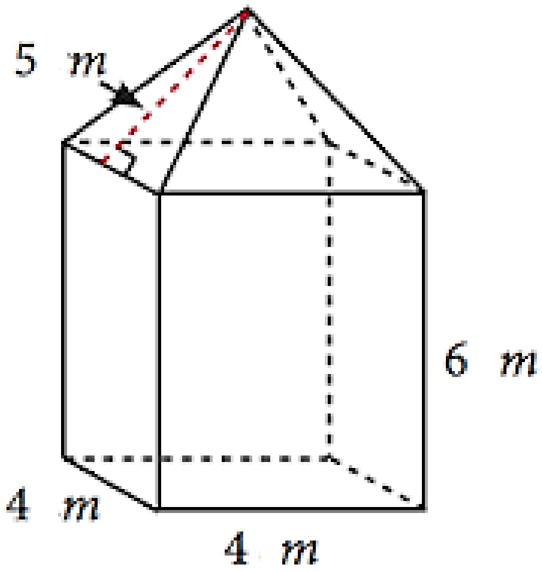
QUESTION 10

10.1 Consider the irregular figure below.



Determine the **area** of the **figure** by **using** the **mid-ordinate rule**. (4)

10.2 A person wants to build a shed as **depicted**(shown) in the diagram below. The shed will have a square base with 4 m side.



The following formulae may be used:
Total surface area of a rectangular prism = $2lw + 2lh + 2wh$
Total surface area of a square pyramid = $2bs + b^2$
Volume of a rectangular prism = lwh
Volume of a square pyramid = $\frac{1}{3}(A)(H)$**, where** A **is the area of the base and** H **is the height of the pyramid**

10.2.1 **Calculate** the **total surface area** of the **shed**, which includes the **roof**, that needs to be painted. (4)

10.2.2 **Calculate** the **volume** of the **shed**. (6)
[14]

TOTAL: 150

INFORMATION SHEET: TECHNICAL MATHEMATICS

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

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

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

$i_{eff} = \left(1 + \dfrac{i}{m}\right)^m - 1$

$f'(x) = \lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$

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

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

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

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

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

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

In ΔABC:

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

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

$\pi rad = 180°$

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

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

Area of a sector $= \dfrac{r^2\theta}{2}$ 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, $m_1 = \dfrac{o_1 + o_2}{2}$ and n = number of ordinates

OR

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