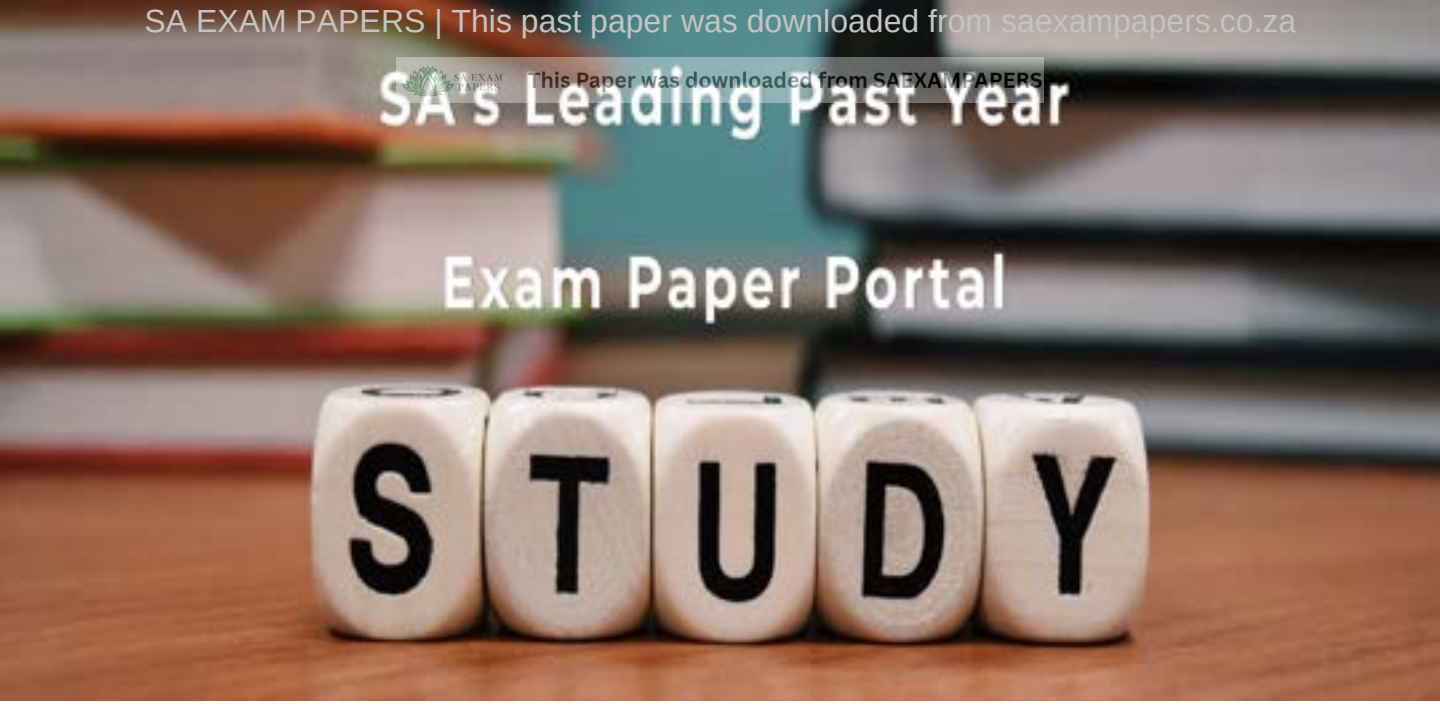


Province of the
EASTERN CAPE
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo
Provinsie van die Oos Kaap: Department van Onderwys
Porafensie Ya Kapa Botjahabela: Lefapha la Thuto

NATIONAL SENIOR CERTIFICATE

GRADE 12

JUNE 2026

TECHNICAL MATHEMATICS P1

MARKS: **150**

TIME: **3 hours**

This question paper consists of 13 pages, including a 2-page information sheet and a SPECIAL ANSWER BOOK of 23 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of NINE questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining the answers.
5. Answers only will NOT necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
7. If necessary, round off answers to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. An information sheet with formulae is included at the end of the question paper.
10. Write neatly and legibly.

QUESTION 1

1.1 Solve for x:

1.1.1 $2x^2 + 7x - 15 = 0$ (2)

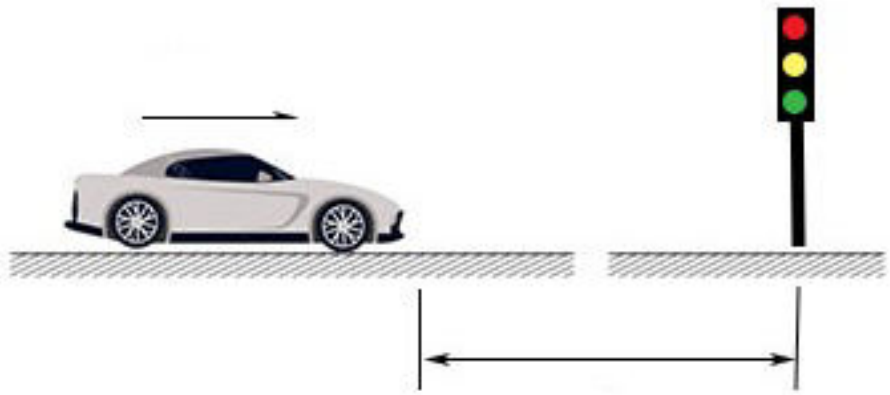
1.1.2 $\frac{x^2}{3} - 2x - 5 = 0$ (Correct to ONE decimal place) (3)

1.1.3 $12 + 4x > x^2$ (Represent your answer on a number line) (4)

1.2 Solve for x and y if:

$x - y - 1 = 0$ and $x^2 + y^2 = 5$ (6)

1.3 The diagram below depicts a car travelling a certain distance to a traffic light.



s **is the displacement** of the object from its starting point.
u **is the initial velocity** of the object.
t **is the time** duration over which the motion occurs.
a **is the constant acceleration** of the object.

If $s = ut + \frac{1}{2}at^2$

1.3.1 Make a the subject of the formula. (2)

1.3.2 Determine the acceleration of the car that travelled 25 m (displacement) in 5 seconds (time) from rest (initial velocity). (2)

1.4 Determine the value of the following and give your answer in decimal form:

$1000111_2 + 101110_2$ (2)

[21]

QUESTION 2

2.1 Given: $p = \frac{x^2-x+1}{1-x}$, determine the value(s) of x for which:

2.1.1 p is undefined. (1)

2.1.2 p has non-real roots. (2)

2.2 Calculate the value of k for which $x^2 - kx + (k+3) = 0$ has equal roots. (5)

[8]

QUESTION 3

3.1 Simplify the following WITHOUT the use of a calculator:

3.1.1 $\frac{\sqrt{20} - \sqrt[3]{8}}{\sqrt{5} - 1}$ (3)

3.1.2 $\frac{5.2^{x+1} - 2^x}{2^{x-1}}$ (3)

3.1.3 $\log_2 \frac{1}{8} + \log_4 1 + \log_9 3$ (3)

3.2 Solve for x WITHOUT the use of a calculator:

$\log_x 8 = 2$ (2)

3.3 Given: $z = -2 + 2i$

3.3.1 Calculate the modulus (r) of z. (2)

3.3.2 Calculate the argument (θ) of z. (3)

3.3.3 Write z in polar form. (1)

3.4 Solve for x and y if: $x + y + ix - iy = 5 - 3i$ (4)

[21]

QUESTION 4

4.1 Given: $f(x)=\frac{2}{x}-2$ and $x^2+y^2=4$

4.1.1 Write down the equations of the asymptotes of f. (2)

4.1.2 Determine the coordinates of the x- and y-intercepts of f. (4)

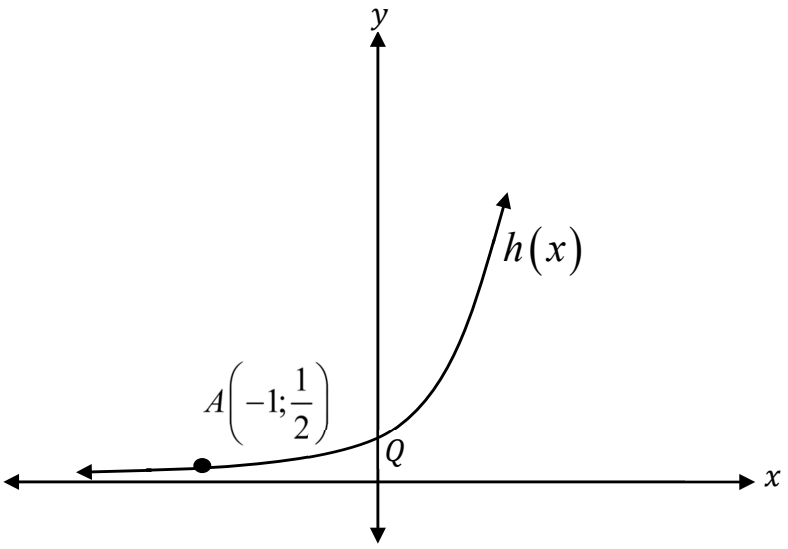
4.1.3 Sketch the graphs of f and the circle on the same system of axes in the SPECIAL ANSWERBOOK provided. Clearly show all the asymptotes and the intercepts with the axes. (6)

4.1.4 Determine the equation of the line of symmetry of f, with a negative gradient. (2)

4.1.5 Write down the range of f. (2)

4.1.6 Write down the domain of the circle. (2)

4.2 The graph of $h(x)=a^x$, is sketched below, with $A\left(-1;\frac{1}{2}\right)$ as a point on the graph.

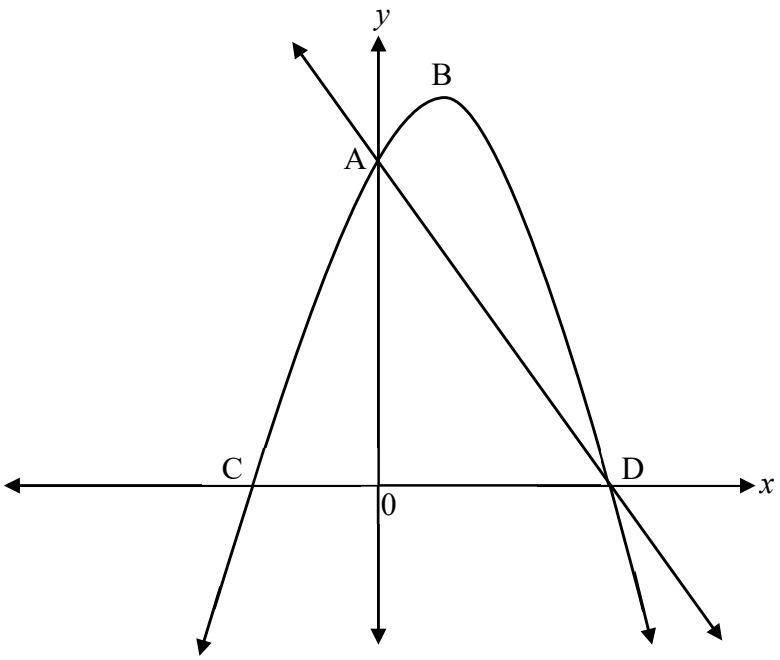


4.2.1 Calculate the value of a. (2)

4.2.2 If h is reflected in the y-axis, write the new equation of $p(x)$ that is formed. (2)

4.2.3 Sketch the reflection of $h(x)$ in QUESTION 4.2.2 on the system of axes in the SPECIAL ANSWER BOOK provided. (2)

4.3 The graph of $g(x) = -x^2 + 3x + 10$ is given below. C and D are the x-intercepts.
A is the y-intercept and B is the turning point of the graph of g.
$k(x) = mx + c$ is a straight line intersecting $g(x)$ at A and D.



4.3.1 Determine the coordinates of C and D. (5)

4.3.2 Determine the equation of $k(x)$ (4)

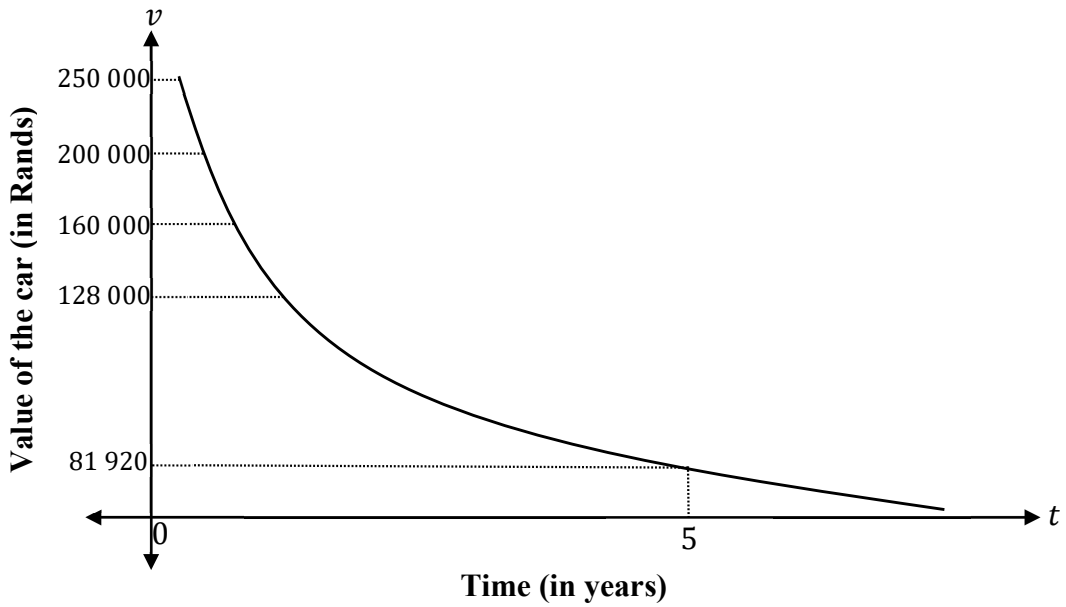
4.3.3 For which values of x is $g(x) > k(x)$? (2)

[35]

QUESTION 5

5.1 Convert 17% per annum compounded quarterly to the effective annual interest rate. (3)

5.2 The graph below represents the value of a car over time, where the y-axis represents the value of the car in Rands and the x-axis represents the time in years.



5.2.1 What was the original price of the car? (1)

5.2.2 Is the value of the car appreciating or depreciating? (1)

5.2.3 Calculate the interest rate (in percentage) compounded annually after 5 years. (4)

5.3 R75 000 is invested in an account that offers interest at 8,2% per annum compounded quarterly for the first 18 months. The interest rate changes to 6,5% per annum compounded monthly, thereafter. Three years after the initial investment, R5 500 is withdrawn from the account. A year later, after the withdrawal, R6 000 is deposited into the account. How much will be in the account at the end of 5 years? (6)

[15]

QUESTION 6

6.1 Given: $f(x) = 4 - 2x$

Determine $f'(x)$ using FIRST PRINCIPLES. (5)

6.2 Evaluate:

6.2.1 $D_x\left[\left(x^3 - 3\right)^2\right]$ (4)

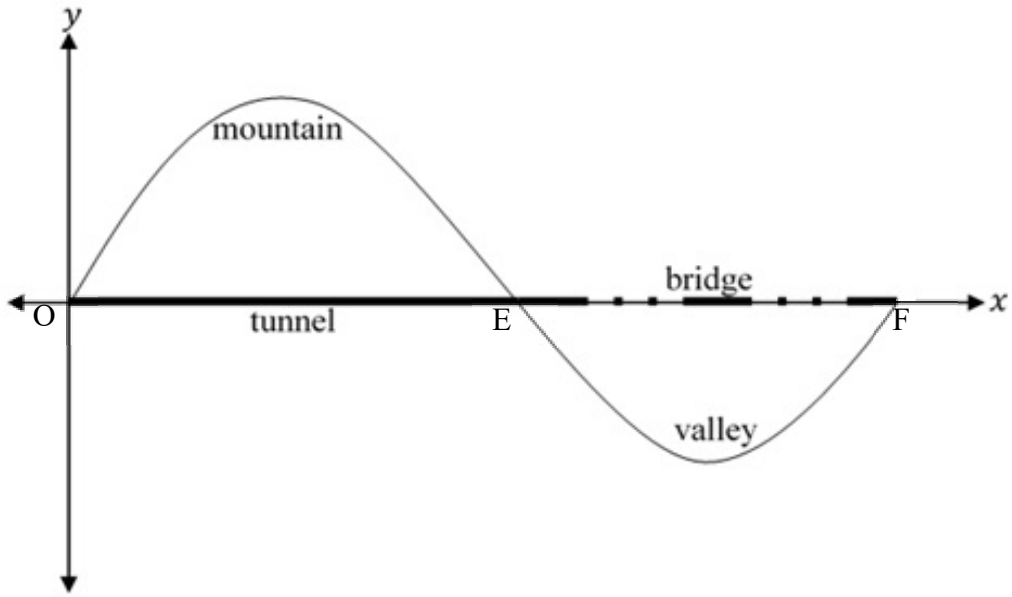
6.2.2 $\frac{dy}{dx}$ if $3x = y + x^2 - 6$ (3)

6.3 Determine the equation of a tangent to a curve defined by:
$g(x) = 2x^2 - 4x + 8$ at $x = -1$ (5)

[17]

QUESTION 7

7.1 BMA Construction has been assigned to build a tunnel (OE) and a bridge (EF) in a mountainous area. They have determined that the cross-section can be modelled by a function:
$y = 2x^3 - 17x^2 + 35x$, where $0 \leq x \leq 5$ and where x is the distance (in hundreds of meters) from a point where the tunnel will start and y is the height (in hundreds of meters) above the proposed bridge.



Determine the length of the following to the nearest meter:

7.1.1 Tunnel (OE) (5)

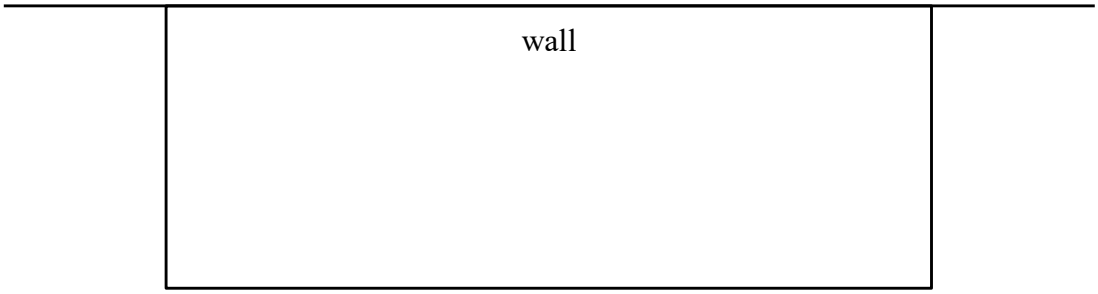
7.1.2 Bridge (EF) (2)

7.2 Calculate the height (above the tunnel) of the top of the mountain. (5)

7.3 Calculate the deepest drop from the bridge to the valley below. (3)
[15]

QUESTION 8

A rectangular garden has an existing wall as one of its borders. The area of the garden is $125\ \text{m}^2$.



8.1 If the length of the garden is x meters, write an expression for the width of the garden in terms of x. (2)

8.2 Write an expression for the total length of fencing needed, if the garden is to be fenced. (2)

8.3 Determine the dimensions of the garden that will require the minimum amount of fencing. (4)

[8]

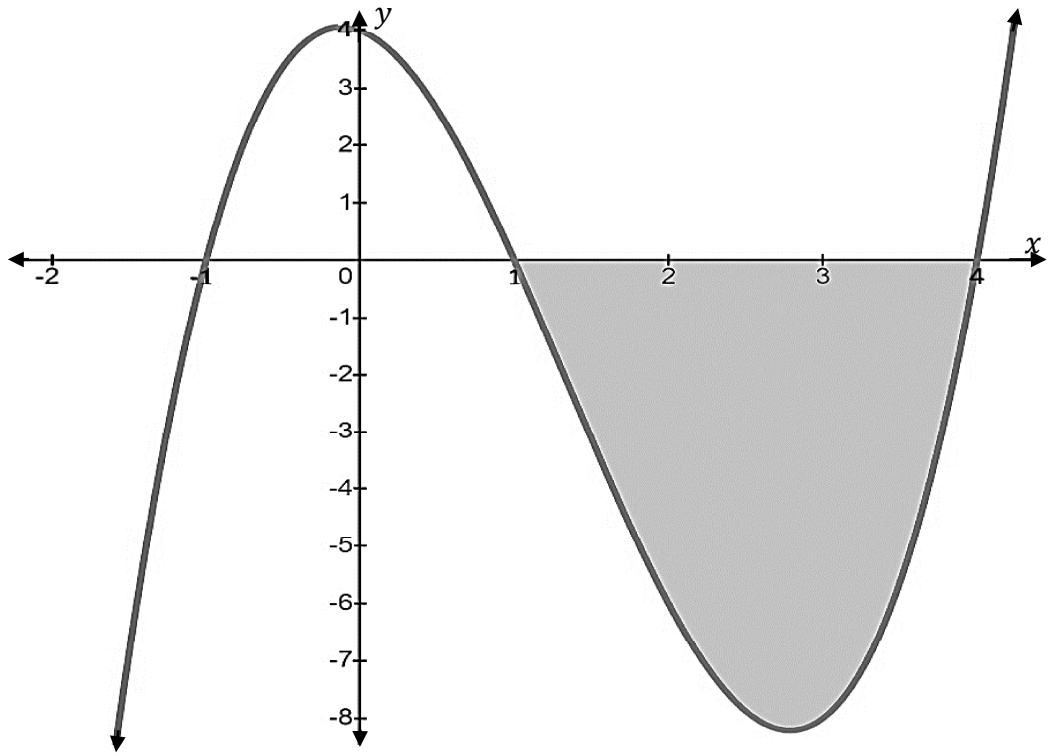
QUESTION 9

9.1 Determine the following integrals:

9.1.1 $\int 3x^2\ dx$ (2)

9.1.2 $\int\left(x^{-1}-\frac{2}{x^6}\right)dx$ (3)

9.2 The sketch below shows the shaded area bounded by the function of s defined by: $s(x)=x^3-4x^2-x+4$ and the axis between the points where $x=1$ and $x=4$.



Determine the area of the shaded region. (5)

[10]

TOTAL: 150

INFORMATION SHEET

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

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

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

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

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

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

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

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

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

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

$$x.x_1 + y.y_1 = r^2$$

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

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

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

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