Province of the
EASTERN CAPE
EDUCATION

SLT / file

NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2024

MATHEMATICS P2

MARKS: 150

TIME: 3 hours

* M A T H E 2 *

This question paper consists of 14 pages, including an information sheet and an answer book of 21 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

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

QUESTION 1

1.1 The number of litres of diesel purchased by 15 truck drivers at a petrol station were recorded as follow.

82	64	55	50	41
71	78	88	98	96
63	66	80	84	88

1.1.1 Write down the mode. (1)

1.1.2 Write down the range. (1)

1.1.3 Calculate the mean. (2)

1.1.4 Calculate the standard deviation ~~of the mean~~. (1)

1.1.5 Determine how many truck drivers purchased litres of diesel below one standard deviation of the mean. (3)

1.2 The mean weight of 8 people entering into a lift is 75 kg. The lift has weight limit of 1 000 kg.

How many people can still get into the lift assuming that the mean weight remains 75 kg? (4)

[12]

QUESTION 2

Grade 8 results of two tests each written out of 50 marks are listed below.

TEST A (x)	39	33	35	44	37	40	24	31	30	5
TEST B (y)	41	45	48	40	47	42	37	44	43	24

2.1 Identify an outlier from the given table. (1)

2.2 Determine the equation of the least squares regression line. (3)

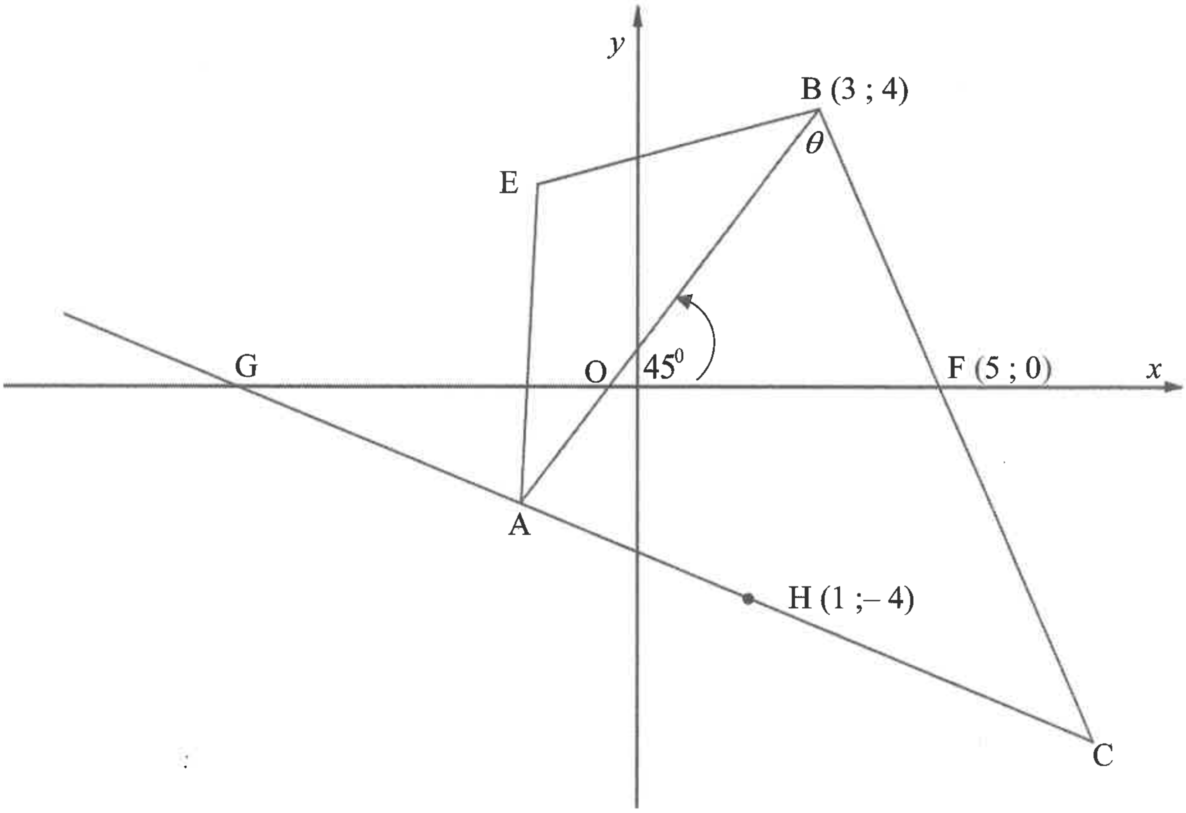
2.3 Use the equation of the least squares regression line to predict a mark for TEST B if a learner obtained 14 marks in TEST A. Round off your answer to the nearest whole number. (2)

2.4 Comment on the strength of correlation between TEST A and TEST B. (2)

[8]

QUESTION 3

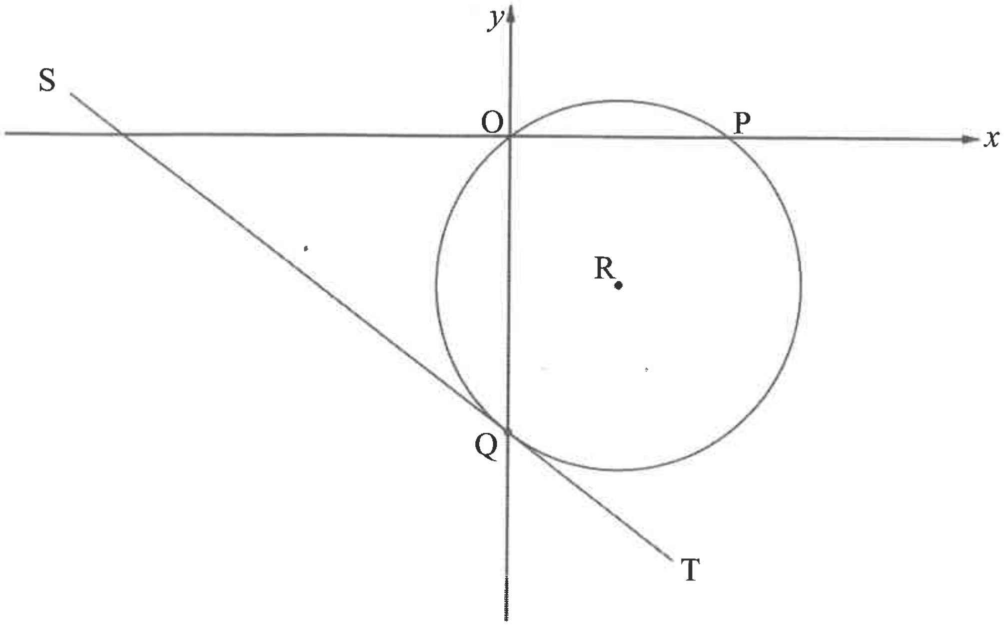
Quadrilateral AEBC is drawn. Coordinates of B are (3 ; 4). G, O and F(5 ; 0) are x-intercepts of lines AC, AB and BC respectively. H(1 ; – 4) is a point on line AC. $A\hat{B}C = \theta$.
Area of $\Delta OBF = 12$ square units and inclination of line AB is $45°$.
HC = 2AH



3.1	Calculate the length of BF. Leave your answer in simplest surd form.	(2)
3.2	Calculate the gradient of BF.	(2)
3.3	Calculate the size of θ.	(3)
3.4	Prove that $HF \parallel AB$.	(4)
3.5	It is further given that, EC bisects AB perpendicularly. What type of quadrilateral is AEBC?	(1)
3.6	Hence or otherwise calculate the length of AC.	(4)
3.7	Calculate the area of quadrilateral AOFC.	(3)
		[19]

QUESTION 4

4.1 In the diagram below, R is the centre of the circle OPQ. Point Q is the y-intercept of the circle. SQT is the tangent of the circle at Q. The equation of SQT is $y = -\frac{3}{4}x - 8$.



4.1.1 Calculate the coordinates of Q. (2)

4.1.2 Determine the equation of QR in the form $y = mx + c$. (3)

4.1.3 Calculate the coordinates of P, the x-intercept of line QR. (2)

4.1.4 Calculate the coordinates of R, the centre of the circle. (3)

4.1.5 Write down the equation of the circle centred at R in the form: $(x-a)^2 + (y-b)^2 = r^2$. (3)

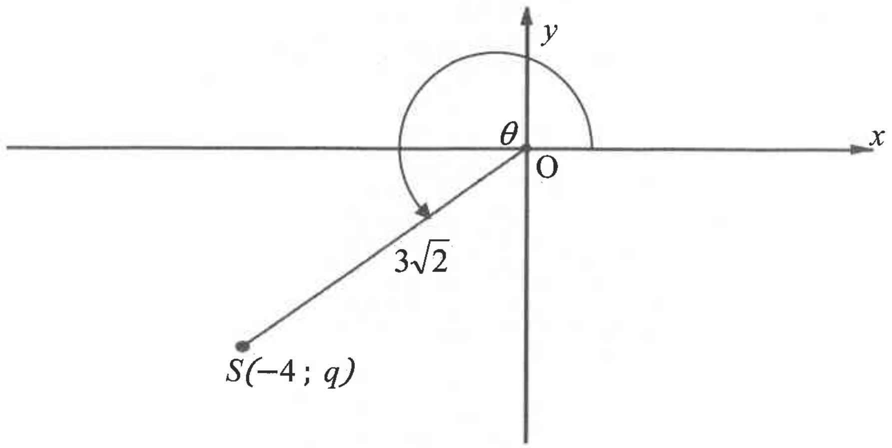
4.1.6 If $y = k$ is a tangent to the circle, determine the value(s) of k. (3)

4.2 Calculate the maximum length of the radius of the circle having equation $x^2 + y^2 - 2x\sin\theta - 4y\sin\theta = -2$. (5)

[21]

QUESTION 5

5.1 In the diagram below, point $S(-4\,;\,q)$ and reflex angle θ are shown. O is the point at the origin. $OS = 3\sqrt{2}$.



Without using a calculator, determine the value of:

5.1.1 q (2)

5.1.2 $\sin(\theta + 45°)$ (4)

5.1.3 $\cos(2\theta - 360°)$ (4)

5.2 Simplify the following without using a calculator:

$$\frac{\sin(90° - \theta).\cos 480° + \cos(180° - \theta)}{\cos\theta.\sin 150° - \tan 180°}$$ (5)

5.3 Prove that $\dfrac{\cos x}{\sin 2x} - \dfrac{\cos 2x}{2\sin x} = \sin x$ (5)

5.4 Given: $\dfrac{\cos 60°}{\sin x} - \dfrac{\sin 60°}{\cos x} = 2$

5.4.1 Show that the equation $\dfrac{\cos 60°}{\sin x} - \dfrac{\sin 60°}{\cos x} = 2$ can be written as $\cos(x + 60°) = \cos(90° - 2x)$ (3)

5.4.2 Hence, or otherwise, determine the general solution of $\dfrac{\cos 60°}{\sin x} - \dfrac{\sin 60°}{\cos x} = 2$ (4)

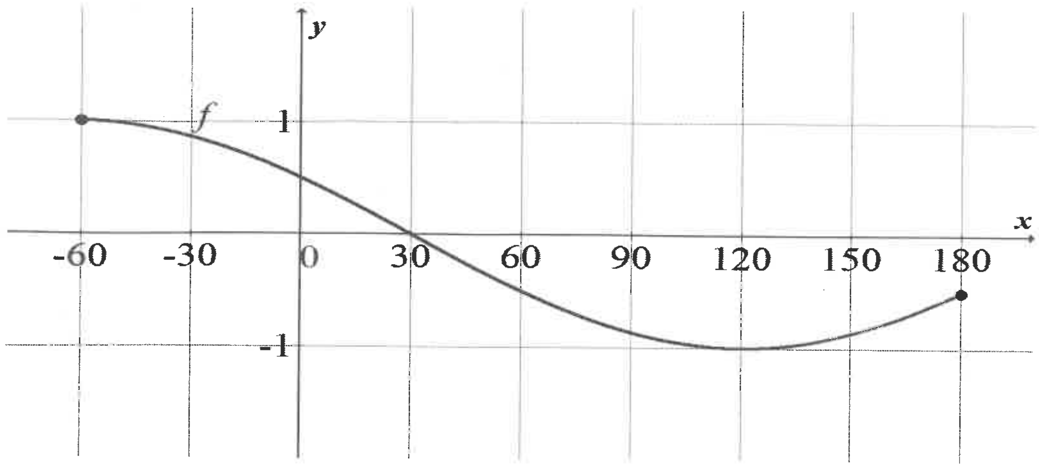
5.5 Given that $\cos 22{,}5° = \dfrac{a}{c}$ and $a^2 + b^2 = c^2$.

With the aid of a diagram, or otherwise, show that $\dfrac{2ab}{c^2} = \dfrac{\sqrt{2}}{2}$. (5)

[32]

QUESTION 6

The graph of $f(x) = -\sin(x - 30^\circ)$ is drawn in the interval of $x \in [-60^\circ ; 180^\circ]$.



Use the graph to answer the following questions.

6.1 Write down the period of f. (1)

6.2 Write down the minimum value of f. (1)

6.3 Determine the range of $f(x)+1$. (2)

6.4 For which values of x is the graph of f increasing, where $x \in [-60^\circ ; 180^\circ]$? (2)

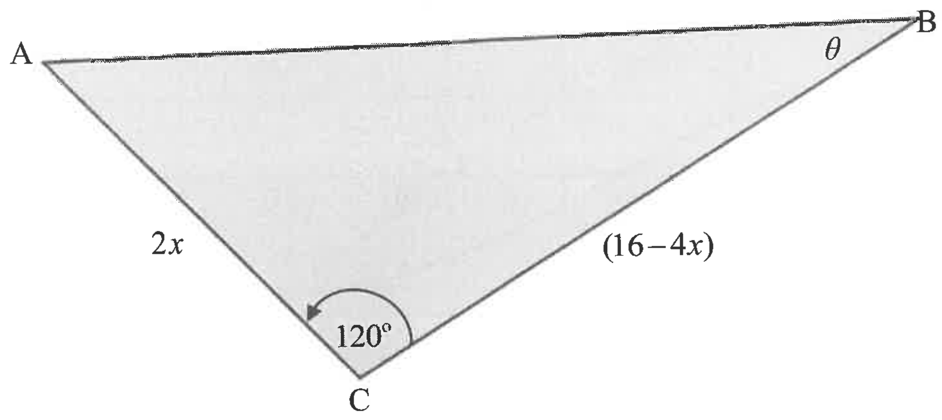
6.5 The graph of f is shifted 60° to the right and then reflected in the x-axis to form a new graph of g. Determine the equation of g in its simplest form. (3)

6.6 Draw the graph of g on the same set of axes. Clearly show the intercepts with the axis and the turning points in the interval of $x \in [-60^\circ ; 180^\circ]$. (3)

[12]

QUESTION 7

In ΔABC below, $AC = 2x$, $BC = (16 - 4x)$, $\hat{C} = 120^\circ$, $\hat{B} = \theta$.

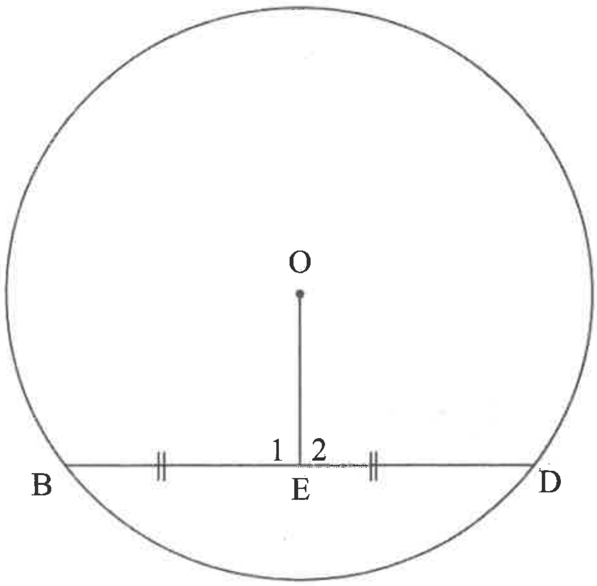


7.1 Determine the area of ΔABC in terms of x, without using a calculator. (3)

7.2 For which value(s) of x will the area of ΔABC be a maximum? (3)
[6]

QUESTION 8

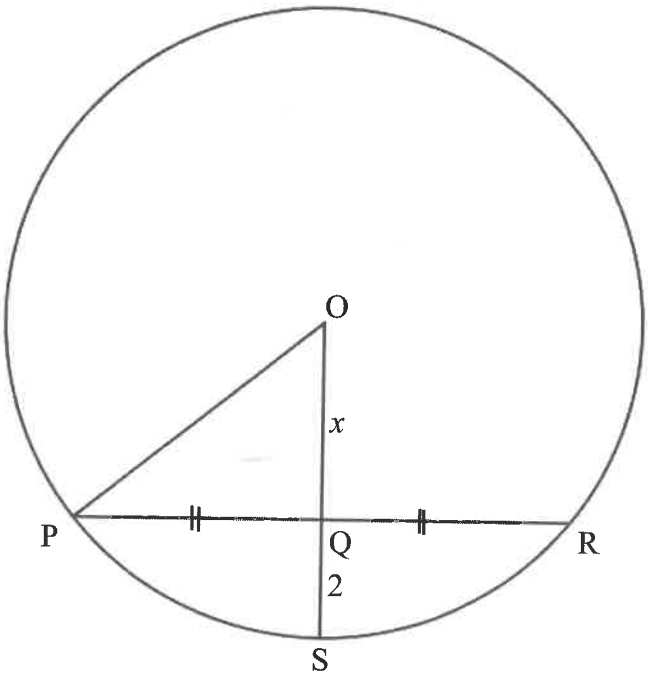
8.1 In the diagram below, O is the centre of the circle. BD is the chord of the circle. E is the midpoint of chord BD.



Use the diagram provided in the ANSWER BOOK to prove the theorem which states that: The line drawn from the centre of a circle that bisects a chord is perpendicular to the chord.

In other words, prove that: OE $\perp$ BD. (5)

8.2 In the diagram below, O is the centre of the circle. Q is the midpoint of chord PR. OQS is the radius of the circle. PR = 8 units, OQ = x units and QS = 2 units.



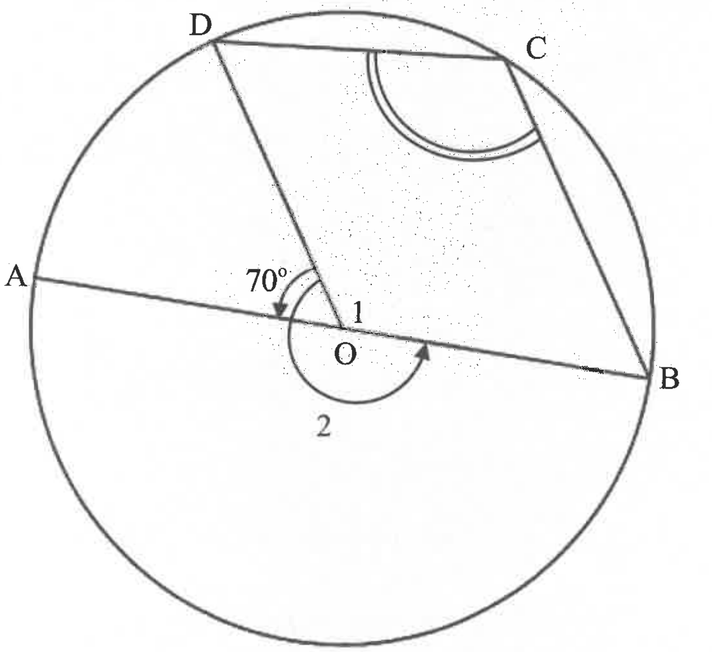
8.2.1 Determine, giving reasons, the size of $O\hat{Q}P$. (2)

8.2.2 Calculate the length of PO. (5)

[12]

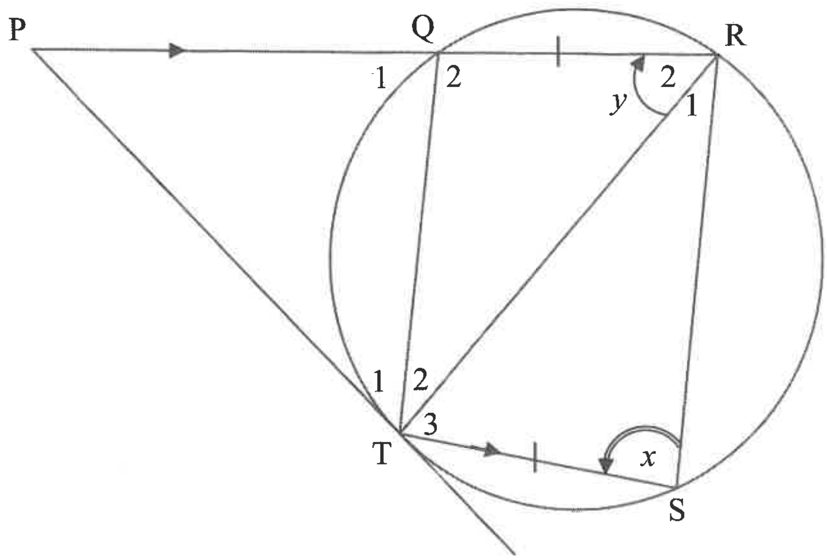
QUESTION 9

9.1 A, B, C and D are points on the circumference of the circle with centre O. AOB is the diameter of the circle. $A\hat{O}D = 70°$.



Calculate the size of $\hat{C}$, giving reasons. (5)

9.2 PT is a tangent to the circle at T. $PR \parallel TS$ and PQR is a straight line. Q, R and S are points on the circumference of the circle. $\hat{R}_2 = y$ and $\hat{S} = x$. QR = TS.



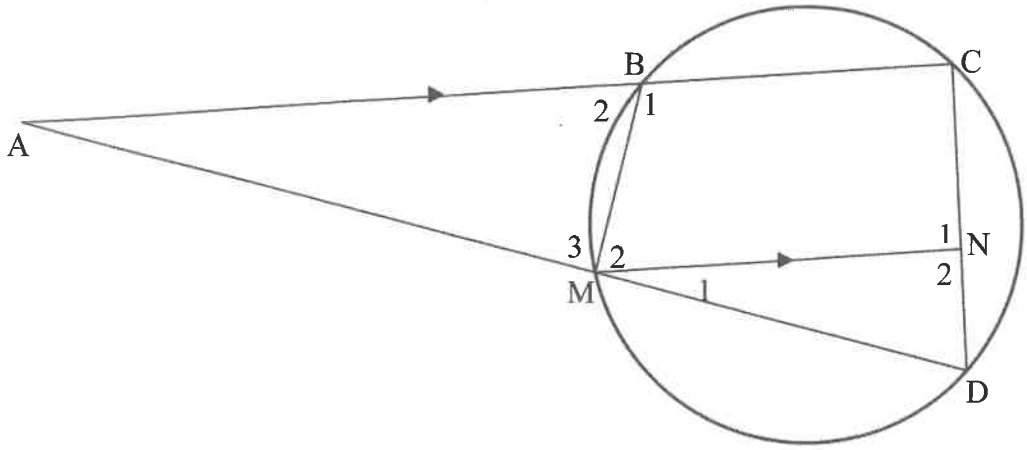
9.2.1 Name, giving reasons, TWO other angles each equal to y. (4)

9.2.2 Determine, giving reason, another angle which is equal to $\hat{T}_2$. (2)

9.2.3 Prove that TR is the diameter of the circle. (4)
[15]

QUESTION 10

BCDM is a cyclic quadrilateral. Chords MD and BC are produced to meet at point A. N is a point on CD. $AC \parallel MN$ and $AM = CD$.
AC = 36 units, AD = 48 units and BM = 24 units.



10.1 Prove that $\Delta ABM \, ||| \, \Delta ADC$. (4)

10.2 Prove that $CD^2 = BM \times AC$. (3)

10.3 Calculate the length of CN. (6)

[13]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $\quad$ $a^2 = b^2 + c^2 - 2bc.\cos A$ $\quad$ $area\,\Delta ABC = \frac{1}{2}ab.\sin C$

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

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

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

$\bar{x} = \frac{\sum x}{n}$ $\quad$ $\sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$ $\quad$ $P(A) = \frac{n(A)}{n(S)}$ $\quad$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

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