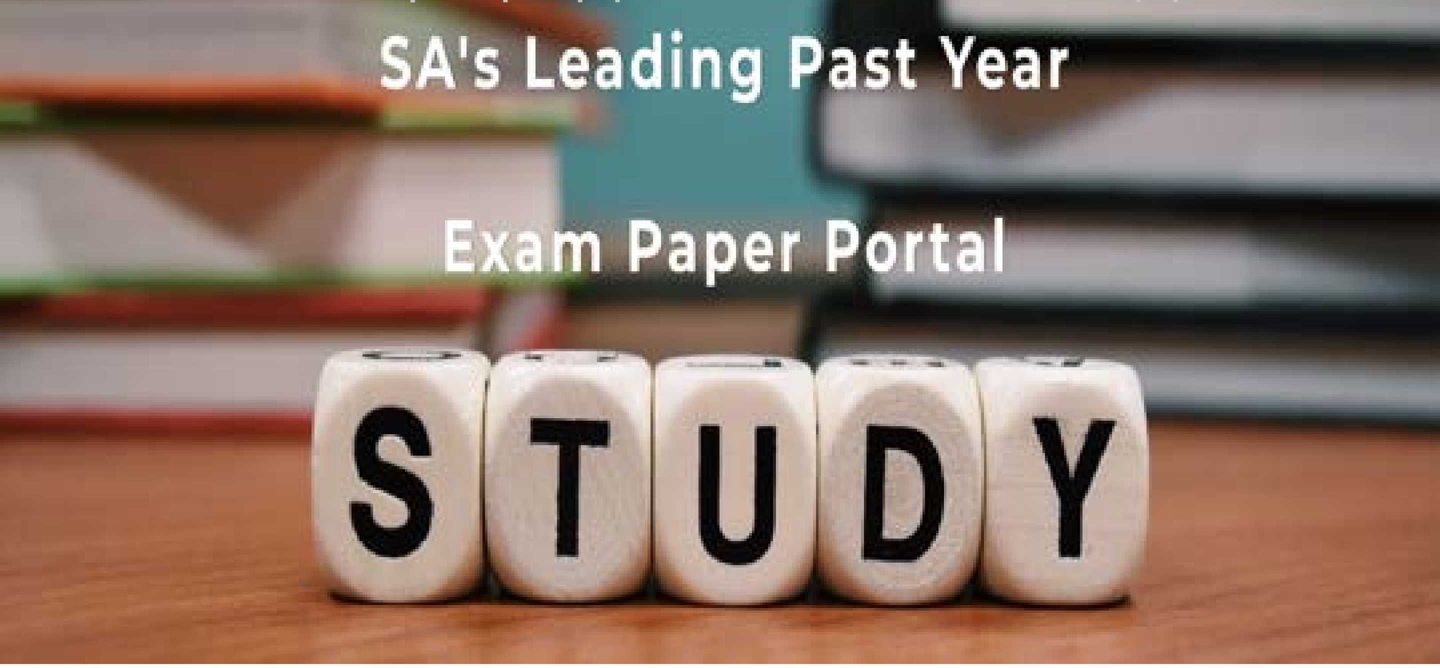
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GRADE 12

MATHEMATICS P2

JUNE EXAMINATION

JUNE 2024

MARKS: 150

TIME: 3 hours

This question paper consists of 12 pages

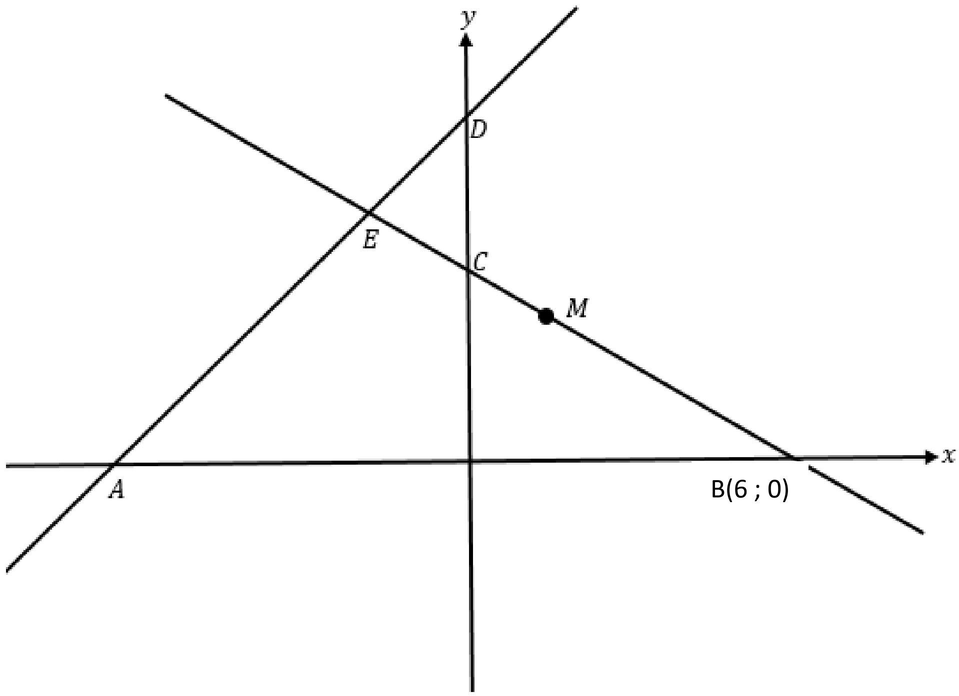
INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions:

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

QUESTION 1

In the diagram, A and D are the x-and y-coordinates of line AD respectively. Line BE cuts the x-axis at B and the y-axis at C. The equations of AD and EB are y= $2x + 10$ and $y = -x + 6$ respectively. M is the midpoint of line BE, AE $= \frac{11}{3}\sqrt{5}$. CB and AD intersect at E$(-4\,;8)$.

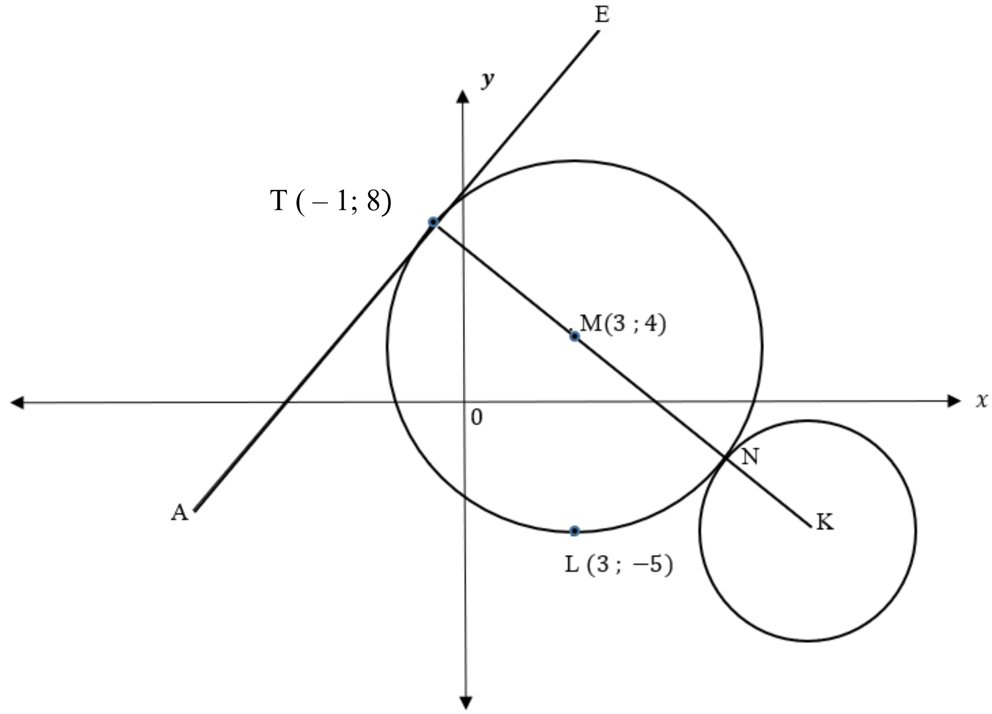


1.1	Write down the coordinates of C	(1)
1.2	Calculate the angle of inclination of line BC.	(2)
1.3	Calculate the length of line CD.	(2)
1.4	Determine the equation of line through M, parallel to AD, in the form $y = \ldots$	(4)
1.5	Calculate the size of $A\hat{E}B$	(4)
1.6	Calculate the coordinates of G, such that ABGE is a parallelogram.	(4)
1.7	Calculated the area of parallelogram ABGE	(5)
1.8	If it is given that CD is a diameter of a circle passing through C and D, determine how many units must M be translated so that it becomes the center of the new circle.	(4)

[26]

QUESTION 2

Drawn below is the BIGGER circle centered at M and SMALLER circle centered at K. ATE is a tangent to the bigger circle at T. TN is a diameter of the bigger circle and NK is a radius of the smaller circle. The coordinates of T (– 1; 8), M (3 ; 4) and L (3 ; – 5)



2.1	Determine the equation of the circle in the form $(x-a)^2+(y-b)^2=r^2$.	(2)
2.2	Determine the equation of the tangent through point T.	(5)
2.3	Does point P(7; 3) lie inside, outside or on the circle. Show all calculations.	(4)
2.4	If it is further given that KL is a tangent at L, to the circle centered at M. Determine the coordinates of K, the center of the smaller circle.	(5)

[16]

QUESTION 3

3.1 Given : $\sin\beta = \frac{1}{3}$ where $\beta \in (90°; 270°)$, determine the following by using a sketch and without the use of a calculator:

3.1.1 $\tan\beta$ (3)

3.1.2 $\cos 2\beta$ (2)

3.1.3 $\cos(-\beta - 450°)$ (2)

3.2 Simplify the following to a single trigonometric ratio:

$$\frac{4\cos(-x).\cos(90° + x)}{\sin(30° - x).\cos x + \cos(30° - x).\sin x}$$ (6)

3.3 If $\cos 23° = a$, express the following in terms of a:

3.3.1 $\tan 203°$ (3)

3.3.2 $\sin 46°$ (3)

3.4 Determine the values of the following, without using a calculator:

3.4.1 $\sin 105°$ (4)

3.4.2 $\cos 69°.\cos 9° + \cos 81°.\cos 21°$ (3)

3.5 Prove the following identity: $\frac{\sin 2x - \cos x}{1 - \cos 2x - \sin x} = \frac{1}{\tan x}$ (5)

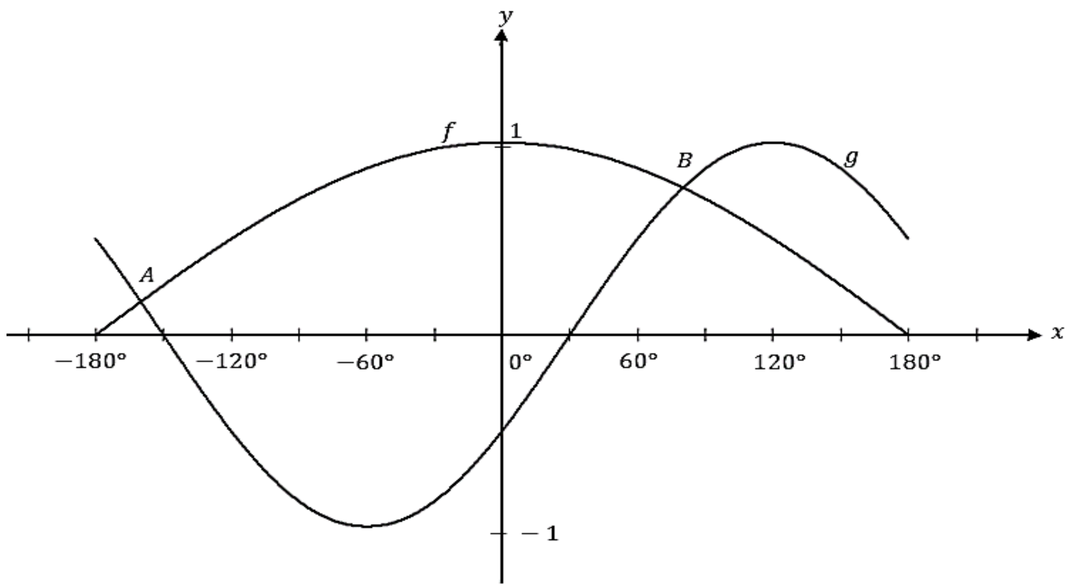
3.6 Calculate the value of x, if $x \in [-180°; 360°]$

$$\cos 2x = \cos x + 2$$ (7)

[38]

QUESTION 4

The graphs of $f(x) = \cos\frac{x}{2}$ and $g(x) = \sin(x - 30°)$ for $x \in [-180°; 180°]$ are drawn below. The graphs intersect at points A and B.



4.1 Write down the value of $f(0°) - g(0°)$ (1)

4.2 Give the period of $f(4x)$ (2)

4.3 Write down the range of $4g(x)$ (2)

4.4 Given that the general solution of $f(x) = g(x)$ is: $x = 80° - k.240°, k \in z$.

Determine the x values of A and B. (2)

4.5 For which value(s) of x will.

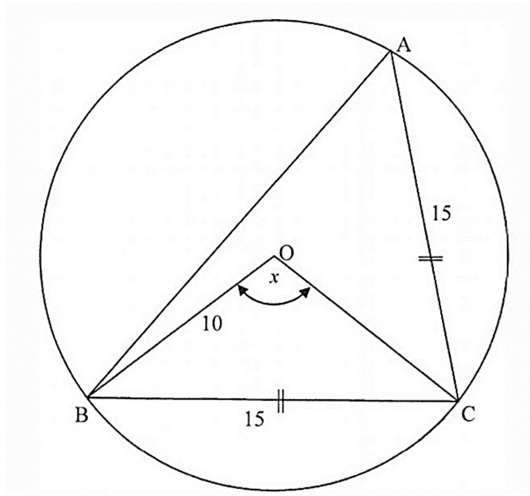
4.5.1 $f(x) > g(x)$ (2)

4.5.2 $f'(x) . g(x) > 0$ where $x > 0°$ (2)

[11]

QUESTION 5

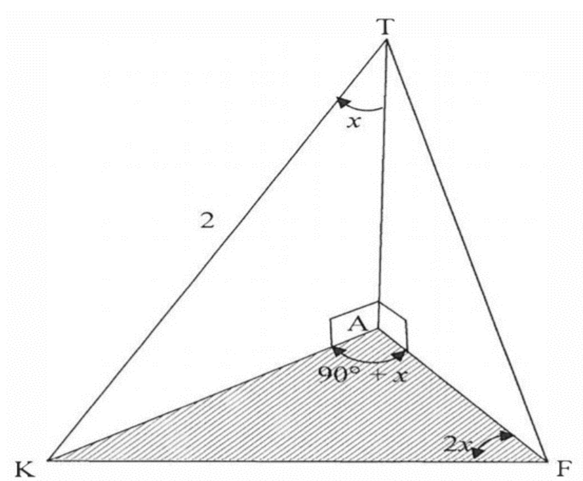
5.1 In the diagram below, a circle with centre O passes through A, B and C.
BC = AC = 15 units. BO and OC are joined. OB = 10 units and $B\hat{O}C = x$



5.1.1 Calculate the size of x. (3)

5.1.2 Calculate the area of triangle ABC. (4)

5.2 In the figure, points K, A and F lie in the same horizontal plane and TA represents a vertical tower. $A\hat{T}K = x$, $K\hat{A}F = 90° + x$ and $K\hat{F}A = 2x$ where $0° < x < 30°$ and TK = 2 units.



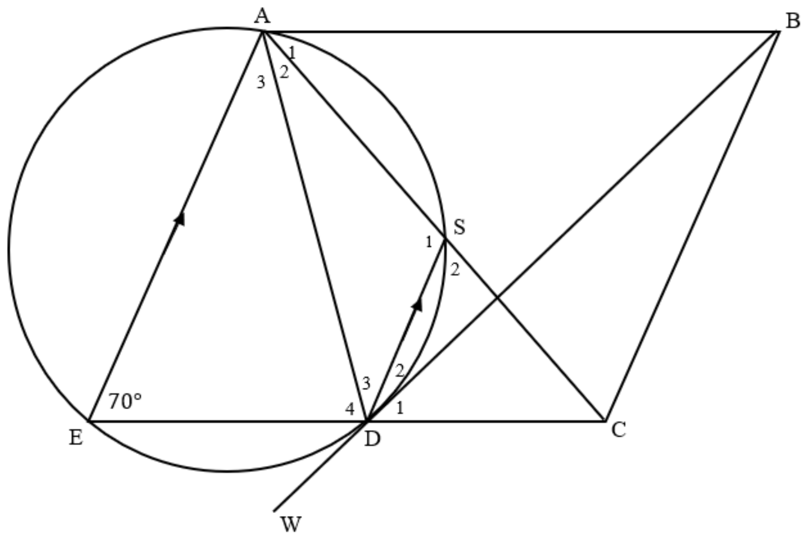
5.2.1 Express AK in terms of $\sin x$. (2)

5.2.2 Determine the value of KF (5)

[14]

QUESTION 6

AB is a tangent to circle ASDE at point A with AE // SD. Chords AS and ED produced meet at C, such that ED = DC. BDW is a straight line and in parallelogram ABCE, $\hat{E} = 70°$ and BC = 16cm.



6.1 Determine with reasons:

6.1.1 $\hat{S}_2$ (2)

6.1.2 $\hat{A}_1$ (3)

6.1.3 $\hat{D}_3$ (2)

6.1.4 The length of SD. (3)

6.2 If it is further given that $A\hat{D}S = B\hat{D}C$, prove with reasons:

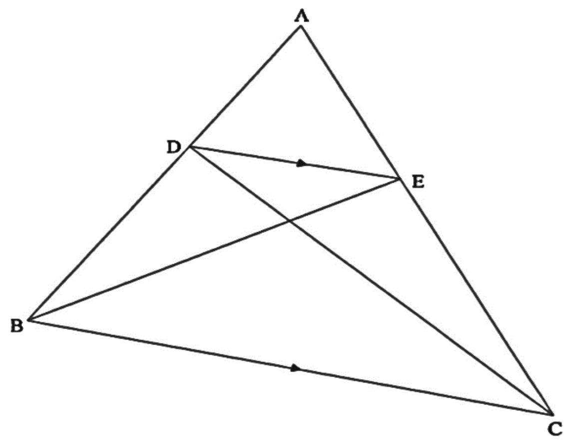
6.2.1 ABCD is a cyclic quadrilateral (2)

6.2.2 DB is a tangent to circle through A, S and D. (5)

[17]

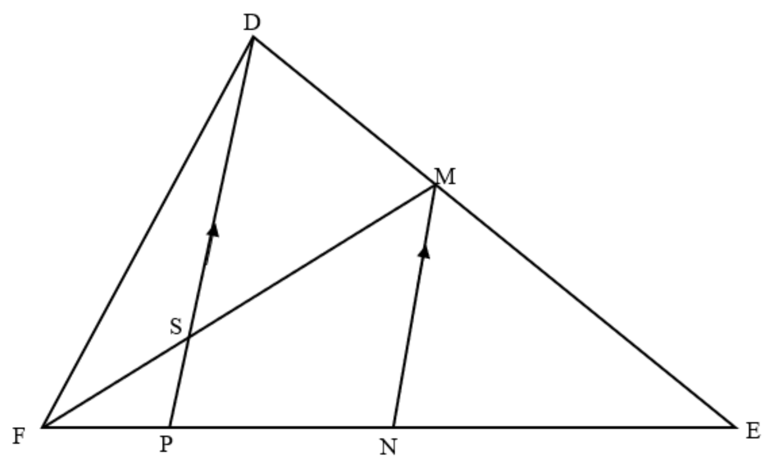
QUESTION 7

7.1 In the diagram below, ΔABC is drawn. D is a point on AB and E is a point on AC such that DE // BC. BE and DC are drawn.



Use the diagram above to prove the theorem which states that a line drawn parallel to one side of a triangle divides the other two sides proportionally, in other words prove that $\frac{AD}{DB} = \frac{AE}{EC}$ (5)

7.2 In ΔDEF below, DM : ME = 2 : 3

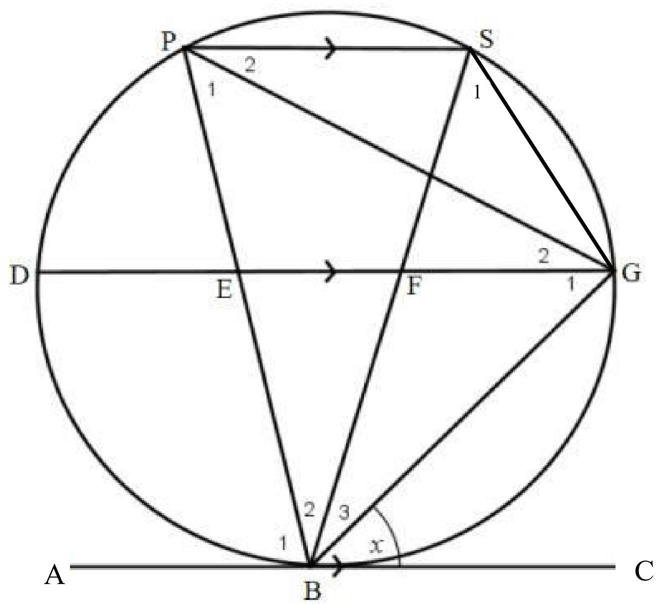


Given PE = 35 cm and 2FP = PN.
Determine:

7.2.1 PN (2)

7.2.2 FS (3)

7.3 In the diagram, P, S, G, B and D are points on the circumference of the circle such that PS // DG // AC. ABC is a tangent to the circle at B. $G\hat{B}C = x$.



Prove that:

7.3.1 $\Delta PGB \parallel\!| \Delta GEB$ (4)

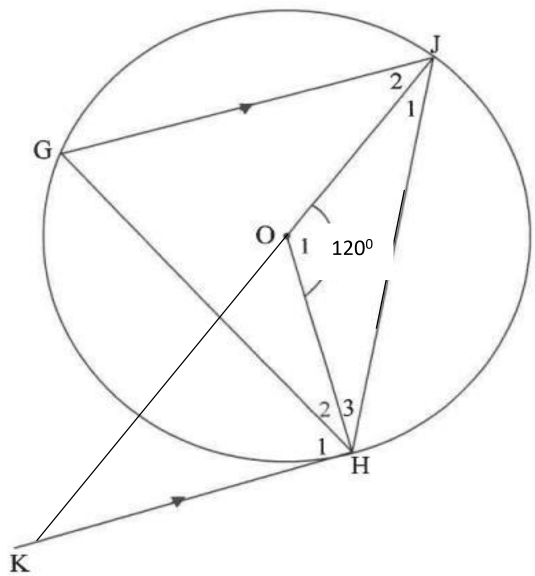
7.3.2 $SB.FB = EB.PB$ (3)

7.3.3 If GB = GE = 9cm and EB = $\frac{3}{5}$ PG, determine the length of PG. (3)

[20]

QUESTION 8

In the diagram, O is the centre of the circle. GJ, JH and GH are chords of the circle. GJ // KH. $\hat{O}_1 = 120°$. JOK is a straight line.



8.1 Determine, with reasons, the size of the following angles:

8.1.1 $\hat{G}$ (2)

8.1.2 $\hat{H}_3$ (3)

8.2 If KH is a tangent to the circle at H.

Prove: $\cos 120° = -\frac{OJ}{OK}$ (3)

[8]

TOTAL 150

INFORMATION SHEET/INLIGTINGSBLAD

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

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

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

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

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

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

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

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

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

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

$area\ \Delta ABC = \frac{1}{2}ab.\sin C$

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

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

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

$\bar{x} = \frac{\sum x}{n}$ $\quad$ $\sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$

$P(A) = \frac{n(A)}{n(S)}$ $\quad$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

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