education

MPUMALANGA PROVINCE

REPUBLIC OF SOUTH AFRICA

NATIONAL
SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P2

JUNE 2023

MARKS: 150

TIME: 3 hours

This question paper consists of 13 pages and 1 information sheet and an answer book is provided.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. The 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. Write neatly and legibly.

QUESTION 1

An estate agent did a survey on the salaries of the people renting homes in a complex. She selected 12 homes where two salary earners live for her survey. The data collected is recorded in the table below.

Salary of person 1	3000	2100	5100	3560	6250	7400	4210	3200	2600	1000	4100	8000
Salary of person 2	4500	8320	6500	3500	1500	4200	6420	3520	10500	11000	7800	19350

1.1 Determine the median salary for person 1 in this data. (2)

1.2 Determine the mean income for person 2 in this data. (2)

1.3 Determine the number of salaries for person 2 that are above ONE standard deviation from the mean. (3)

1.4 Determine the equation of the least squares regression line for the given data in the table. (3)

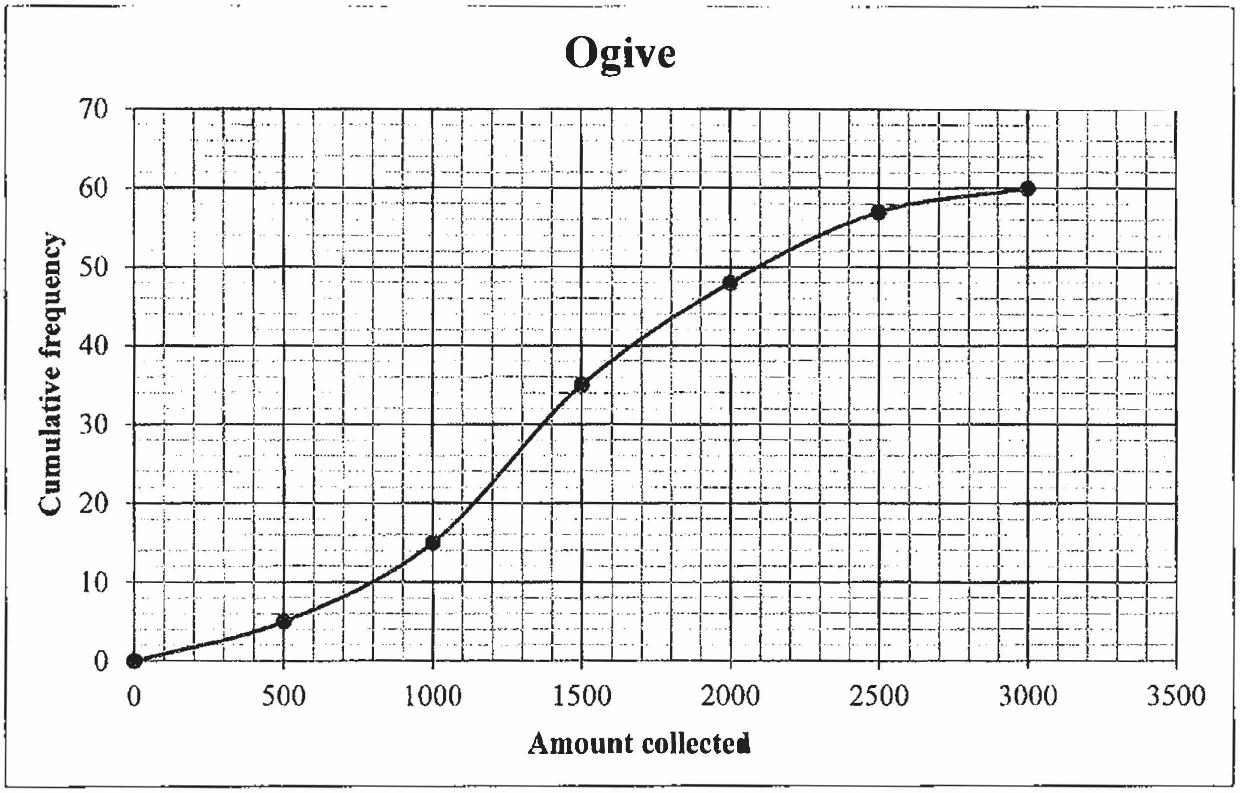
1.5 Draw a scatter plot and the least squares regression line for this data on the grid provided in the ANSWER BOOK. (4)

1.6 Explain what will happen to the least squares regression line if the income of the person receiving an income of R19350 decreases by 50%. (2)

[16]

QUESTION 2

The ogive below shows the money collected by parents during a fundraising event at a school.



2.1 Determine the modal class of this data. (1)

2.2 Use the ogive to determine the total number of parents who raised R1000 or more. (3)

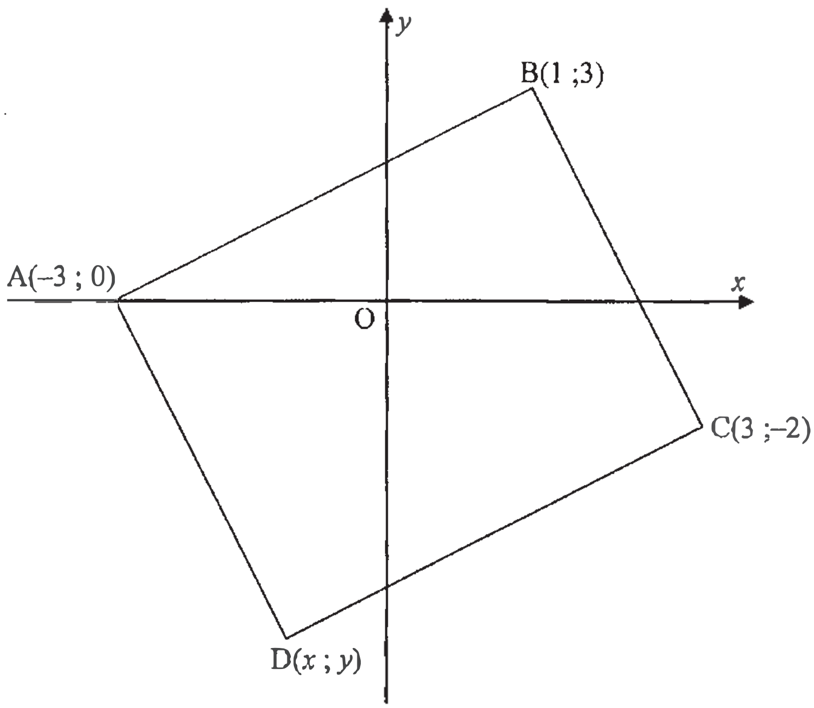
2.3 Use the ogive to determine the values of a, b and c in the five number summary, given in the table below.

R0	a	b	c	R3000

(4)
[8]

QUESTION 3

In the diagram below ABCD is a parallelogram with A(−3; 0), B(1; 3), C(3; −2) and D(x; y).



3.1 Write down the coordinates of D. (2)

3.2 Calculate the gradients of AB and BC and state if ABCD is a rectangle. Give a reason for your answer. (4)

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

3.4 Find the equation of line MN passing through M, which is perpendicular to AB. (3)

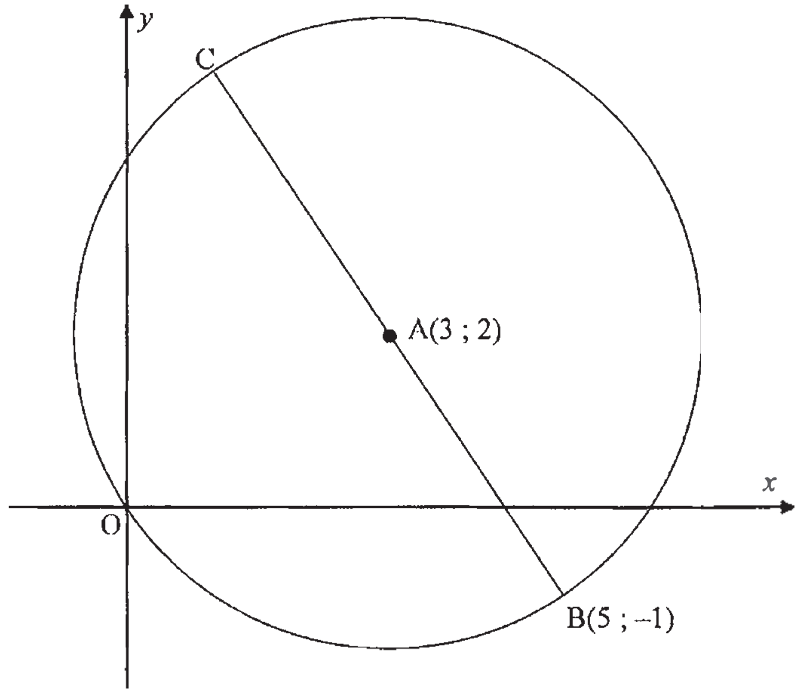
3.5 Calculate the size of $B\hat{C}D$. (5)

3.6 Determine the area of ΔBCD. (5)

[21]

QUESTION 4

4.1 A(3; 2) is the centre of the circle through B and C. BC is a diameter of the circle.



4.1.1 Write down the equation of the circle in the form $(x-a)^2+(y-b)^2=r^2$ (4)

4.1.2 determine the coordinates of C. (2)

4.1.3 Determine the equation of the tangent to the circle at C. (4)

4.1.4 Determine the equations of the tangents to the circle which gradients are zero. Give your answers in the simplest surd form. (2)

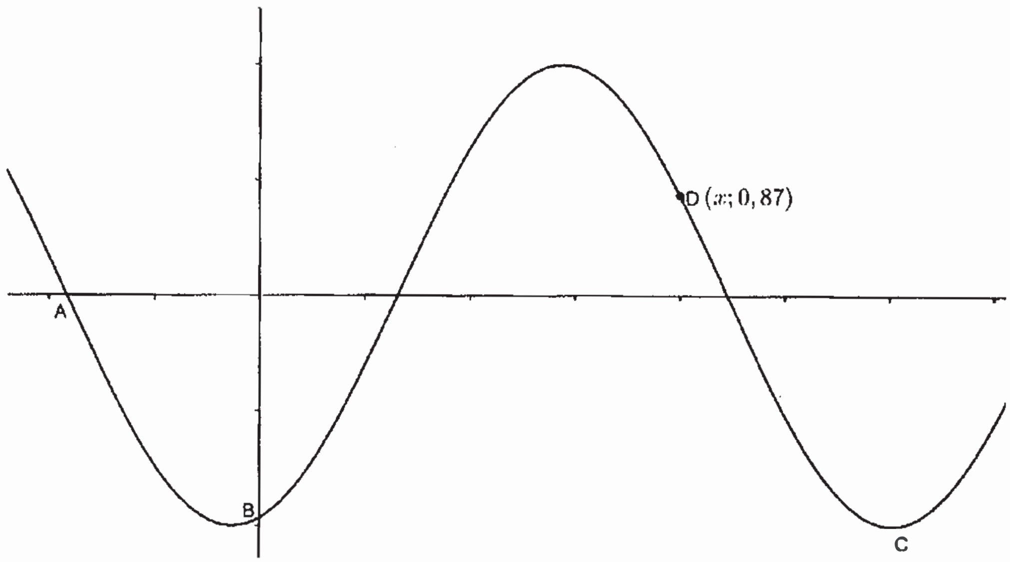
4.1.5 A new circle is drawn. A point P(x; y) on the circumference of the new circle, is such that it is always 4 units from the circumference of the original circle, and outside the original circle. Determine the equation if this new circle. (2)

4.2 Determine whether the circles with equations A:$(x+3)^2+y^2=4$ and B: $x^2+y^2+4y+3=0$ will intersect or not. Show ALL calculations. (6)

[20]

QUESTION 6

The graph of $f(x) = -2\cos(x + 15°)$ is given.



6.1 Give the amplitude of $f(x)$. (1)

6.2 Give the period of $f(x)$. (1)

6.3 If $g(x) = f(x) + 2$, give the range of $g(x)$. (2)

6.4 Give the coordinates of:

6.4.1 A, an x - intercept of f (2)

6.4.2 B, the y - intercept of f (2)

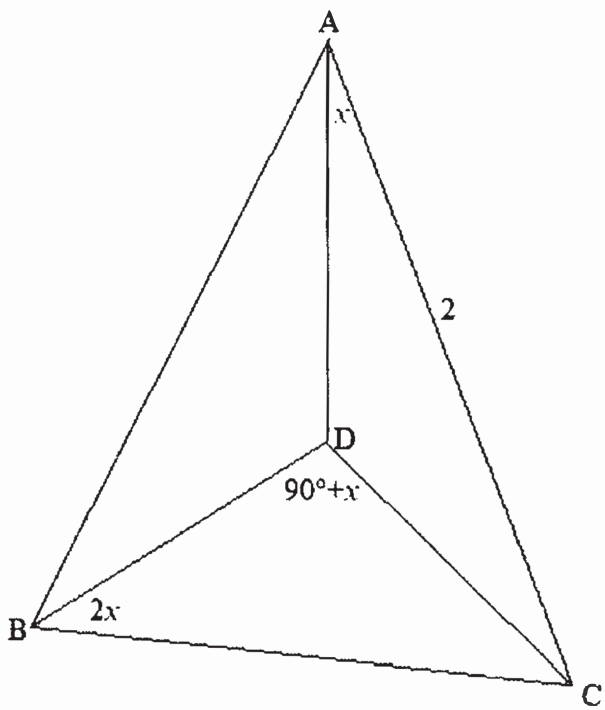
6.4.3 C, a turning-point of f. (2)

6.4.4 The x- coordinate of D, if D has coordinates $(x; 0,87)$. Show your calculations (3)

[13]

QUESTION 7

AD is a vertical pole and points B and C are in the same horizontal plane as D, the foot of the tower., and $D\hat{A}C = x$, $C\hat{B}D = 2x$, $B\hat{D}C = 90° + x$ and $AC = 2$



7.1 Show that $BC = 1$. (6)

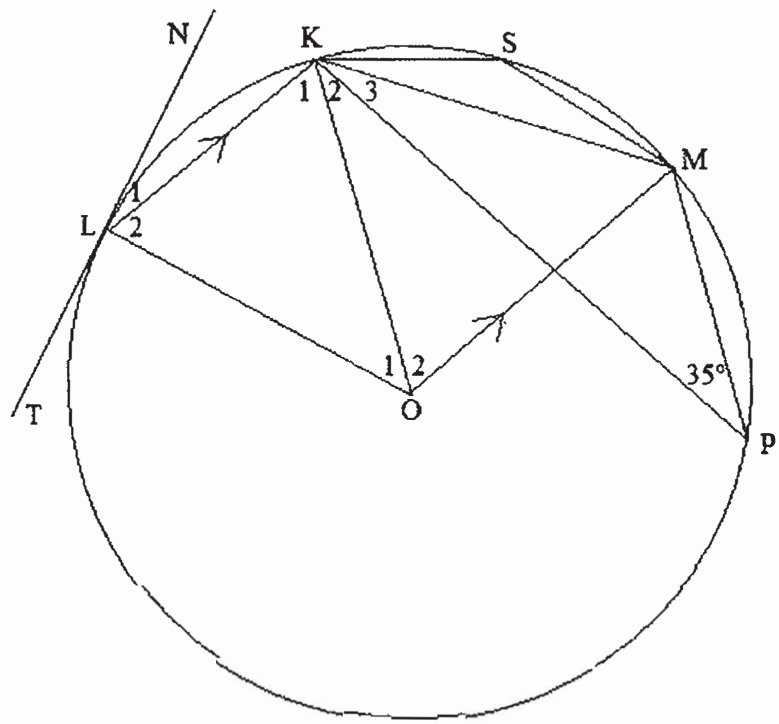
7.2 Show that $BD = \dfrac{\cos 3x}{\cos x}$ (3)

[9]

Give reasons for your statements and calculations in QUESTIONS 8, 9 and 10.

Question 8

8.1 In the diagram, O is the centre of the circle. KL // OM, NLT is a tangent to the circle at L. $K\hat{P}M = 35°$



Determine, giving reasons, the sizes of the following angles:

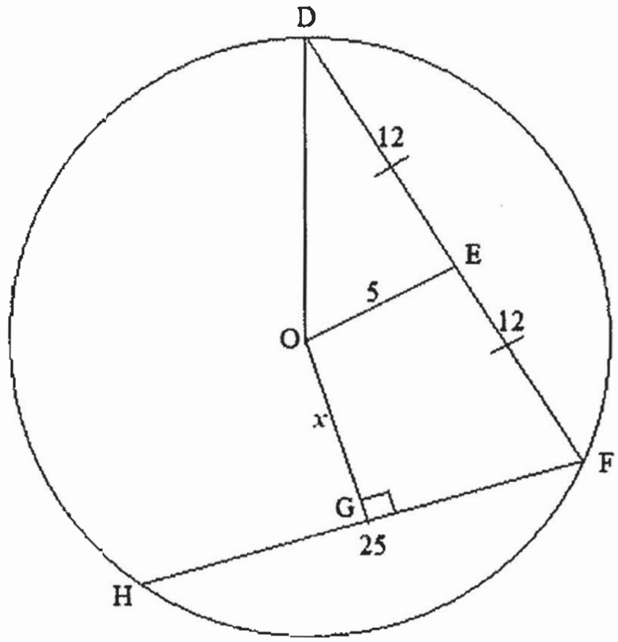
8.1.1 $\hat{O}_2$ (2)

8.1.2 $\hat{O}_1$ (3)

8.1.3 $\hat{L}_1$ (2)

8.1.4 $\hat{S}$ (2)

8.2 In the circle below with centre O, DE = EF = 12, FH = 25, OG $\perp$ FH, OE = 5 and OG = x.



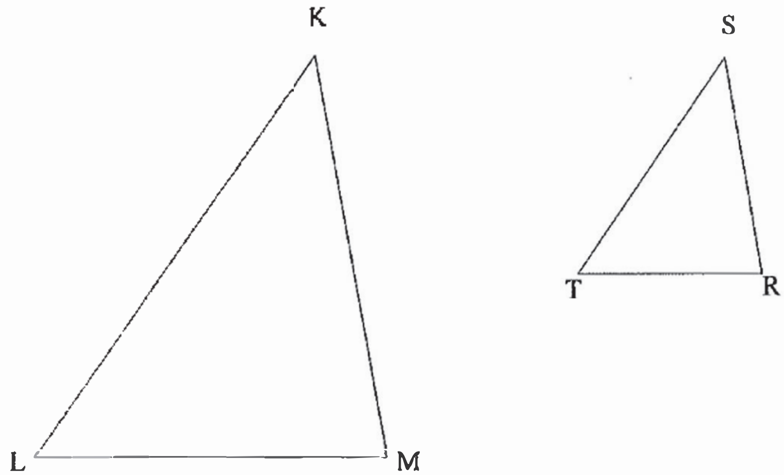
Determine, giving reasons, the length of:

8.2.1 OD. (4)

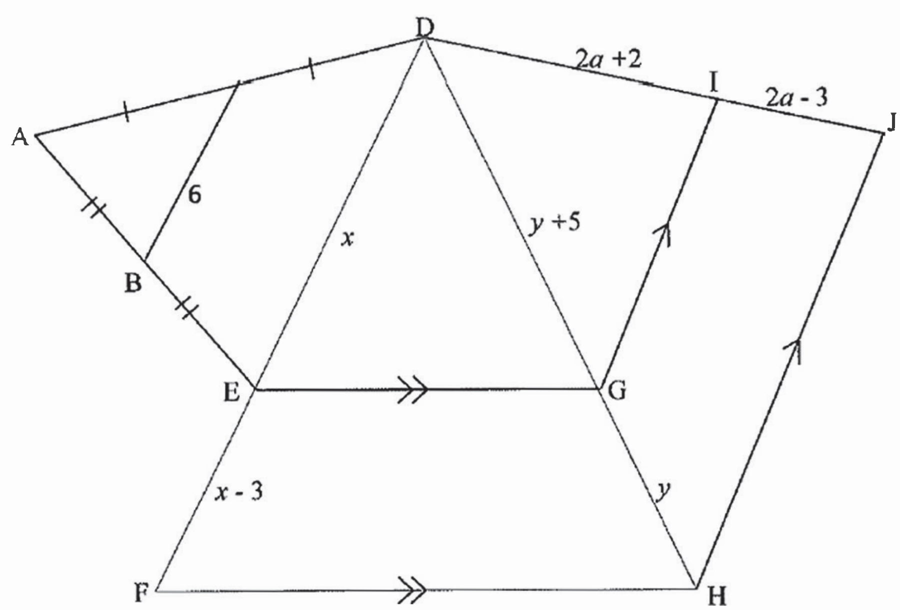
8.2.2 GH. (2)
[15]

QUESTION 9

9.1 In ΔKLM and ΔSTR, $\hat{K} = \hat{S}$, $\hat{L} = \hat{T}$, $\hat{M} = \hat{R}$. Prove that $\frac{ST}{KL} = \frac{SR}{KM}$. (6)



9.2 In the sketch EG // FH and GI // HJ. AB = BE and AC = CD. BC = 6, DE = x, EF = $x - 3$, DG = $y + 5$, GH = y, DI = $2a + 2$ and IJ = $2a - 3$.



Calculate the values of :

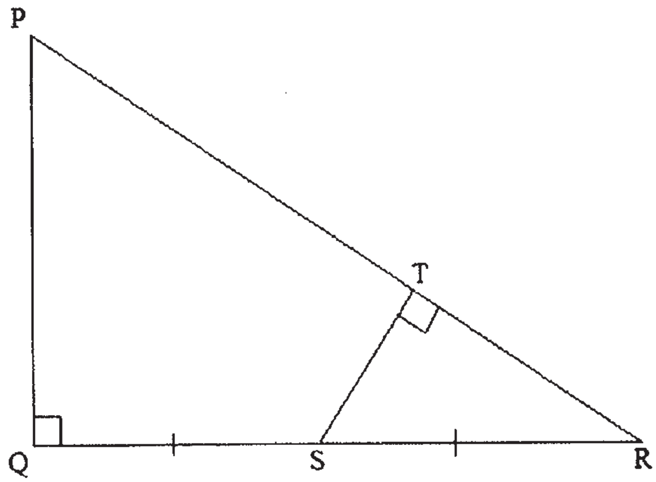
9.2.1 x (2)

9.2.2 y (3)

9.2.3 a (3)
[8]

QUESTION 10

In the sketch, QS = SR and $P\hat{Q}T = S\hat{T}R = 90°$.



10.1 Prove that ΔPQR /// ΔSTR (4)

10.2 Hence, prove that $PR.RT = SQ.RQ$ (2)

[16]

TOTAL: 150

FORMULA SHEET

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

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

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

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

$S_\infty = \frac{a}{1 - r}\ ; -1 < r < 1$

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

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

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

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

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

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

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

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

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

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

$\cos 2\alpha = cos^2\alpha - sin^2\alpha$ $\quad \sin 2\alpha = 2\sin\alpha\cos\alpha$

$= 1 - 2sin^2\alpha$

$= 2cos^2\alpha - 1$

$\bar{x} = \frac{\sum fx}{n}$ $\quad \sigma^2 = \frac{\sum_{i=1}^{n}(x_1 - x)^2}{n}$

$P(A) = \frac{n(A)}{n(S)}$ $\quad P(A\ of\ B) = P(A) + P(B) - P(A\ en\ B)$

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

QUESTION/*VRAAG* 5

5.1.1		(3)
5.1.2		(2)
5.2		(5)