HILLCREST HIGH SCHOOL

GRADE 11

MATHEMATICS

PAPER 2

NOVEMBER 2015

MARKS: 150 **TIME:** 3 Hours

This question paper consists of 9 pages and 2 diagram sheets

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions:

1. This question paper consists of 11 questions. Answer ALL the questions.
2. Show ALL calculations, diagrams, graphs etc., clearly, which you have used in determining the answers.
3. Answers only will NOT necessarily be awarded full marks.
4. An approved scientific 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. Number the answers correctly according to the numbering system used in this question paper.
7. Diagrams are NOT necessarily drawn to scale.
8. Write neatly and legibly.

QUESTION 1

The following scores of a cricket player were recorded during one season:

88	76	12	29	39	50	64	50	80	55
24	51	67	58	33	77	48	73	40	

1.1 Determine the median score of the given data. (2)

1.2 Calculate the Interquartile Range for the data. (2)

1.3 Represent the scores of the cricket player using a box-and-whisker diagram. (3)

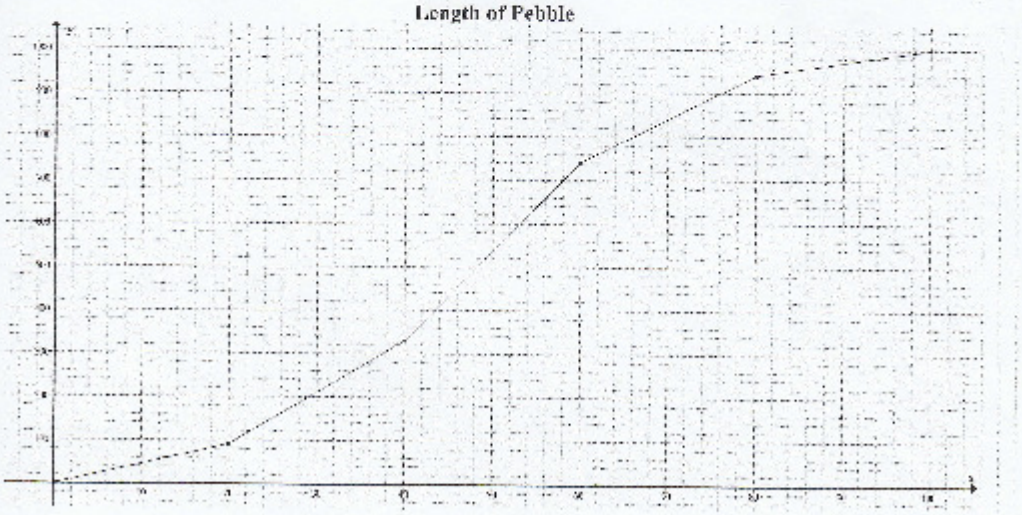
1.4 What information about the players' performance can be deduced relative to the lower quartile? (2)

1.5 In which direction is the data skewed? (1)

[10]

QUESTION 2

Pebbles from the beach were collected and their lengths measured. The length of the smallest pebble is 1mm and the length of the largest pebbles is 95mm. A cumulative frequency graph (ogive) of this data is shown below:



2.1 Complete the cumulative frequency table for the above data provided on DIAGRAM SHEET 1. (2)

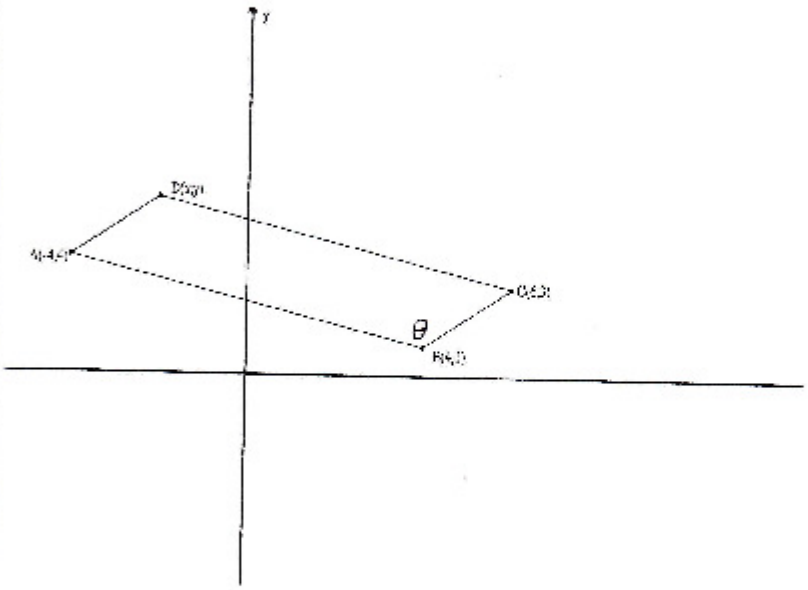
2.2 How many pebbles were collected? (1)

2.3 Use the ogive to estimate how many pebbles had a length of 50mm or less. (2)

2.4 Use the grid provided on DIAGRAM SHEET 1 to draw a frequency polygon of the data. (4)

[9]

QUESTION 3



The diagram shows parallelogram ABCD with A(-4;4) , B(4;1), C(6;3) and D(x;y).

E is a point on the Y-axis and lies on CD

3.1 Determine the gradient of AB (2)

3.2 Determine the equation of DC (3)

3.3 Write down the co-ordinates of D. (2)

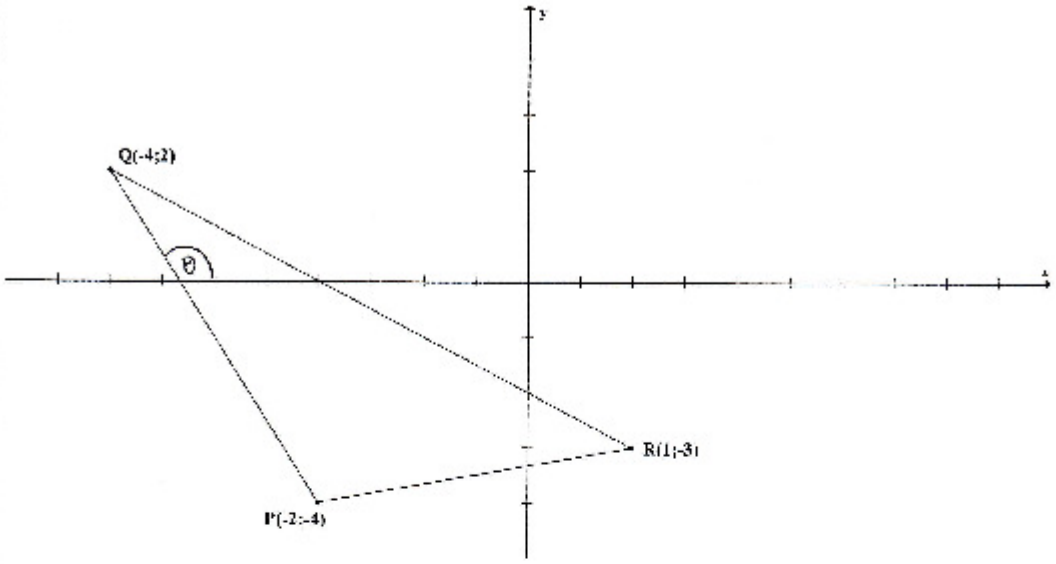
3.4 Establish whether E is the midpoint of DC. Show all calculations clearly. (4)

3.5 Calculate θ (5)

[16]

QUESTION 4

In the diagram below, ΔPQR has vertices P(-2; -4), Q(-4; 2) and R(1; 3) on the Cartesian plane.



4.1 Prove that ΔPQR is a right-angled triangle. (7)

4.2 Calculate the area of ΔPQR (3)

4.3 Calculate the size of θ to the nearest degree. (3)

[13]

QUESTION 5

5.1 If $\sin 29^\circ = p$, determine the following in terms of p:

5.1.1 $\cos 29^\circ$ (3)

5.1.2 $\tan(-569^\circ)$ (3)

5.1.3 $1-\cos^2 61^\circ$ (2)

5.2

5.2.1 Prove the following identity:

$$\left(\frac{1}{\sin\beta}+\frac{1}{\tan\beta}\right)^2=\frac{1+\cos\beta}{1-\cos\beta}$$ (5)

5.2.2 For which values of β in the interval $0^\circ \le \beta \le 360^\circ$ will the identity in QUESTION 5.2.1 be undefined?

(2)

5.3 Simplify without using a calculator:

$$\frac{\cos(90^\circ + x).\sin(360^\circ + x) - \cos^2(x - 180^\circ)}{\cos(-x)}$$ (6)

5.4 Determine the general solution for the following equation (rounded off to 2 decimal places):

$\cos^2\theta + 3\sin\theta = -3$ (6)

5.5 If $5\sin\hat{A} = -3$, where $0^\circ < \hat{A} < 270^\circ$, find by using a suitable sketch and without the use of a calculator, the value of:

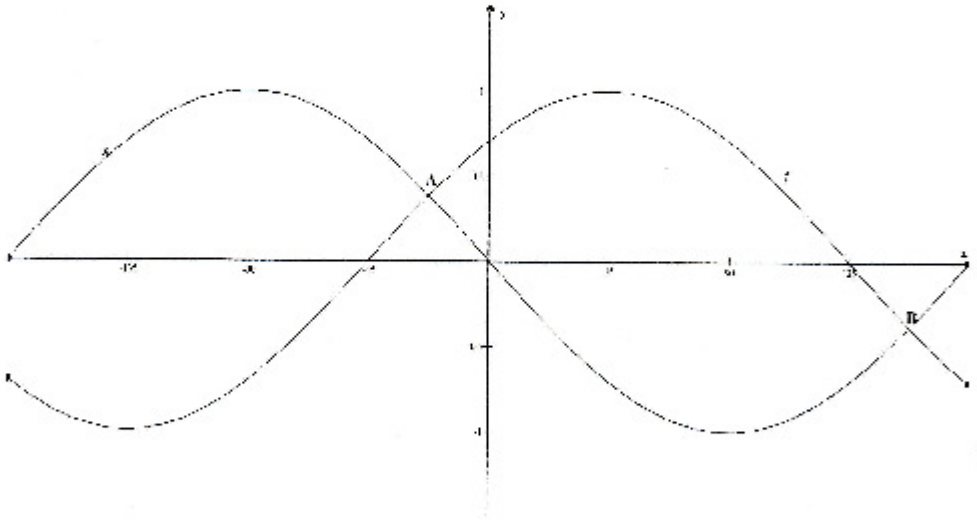
5.5.1 $\cos\hat{A}$ (3)

5.5.2 $\sin^3\hat{A} - \tan^2\hat{A}$ (3)

[33]

QUESTION 6

In the diagram below, the graphs of $f(x) = \cos(x+p)$ and $g(x) = q\sin x$ are shown for the interval $-180 < x < 180$



6.1. Determine the values of p and q. (2)

6.2 The graphs intersect at A(-22,5°;0,38) and B. Determine the coordinates of B. (2)

6.3 Write down the period of $g(2x)$ (2)

6.4 The graph f is shifted 30° to the left to obtain a new graph h.

6.4.1 Write down the equation of h in its simplest form. (2)

6.4.2 Write down the value of x for which h has a maximum in the interval $-180° \leq x \leq 180°$. (1)

[9]

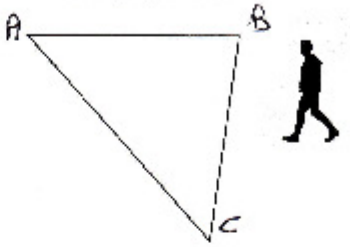
QUESTION 7

7.1 If $m^2 = p^2 + n^2 - 2pn \cos \hat{M}$, then complete:

$\cos \hat{M} =$ _____ (1)

7.2 The figure represents a triangular field with three beacons, A, B and C.

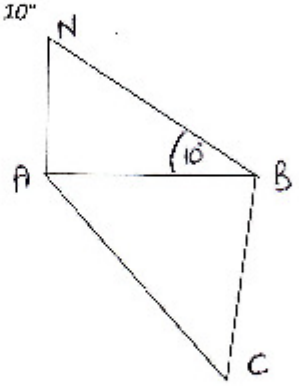
AB = 302 m, AC = 517 m and $B\hat{A}C = 53°$



7.2.1 Calculate the distance a boy would cover if he walks around the field. (correct to the nearest metre) (4)

7.2.2 Calculate $A\hat{B}C$ (3)

7.2.3 AN is a pylon of Eskom and a vantage point for an owl at night. The angle of elevation from B to N is $10°$



Determine how high above the ground the owl's vantage point is. (3)

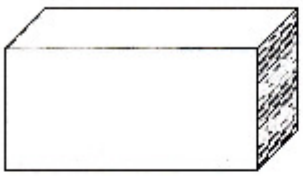
7.2.4 $\triangle ABC$ in the horizontal plane represents the owls hunting area. Calculate the owl's hunting area. (3)

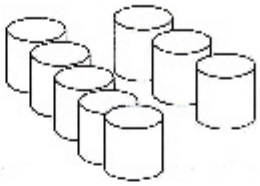
[14]

QUESTION 8

Andrew is packing cylindrical cans with a diameter of 6cm and height of 10cm tightly into a box that measure 3m by 2m by 1m. All rows must contain the same number of cans. The cans can touch each other.

8.1 How many cans can Andrew pack in one box? (3)





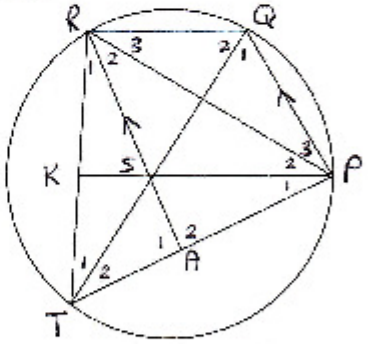
8.2 Andrew then fills the all the empty space in the box with packing foam. Find the volume of the packing foam he uses. (5)

[8]

ALL GEOMETRY DIAGRAMS ARE ON DIAGRAM SHEET 2

QUESTION 9

Refer to the diagram below. PQRS is a parallelogram. P, Q and R lie on the circle. PS produced meets RT at K, where RT $\perp$ PK. RS produced meets PT at A. $\hat{P}_2 = 35°$



9.1 Calculate with reasons, the size of:

9.1.1 $\hat{R}_1$ (2)

9.1.2 $\hat{T}_2$ (2)

9.1.3 $T\hat{R}P$ (2)

9.2 Prove that QT is the diameter of the circle. (3)

9.3 Prove that PAKR is a cyclic quadrilateral. (6)

[15]

DIAGRAM SHEET 1

Name: _____ **Grade:** _____

Teacher's Name: _____

2.1

Cumm Freq. Freq.

Length of Pebble (mm)	Number of Pebbles
$x < 20$	90
$20 \leq x < 40$	
$40 \leq x < 60$	
$60 \leq x < 80$	
$80 \leq x < 100$	

2.4.

Frequency Polygon

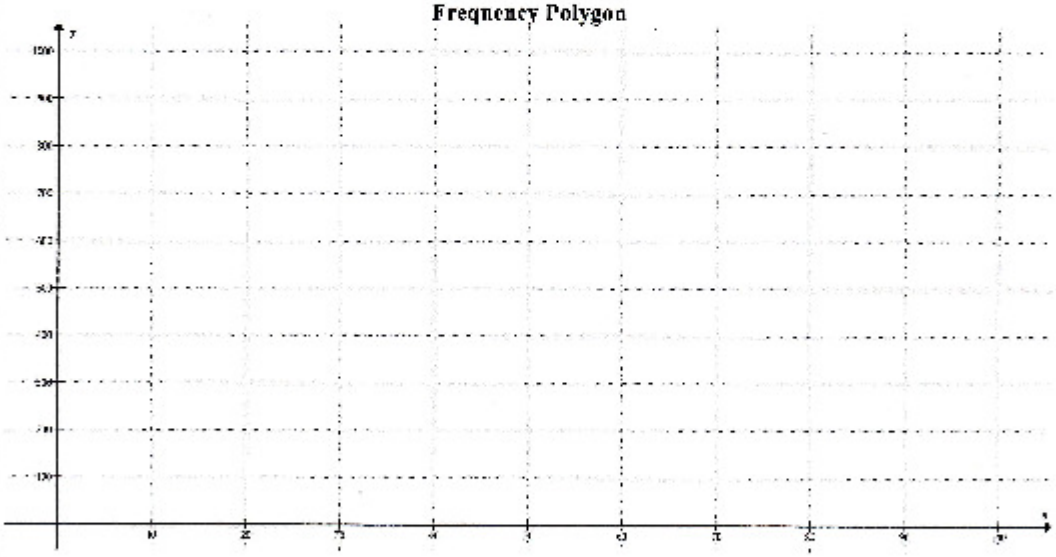


DIAGRAM SHEET 1

Name: _____ **Grade:** _____

Teacher's Name: _____

2.1

Cumm Freq. Freq.

Length of Pebble (mm)	Number of Pebbles
$x < 20$	90
$20 \leq x < 40$	
$40 \leq x < 60$	
$60 \leq x < 80$	
$80 \leq x < 100$	

2.4.

Frequency Polygon

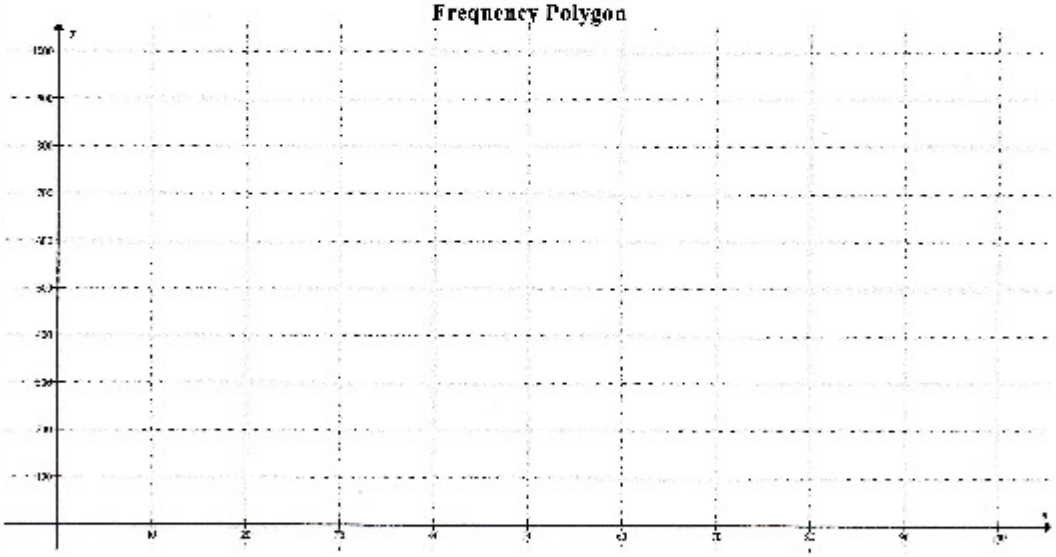
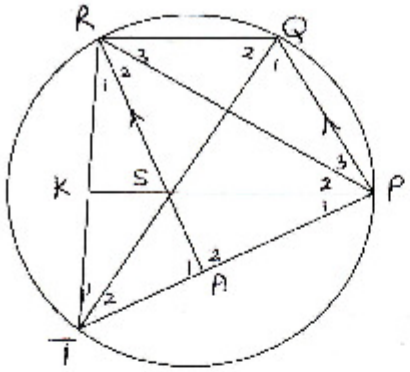
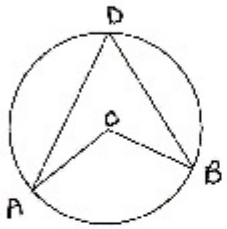


DIAGRAM SHEET 2

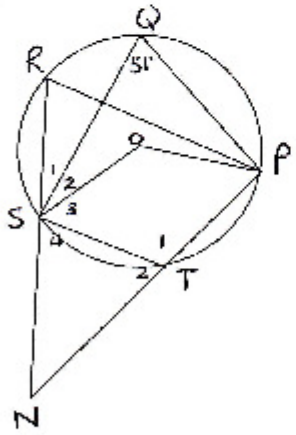
9.



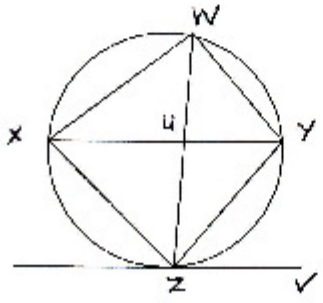
10.1



10.2

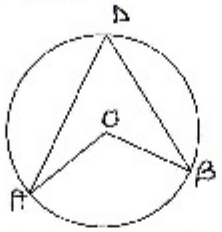


11.



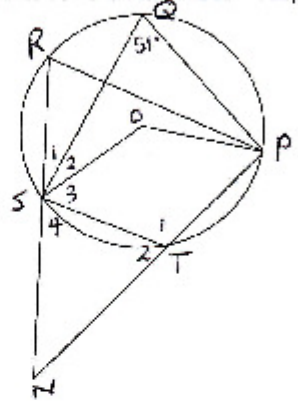
QUESTION 10

10.1 In the diagram, O is the centre of the circle and A, B and D are points on the circle. Prove the theorem which states that $A\hat{O}B = 2A\hat{D}B$.



(5)

10.2 In the diagram, O is the centre of the circle. P,Q, R, S and T lie on the circle. PT is produced and RS produced meet in N. NR = NP and $\hat{Q} = 51°$



10.2.1 Calculate, with reasons the size of $S\hat{O}P$ (2)

10.2.2 Prove that NS = NT (8)

[15]

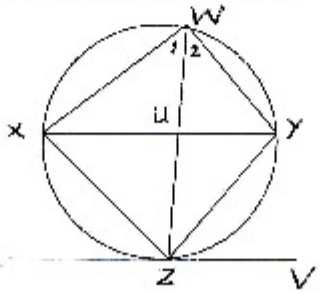
QUESTION 11

In the given figure below, ZV is a tangent to the circle and ZV || XY.
Prove that:

11.1 WZ bisects $X\hat{W}Y$ (5)

11.2 YZ is a tangent to the circle passing through Y, U and W. (3)

[8]



INFORMATION SHEET

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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