basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P3

FEBRUARY/MARCH 2014

MARKS: 100

TIME: 2 hours

This question paper consists of 7 pages, 3 diagram sheets and 1 information sheet.

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.

3. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your 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. Diagram sheets for QUESTION 1.1, QUESTION 1.3, QUESTION 7, QUESTION 8, QUESTION 9, QUESTION 10.1 and QUESTION 10.2 are attached at the end of this question paper. Write your centre number and examination number on these diagram sheets in the spaces provided and insert the diagram sheets inside the back cover of your ANSWER BOOK.

8. An information sheet with formulae is included at the end of this question paper.

9. Number the answers correctly according to the numbering system used in this question paper.

10. Write neatly and legibly.

QUESTION 1

The table below lists the concentration of dissolved oxygen, in parts per million, at various temperatures, in degrees Celsius, in a sample of lake water.

Temperature (°C) (x)	17	15	13	16	11	13	10	8	6	7	8	4	5	9	6
Dissolved oxygen (in parts per million) (y)	8	9	11	10	14	11	14	14	16	13	14	17	15	13	16

1.1 Draw a scatter plot of the data on the grid on DIAGRAM SHEET 1. (3)

1.2 Determine the equation of the least squares regression line. (4)

1.3 Draw the least squares regression line on DIAGRAM SHEET 1. (2)

1.4 Use the least squares regression line to predict the concentration of dissolved oxygen, in parts per million, if the temperature of the sample of water is 14 °C. (2)

1.5 Determine the correlation coefficient of the data. (2)

1.6 Comment about the relationship between the variables mentioned in the question. (2)
[15]

QUESTION 2

One hundred and seventy-five movie critics were invited to preview a new movie. After seeing the movie, a survey was conducted and the results were recorded in a two-way contingency table.

	Age < 40	**Age ≥ 40**	**Totals**
Liked the movie	65	37	102
Did not like the movie	***b***	31	***a***
Totals	***c***	***d***	175

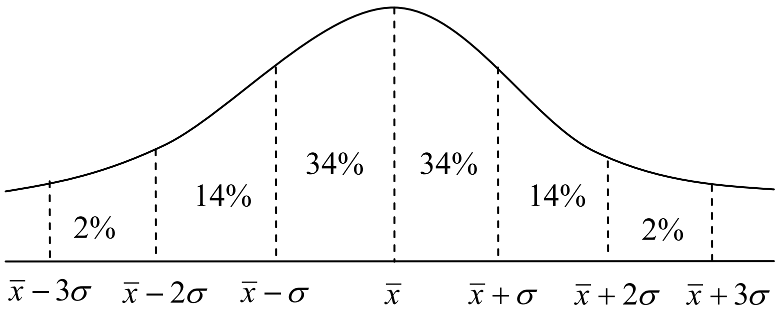
2.1 Calculate the values of a, b, c and d in the contingency table. (4)

2.2 A movie critic is selected at random. What is the probability that the critic was less than 40 years old and did not like the movie? (2)

2.3 Are the events, age of the critic and preference for the movie, independent? Support your answer with the appropriate calculations. (4)
[10]

QUESTION 3

The lifetime of a certain type of battery follows a normal distribution with a mean of 500 hours. It is observed that 48% of the lifetime of this battery lies in the interval 500 hours to 542 hours.



3.1 Calculate the standard deviation of the lifetime of this battery. (2)

3.2 What percentage of the battery life lies in the interval 458 hours to 521 hours? (3)

3.3 Calculate the expected minimum lifetime of this battery. (2)
[7]

QUESTION 4

Eight learners are seated on eight chairs in the front row at an assembly.

4.1 In how many different ways can these 8 learners be seated? (2)

4.2 In how many different ways can the 8 learners be seated if 3 of the learners must sit together? (3)

4.3 In how many different ways can the 8 learners be seated if 2 particular learners refuse to sit next to each other? (3)
[8]

QUESTION 5

Alfred and Barry have an equal chance of winning a point in a game.

5.1 Draw a tree diagram to represent the situation after a total of 3 points have been contested. Indicate on your diagram the probabilities and all the outcomes associated with each branch. (5)

5.2 Calculate the probability that Barry would have won all 3 points. (2)

5.3 Calculate the probability that Alfred would have won 2 points and Barry would have won 1 point of the 3 points contested. (2)

5.4 Barry and Alfred play a fourth point. Calculate the probability that Alfred will win 3 of the 4 points contested. (4)
[13]

QUESTION 6

The following sequence is of the form: $T_{n+1} = T_n + aT_{n-1} + b$; $a, b \in Z$; $n \geq 2$

4 ; 7 ; 9 ; 14 ; 21 ; 33 ; ...

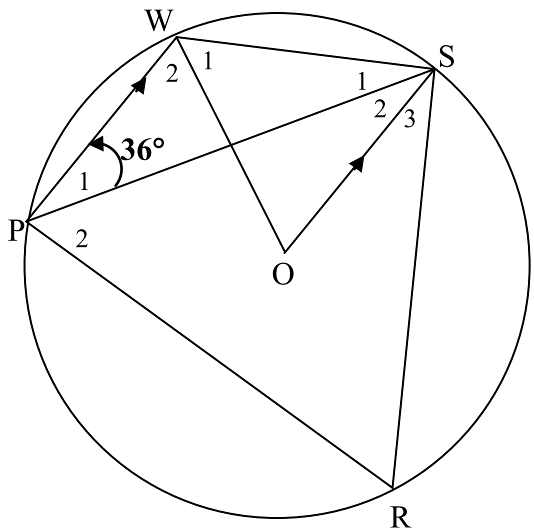
6.1 Determine the values of *a* and *b*. (4)

6.2 Write down the 7^{th} term of the sequence. (1)
[5]

GIVE REASONS FOR YOUR STATEMENTS AND CALCULATIONS IN QUESTIONS 7 TO 10.

QUESTION 7

In the diagram, O is the centre of the circle. PWSR is a cyclic quadrilateral. PS, WO and OS are drawn. PW || OS and $\hat{P}_1 = 36°$.



Calculate the sizes of the following angles:

7.1 $S\hat{O}W$ (2)

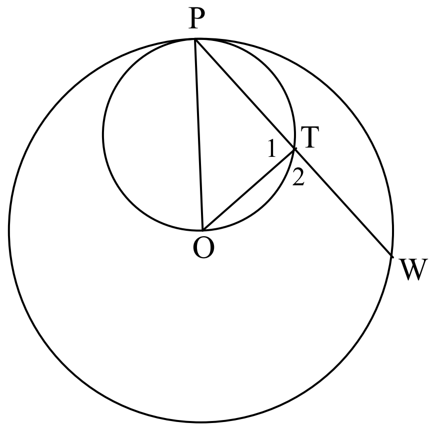
7.2 $\hat{W}_2$ (2)

7.3 $O\hat{S}W$ (3)

7.4 $\hat{R}$ (3)
[10]

QUESTION 8

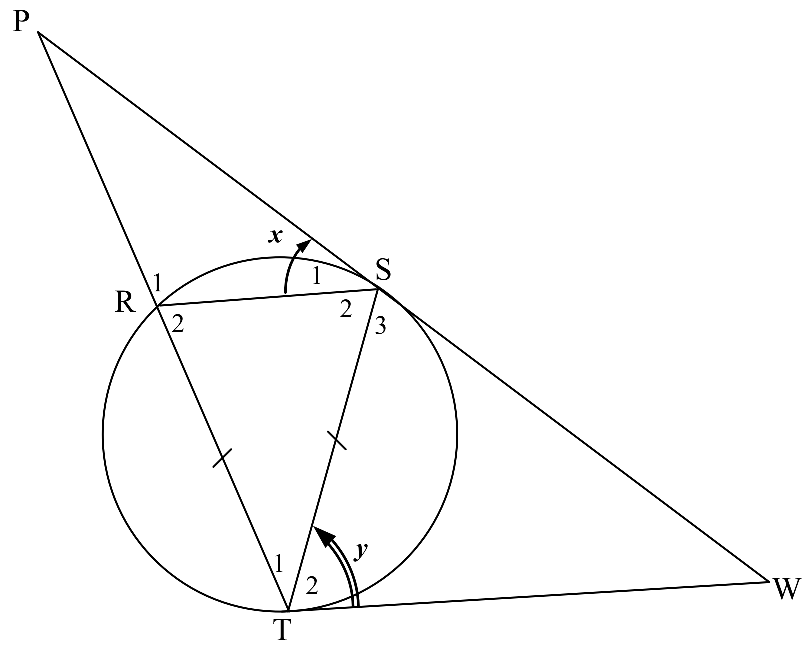
In the diagram, OP is the diameter of the smaller circle. O is the centre of the larger circle. Also, PTW is a chord of the larger circle and T lies on the smaller circle. OT is joined.



If OT = 10 cm and PW = 48 cm, calculate the length of the radius of the smaller circle. **[5]**

QUESTION 9

In the diagram, PSW and WT are tangents to circle RST at S and T respectively. PT is drawn and intersects the circle at R. RS and ST are joined. RT = TS.
Let $\hat{S}_1 = x$ and $\hat{T}_2 = y$.



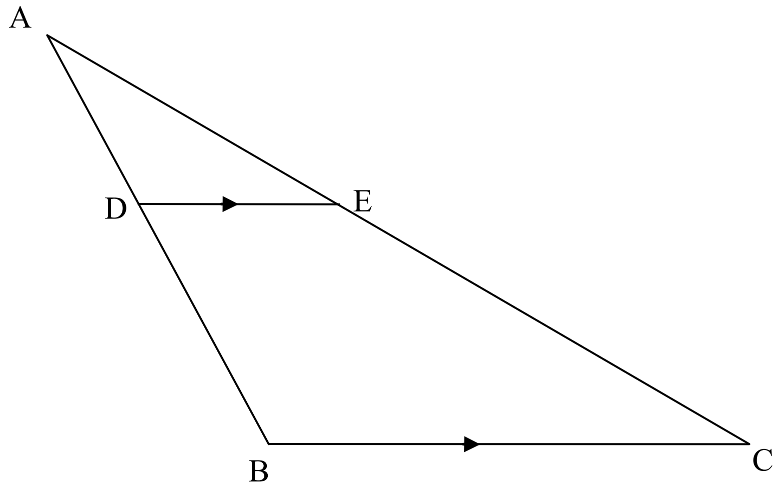
9.1 Name, with reasons, THREE angles each equal to y. (6)

9.2 Prove that $\Delta PRS \,|||\, \Delta PST$. (3)

9.3 Prove that $PS \times RT = RS \times PT$. (3)
[12]

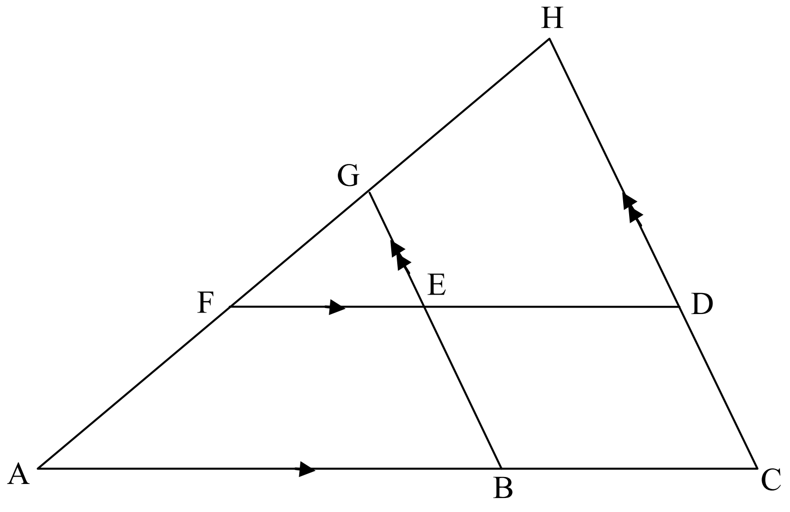
QUESTION 10

10.1 In ΔABC below, D is a point on AB and E is a point on AC such that $DE \parallel BC$.
Prove, using Euclidean geometry methods, the theorem that states $\frac{AD}{DB} = \frac{AE}{EC}$.



(7)

10.2 In the diagram below, ACH is a triangle with point B on AC and point G on AH such that $BG \parallel CH$. F is a point on AH and D is a point on HC such that $FD \parallel AC$. GB intersects FD at E.
It is also given that HD : DC = 5 : 3 and AB = 2BC.



If AH = 48 cm, calculate the following with reasons:

10.2.1 HF (3)

10.2.2 FG (3)

10.2.3 EF : ED (2)

[15]

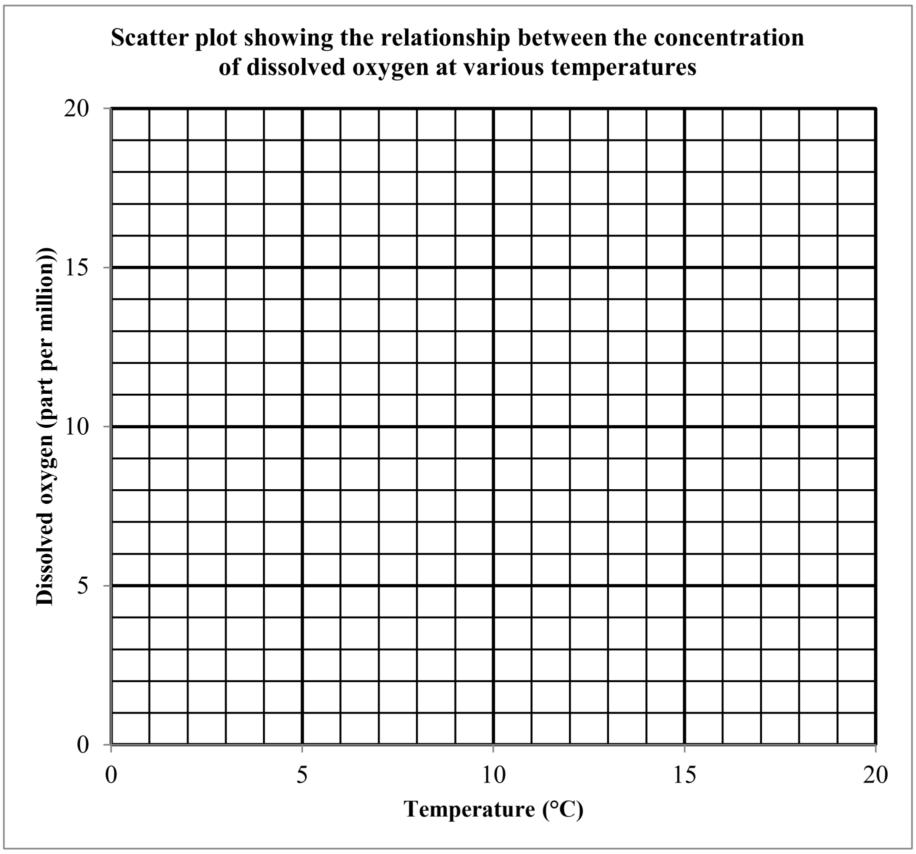
TOTAL: 100

CENTRE NUMBER:

EXAMINATION NUMBER:

DIAGRAM SHEET 1

QUESTION 1.1 and 1.3



QUESTION 7

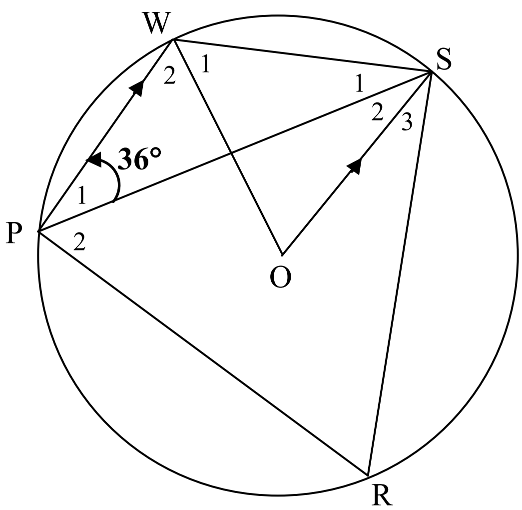


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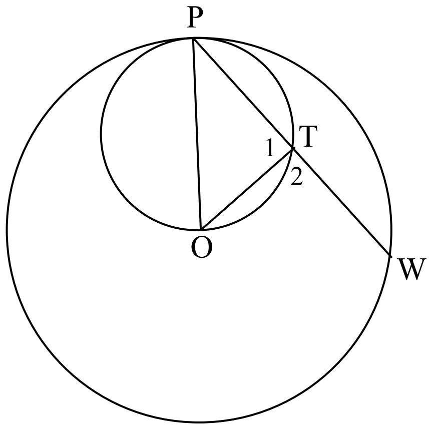
DIAGRAM SHEET 2

QUESTION 8



QUESTION 9

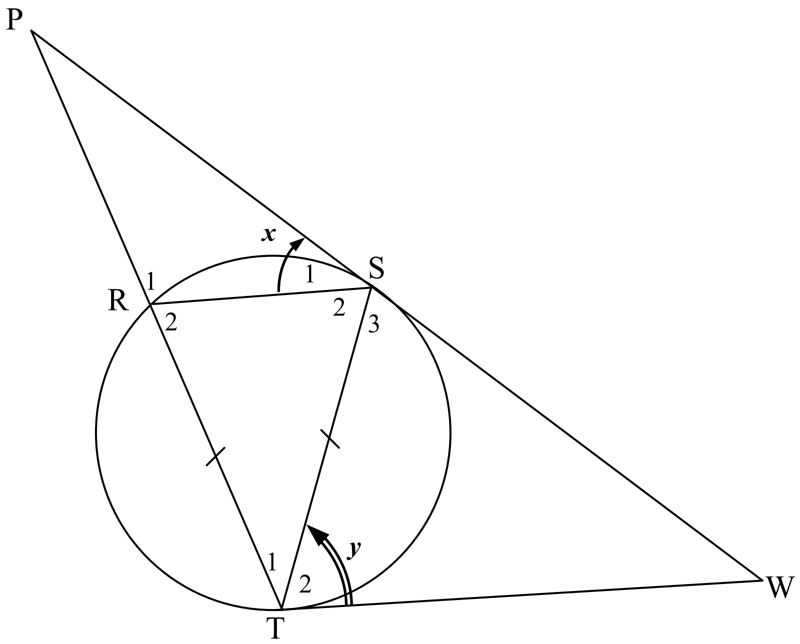


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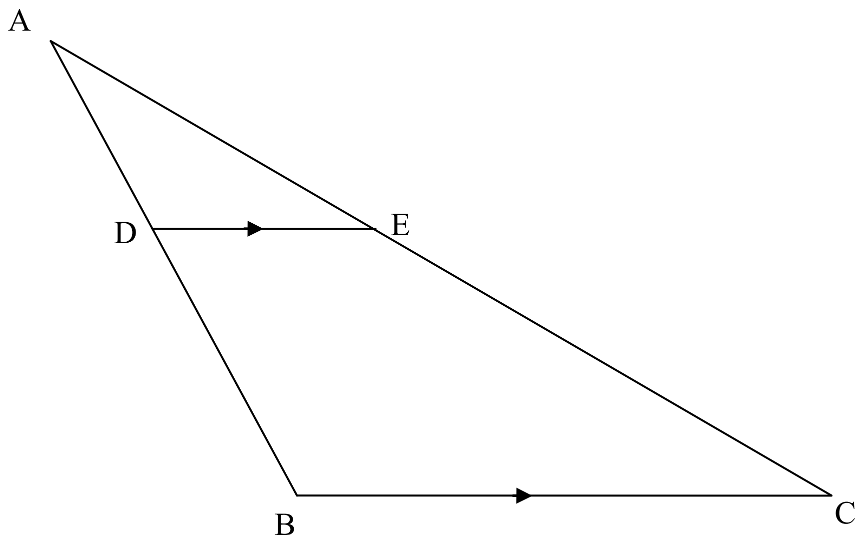
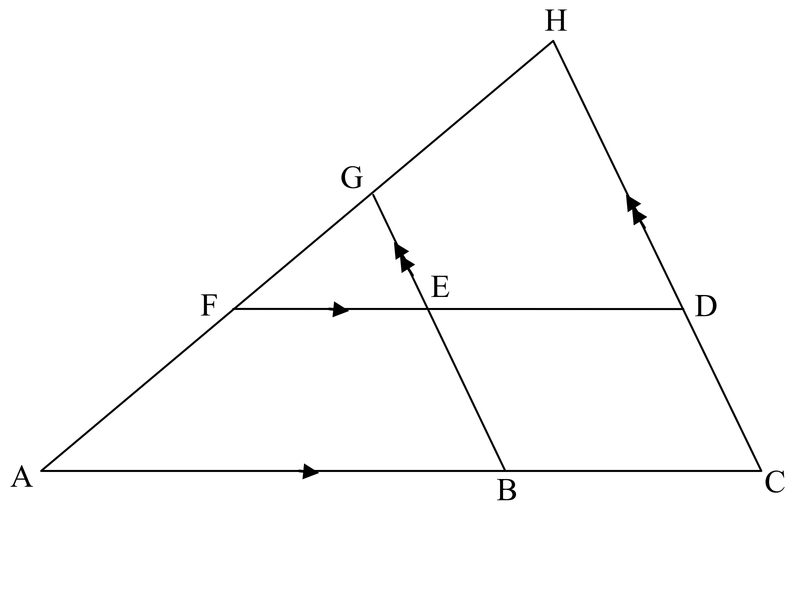
DIAGRAM SHEET 3

QUESTION 10.1



QUESTION 10.2



INFORMATION SHEET

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

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

$\sum_{i=1}^{n} 1 = n$ $\quad \sum_{i=1}^{n} i = \frac{n(n+1)}{2}$ $\quad T_n = a + (n-1)d$ $\quad S_n = \frac{n}{2}\left(2a + (n-1)d\right)$

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

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

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

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

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

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

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

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

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

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

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

$$(x ; y) \to (x\cos\theta - y\sin\theta ; y\cos\theta + x\sin\theta)$$

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

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

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