BALLITO

Mathematics Paper 2

FORM 4 26th November 2015

TIME: 3 hours **TOTAL: 150 marks**

Examiner: Mrs A Gunning **Moderated: Mr R Steenhuisen**

NAME:

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY BEFORE ANSWERING THE QUESTIONS.

- This question paper consists of 24 pages. This includes an information sheet. Please check that your question paper is complete.
- Answer all questions on this question paper.
- Read and answer all questions carefully.
- It is in your own interest to write legibly and to present your work neatly.
- All necessary working which you have used in determining your answers **must** be clearly shown.
- Approved non-programmable calculators may be used except where otherwise stated. Where necessary give answers correct to 2 decimal places unless otherwise stated.
- Ensure that your calculator is in DEGREE mode.
- Diagrams have not necessarily been drawn to scale.

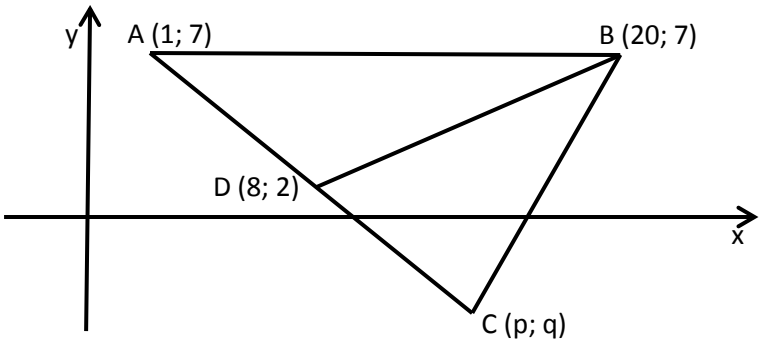
Ques No	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Out of	8	6	10	10	18	11	7	7	11	12	7	31	12	150
Mark														

SECTION A

QUESTION 1

In the diagram the coordinates of the vertices of ΔABC are $A(1;7), B(20;7)$ and $C(p;q)$.

$D(8;2)$ is the midpoint of AC. B and D are joined.



(a) Find the values of p and q. (2)

(b) Find the gradient of BD and hence work out the value of θ, the inclination of BD. (3)

(c) Calculate $B\widehat{D}C$ (3)

[8]

QUESTION 2

The points $A(-2;\ -7)$ and $B(3;8)$ are points on the graph of $y = f(x)$.

(a) Find the gradient of the line though A and B. (2)

(b) Hence find the equation of the line AB (2)

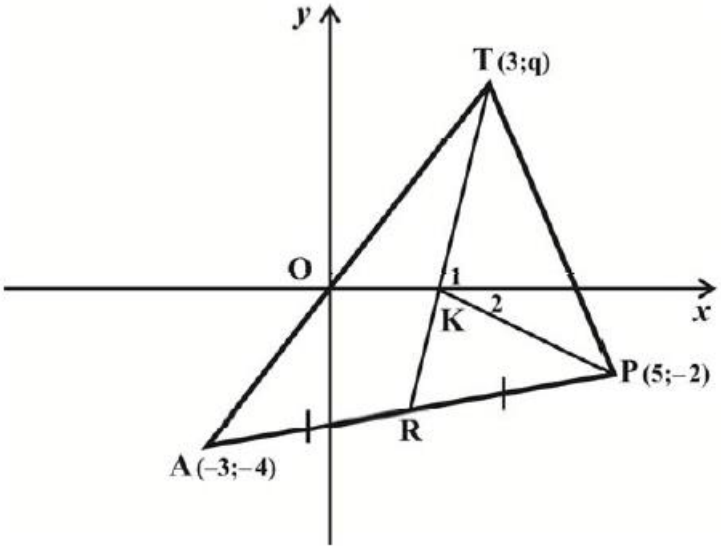
(c) Find the coordinates of the point at which the line crosses the x axis. (2)

[6]

QUESTION 3

In the diagram, ΔAPT is drawn with $T(3; q)$, $A(-3; -4)$ and $P(5; -2)$.

TA passes through the origin. R is the midpoint of AP. K is the x-intercept TR



(a) Find the equation of the line TA. (2)

(b) Show that $q = 4$ (1)

(c) Find the coordinates of R, the midpoint of AP. (2)

(d) Find the coordinates of K, the x intercept of TR. (5)

[10]

QUESTION 4

$G(1;5);\ H(3;7)\ and\ I(8;2)$ are points in the Cartesian plane.

(a) Show that $G\widehat{H}I = 90°$ (4)

(b) Show that the area of $\Delta GHI = 10\ units^2$ (6)

[10]

QUESTION 5

(a) Given $12\ tan\theta\ -\ 5 = 0$ and $\theta\ \epsilon\ (90°;\ 270°)$.

(1) Using a relevant sketch drawn in the correct quadrant, without the use of a calculator, determine the value of $sin(180° - \theta)$. (3)

(2) Using a calculator, give the value of θ (correct to 2 decimal places). (2)

(b) Simplify $\frac{\cos(90°-A).sin20°}{\sin(180°-A).cos70°} + \cos(180° + A) . \sin(90° + A)$ (7)

(c) If $sin18° = p$ determine the following in terms of p:

(1) $sin198°$ (1)

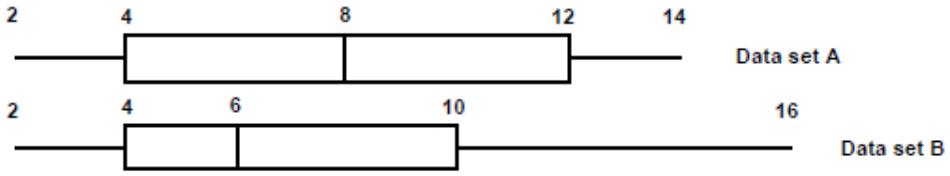
(2) $\cos(-108°)$ (2)

(d) Solve for α given that $\alpha \epsilon [0°; 360°]$ given $\frac{1}{2}\sin(\alpha - 25°) = 0{,}25$ (3)

[18]

QUESTION 6

(a) The box and whisker diagrams of two sets of data – A and B – are shown below.



The extreme values of Set A are 14 and 2, and in Set B 16 and 2. They both have the same lower quartile.

(1) Which data set is the most symmetrical? (1)

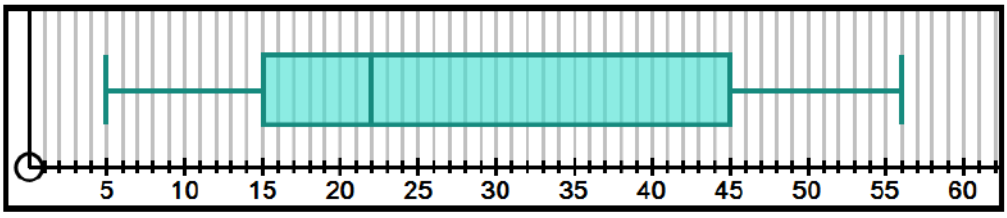
(2) Comment on the dispersal of data items in Set B. (2)

(3) Which data set has the larger standard deviation? Explain your answer. (2)

(b) The weight of luggage belonging to each of 135 passengers on an aeroplane is summarised in the following table.

Weight (kg)	Number of passengers
$0 \leq w < 10$	23
$10 \leq w < 20$	28
$20 \leq w < 30$	31
$30 \leq w < 40$	4
$40 \leq w < 50$	33
$50 \leq w < 60$	16

The diagram below is a box and whisker plot of the raw data summarised in the table.



(1) Estimate the number of passengers with luggage in each of the following weight classes.

a. $15 \leq w < 22$ (2)

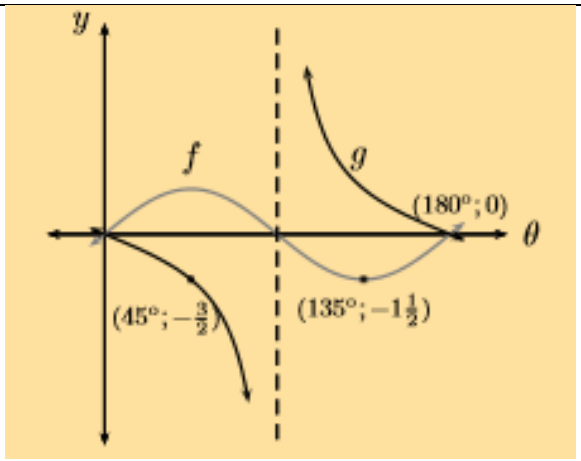
b. $22 \leq w < 45$ (1)

(2) Calculate an estimate for the mean and the standard deviation of the luggage weights. Give your answer to 1 decimal place. (3)

[11]

QUESTION 7

Determine the equation of each of the graphs given below.

<table>
<tr>
<td> 
</td>
<td>(a) $f(\theta) = a\ sink\theta$ and
$g(\theta) = b\ tan\theta$ (3)</td>
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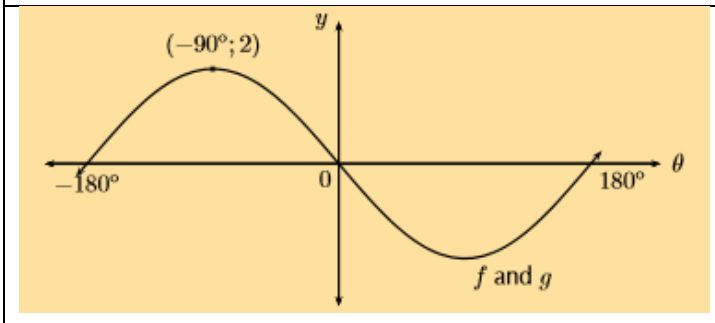
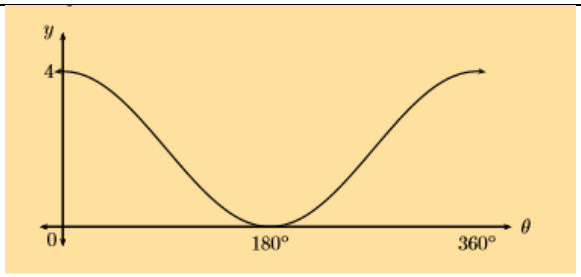
<tr>
<td> 
</td>
<td>(b) $y = a\cos(\theta - p)$ (2)</td>
</tr>
</table>



(c) $y = a\cos\theta + q$ (2)

[7]

SECTION B

QUESTION 8

$A(-2;1)$ and $B(6;k)$ are 2 points in the Cartesian plane.

(a) Find the length of AB, giving your answer in terms of k. (No need to simplify.) (2)

(b) Given that $AB = 10$, find the possible values of k. (5)

[7]

QUESTION 9

(a) Show that $sin^4\theta - cos^4\theta = 2sin^2\theta - 1$ (4)

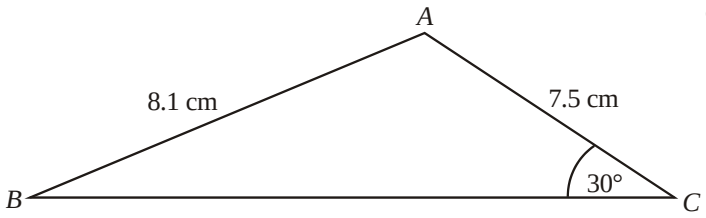
(b) Without the use of a calculator, and showing all relevant working detail, evaluate

$$\frac{3sin55°sin^2325°}{\cos(-145°)} - 3cos395°sin125°$$ (7)

[11]

QUESTION 10

(a)



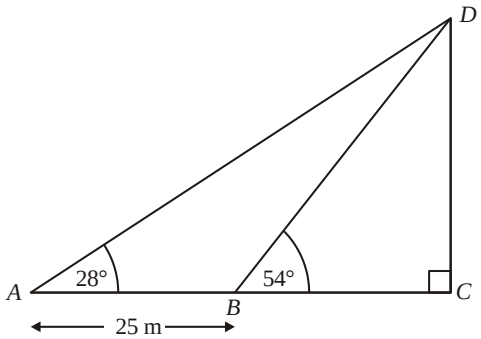
In ΔABC, AB = 8.1 cm, AC = 7.5 cm, $A\hat{C}B$ = 30°.

(1) Calculate the size of $\hat{B}$ (correct to 1 decimal place) given that $\hat{B}$ is acute.

(3)

(2) Calculate the area of ΔABC (correct to 1 decimal place). (3)

(b)



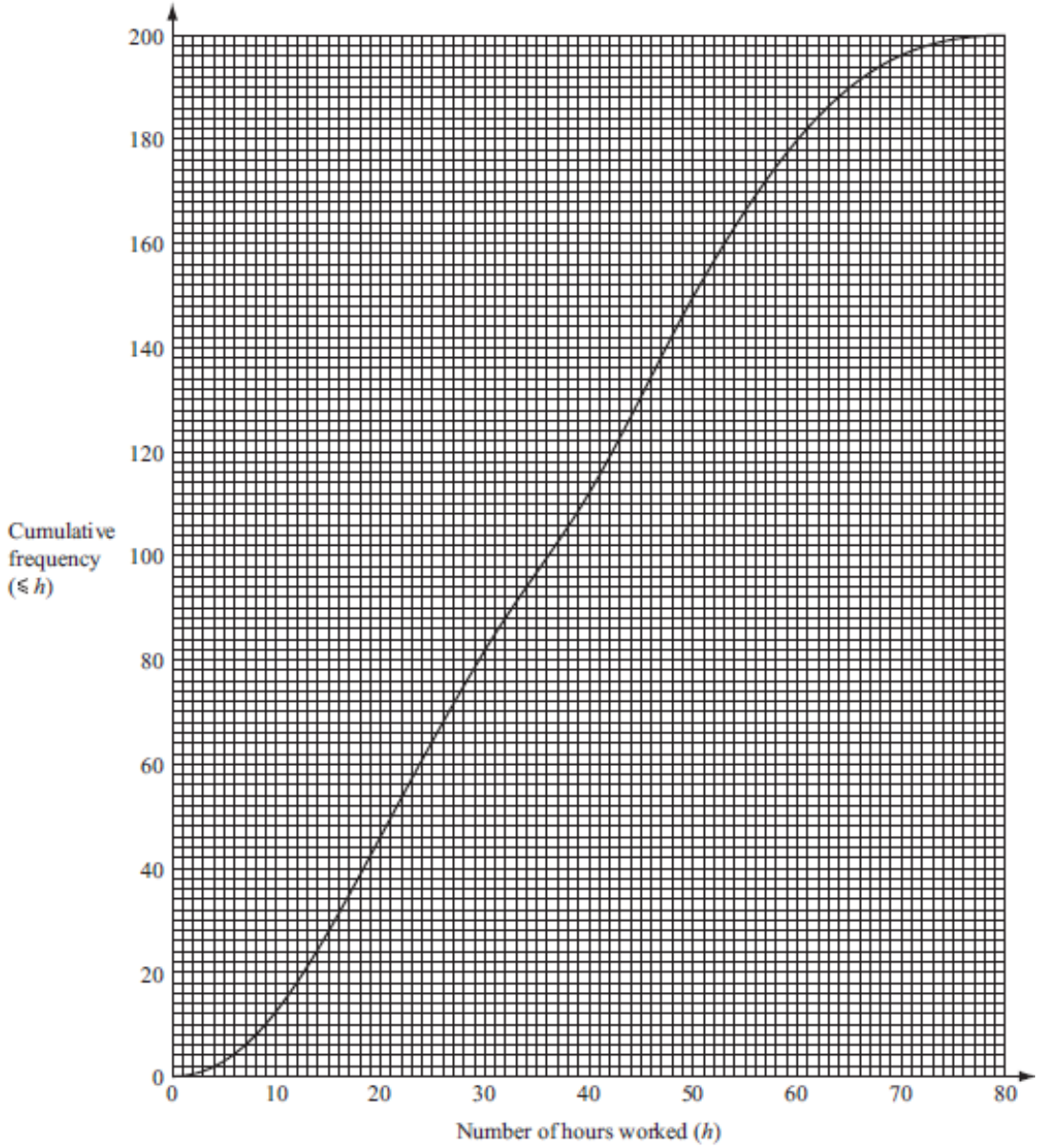
The diagram shows a vertical tower *DC* on horizontal ground *ABC*. *ABC* is a straight line. The angle of elevation of *D* from *A* is 28°.

The angle of elevation of *D* from *B* is 54°. *AB* = 25 m.

Calculate the height of the tower. Give your answer correct to 1 decimal place. (6)

[12]

QUESTION 11



(a) 200 people record the number of hours they work in a week. The cumulative frequency graph shows this information.

Use this graph to find each of the following, and indicate ON YOUR GRAPH where you took your readings.

(1) The median (1)

(2) The upper quartile (1)

(3) The interquartile range. (2)

(4) The number of people who work more than 60 hours in a week. (1)

(b) Fred uses the graph to draw up the following frequency table.

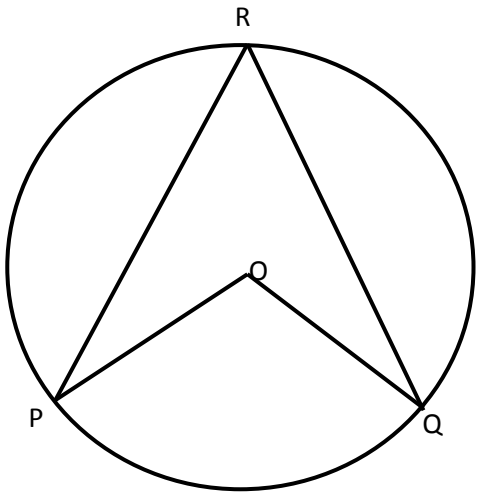
Hours worked (h)	$0<h\leq10$	$10<h\leq20$	$20<h\leq30$	$30<h\leq40$	$40<h\leq50$	$50<h\leq60$	$60<h\leq70$	$70<h\leq80$
Frequency	12	34	36	30	38	30	p	q

Use your graph to find the values of p and q (2)

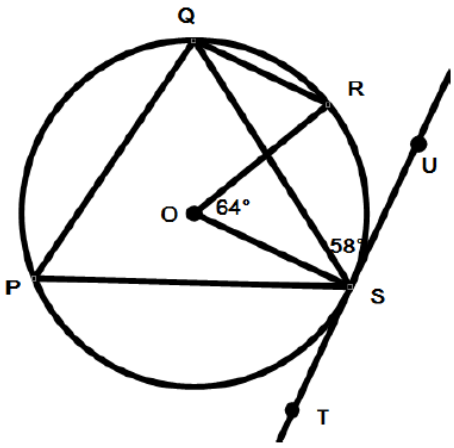
[7]

QUESTION 12

(a) Using the given diagram, prove the theorem which states that the angle subtended by a chord at the centre of a circle O is equal to the angle subtended by that same chord on the circumference of the circle. (5)



(b) P, Q, R and S are points on the circumference of the circle, centre O. TU is a tangent to the circle at the point S. $R\hat{O}S = 64°$ and $\widehat{QSU} = 58°$.



(1) Find the size of each of the following angles.

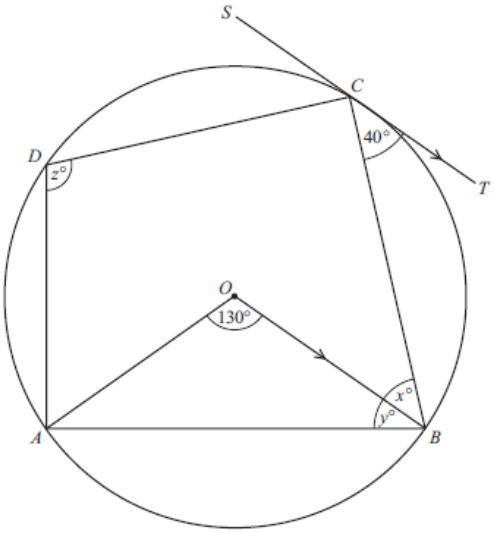
	Statement	Reasons
$O\hat{S}Q$ (1)		
$S\hat{Q}R$ (1)		
$Q\hat{P}S$ (1)		
$Q\hat{R}S$ (2)		

(2) Why are the lines QR and OS parallel? (2)

(c) A, B, C and D lie on the circle, centre O.

SCT is a tangent at C and is parallel to OB.

$A\hat{O}B = 130°$ and $B\hat{C}T = 40°$. $O\hat{B}C = x$, $O\hat{B}A = y$ and $A\hat{D}C = z$



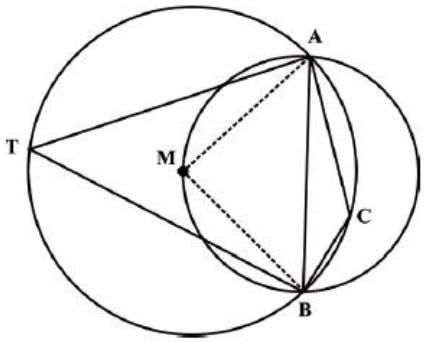
(1) Find, with reasons, the numerical values of x, y and z. (3)

(2) Write down the value of $O\hat{C}T$. (1)

(3) Find the value of the reflex angle $A\hat{O}C$ (1)

(d) In the diagram below, circle centre M intersects a second smaller circle at A and B.

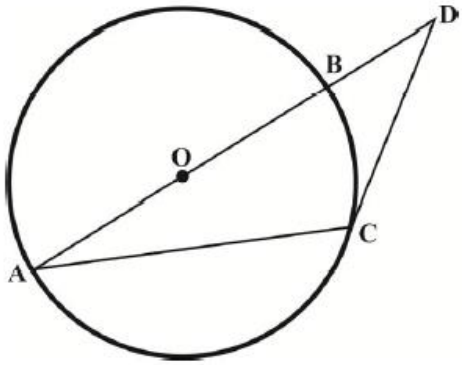
A, C, B and T are points on the circle centre M. AB is a diameter of the smaller circle.



(1) Determine the size of $\hat{C}$ (3)

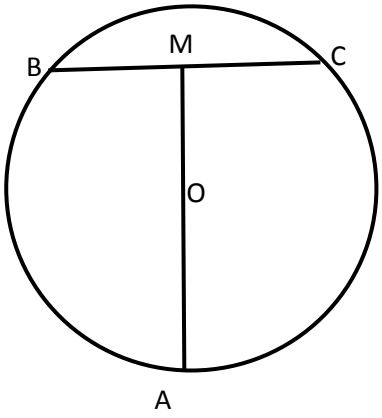
(2) Explain why AMBC is not a cyclic quadrilateral. (1)

(e) In the diagram below, a circle centre O is drawn. AB is a diameter of the circle and C is a point on the circle. AB produced meets the tangent at CD, at D. AC = DC



Determine, giving reasons, the size of $\hat{A}$ (5)

(f) O is the centre of the circle with radius 5 cm and chord BC = 8 cm. $AM \perp BC$.



Calculate

(1) OM (2)

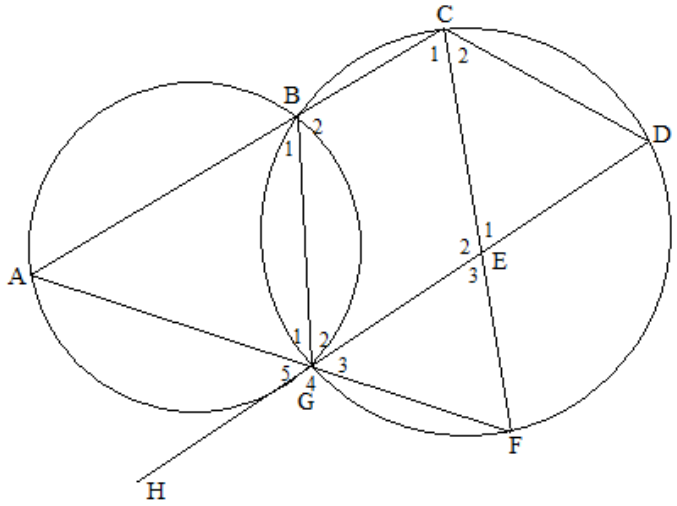
(2) AM (1)

(3) AB (2)

[31]

QUESTION 13

HGD is a tangent to the smaller circle. DG bisects $B\hat{G}F$.



Prove that

(a) ABC /// HGED (5)

(b) AG = BG (2)

(c) ACDG is a parallelogram (5)

[12]

INFORMATION SHEET

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

$$A = P(1 + ni) \qquad A = P(1 - ni)$$

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

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

$$y = mx + c \qquad y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1} \qquad m = \tan\theta$$

$In\ \Delta ABC$:

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

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

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

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

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