TIME: 3 HOURS
MARKS: 150

MATHEMATICS

(PAPER 2)

JUNE 2008

education

Western Cape Education Department

NATIONAL STRATEGY FOR LEARNER ATTAINMENT

NATIONAL SENIOR CERTIFICATE

JUNE EXAMINATION - 2008

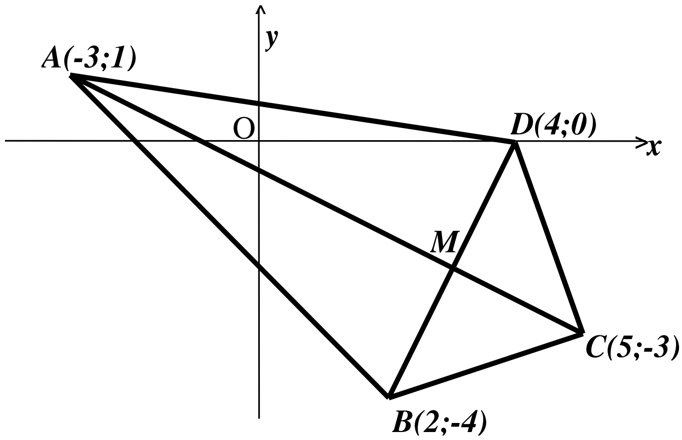
This question paper consists of **10** pages and
1 Diagram sheet and
1 Information sheet.

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. Clearly show ALL calculations, diagrams, graphs, et cetera, which you have used in determining the answers.
3. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
4. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.
5. Number the answers correctly according to the numbering system used in this question paper.
6. Diagrams are NOT necessarily drawn to scale.
7. It is in your own interest to write legibly and to present the work neatly.
8. A diagram sheet for answering QUESTION 3.2.1 is included at the end of this question paper. Write your name/examination number in the space provided and hand it in together with your ANSWER BOOK.

QUESTION 1



1.1 Calculate the length of AC in simplest surd form. (2)

1.2 Determine the equation of AC. (3)

1.3 Show that AC is the perpendicular bisector of DB. The equation of DB is $y = 2x - 8$ (8)

1.4 Determine the area of the kite ABCD (4)

1.5 Calculate the inclination of AB (2)

1.6 Hence or otherwise, calculate the size of $\hat{\ }$, correct to the nearest degree. (4)

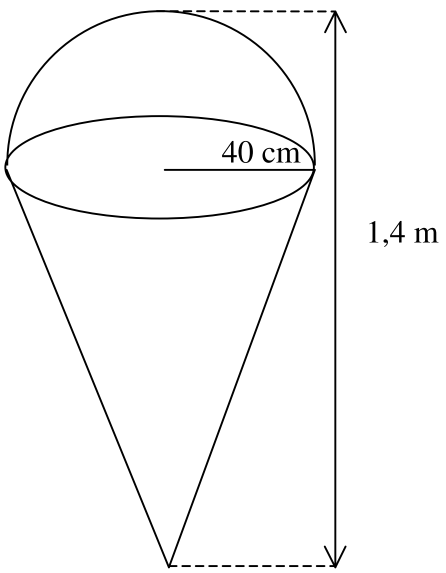
[23]

QUESTION 2

$Volume = \frac{1}{3}\pi r^2 h$ $Volume = \frac{4}{3}\pi r^3$

$Surface\ Area = \pi r^2 + \pi rH$ (where H is slant height) $Surface\ Area = 4\pi r^2$

An owner of an ice-cream parlor wants to install a steel model of an ice-cream cone outside the entrance of the parlor. The shape of the model of the cone is constructed by using a hemisphere and a cone as shown in the diagram below.
The total height of the model is 1,4 m and the radius of the cone is 40 cm.



Calculate:

2.1 The volume of the model in cm^3 (5)

2.2 The total exterior surface area of the model in m^2 (5)

2.3 The mass of the steel model if 1 m^2 has a mass of 2,5 kg (1)
[11]

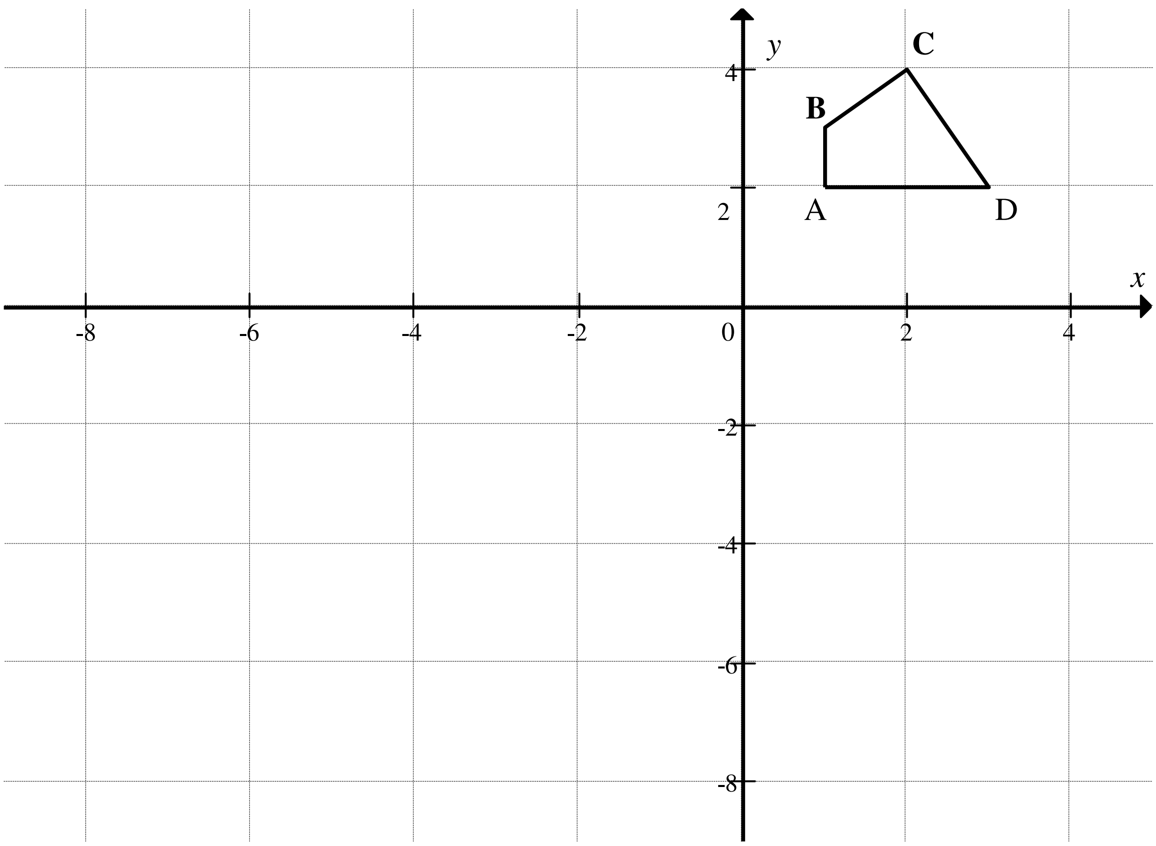
QUESTION 3

3.1 The point P(2 ; $\sqrt{3}$) lies in a Cartesian plane. Determine the coordinates of the image of P if:

3.1.1 P is reflected across the x-axis (2)

3.1.2 P has been rotated about the origin through 90° in an anticlockwise direction (2)

3.2 A transformation T of the Cartesian plane is described as follows: A point is first rotated about the origin through 180° in the anticlockwise direction. Thereafter it is enlarged through the origin by a factor of 2. In the diagram below quadrilateral ABCD is given with A(1 ; 2), B(1 ; 3), C(2 ; 4) and D(3 ; 2).



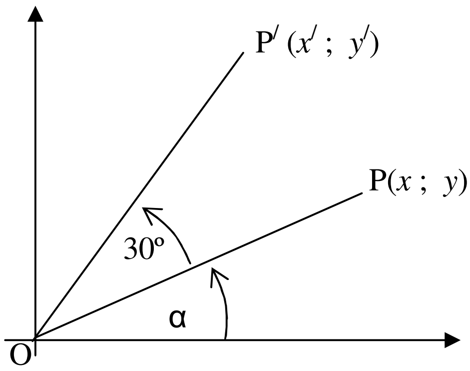
3.2.1 Use the grid on the attached DIAGRAM SHEET 1 to sketch and label PQRS, the image of ABCD under the transformation T. (4)

3.2.2 Write down the image of (x ; y) in terms of x and y. (4)

3.2.3 Write down the ratio of area ABCD : area PQRS. (1)

3.3 Show that the coordinates of $P^{/}$, the image of P(x ; y) rotated about the origin through an angle of 30º in the anticlockwise direction, is given by

$$\left(\frac{\sqrt{3}}{2}x-\frac{y}{2};\frac{\sqrt{3}}{2}y+\frac{x}{2}\right)$$



(8)

3.4 $K^{/}$ and $L^{/}$ are the images of K(4 ; 3) and L(3 ; 6) under a rotation of 30°, in the anticlockwise direction, about the origin.

Using the results in QUESTION 3.3, determine the coordinates of $K^{/}$and $L^{/}$

(4)
[25]

QUESTION 4

4.1 Simplify: $\dfrac{\sin(-\alpha).\cos(90^0-\alpha)}{\cos\alpha.\cos(180^0+\alpha)}$ (5)

4.2 Given that $\sin 27^0 = t$, express each of the following in terms of t:

4.2.1 $\cos 27^0$ 4.2.2 $\tan 153^0$ (2, 3)

4.2.3 $\cos 243^0$ 4.2.4 $\cos 54^0$ (2, 3)

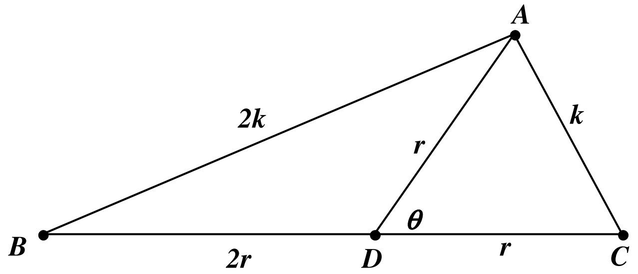
4.3 Determine the general solution of the equation: $\tan(3x+75^0)+1=0$ (5)

4.4 Simplify, without using a calculator: $\dfrac{\sin 15^0}{2}+\dfrac{\sqrt{3}\cos 195^0}{2}$ (5)

[25]

QUESTION 5

In ΔABC, $A\hat{D}C = \theta$, $DA = DC = r$, $BD = 2r$, $AC = k$ and $BA = 2k$



5.1 In ΔADC, express $\cos\theta$ in terms of r and k (2)

5.2 In ΔABD, express $\cos\theta$ in terms of r and k (3)

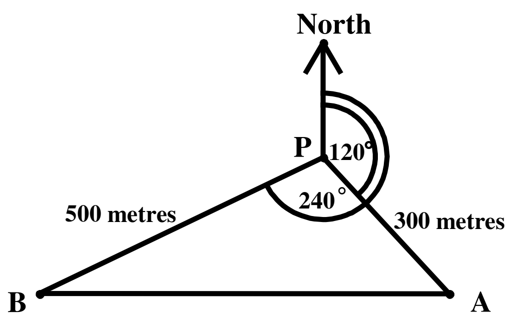
5.3 Hence show that $\cos\theta = \frac{1}{4}$ (3)

[8]

QUESTION 6

The diagram below represents the course of a swimming race in a bay on the coast.

- P is the starting and finishing point;
- A is a buoy, 300 metres from P on a bearing of 120^0
- B is a buoy, 500 metres from P on a bearing of 240^0.



Calculate:

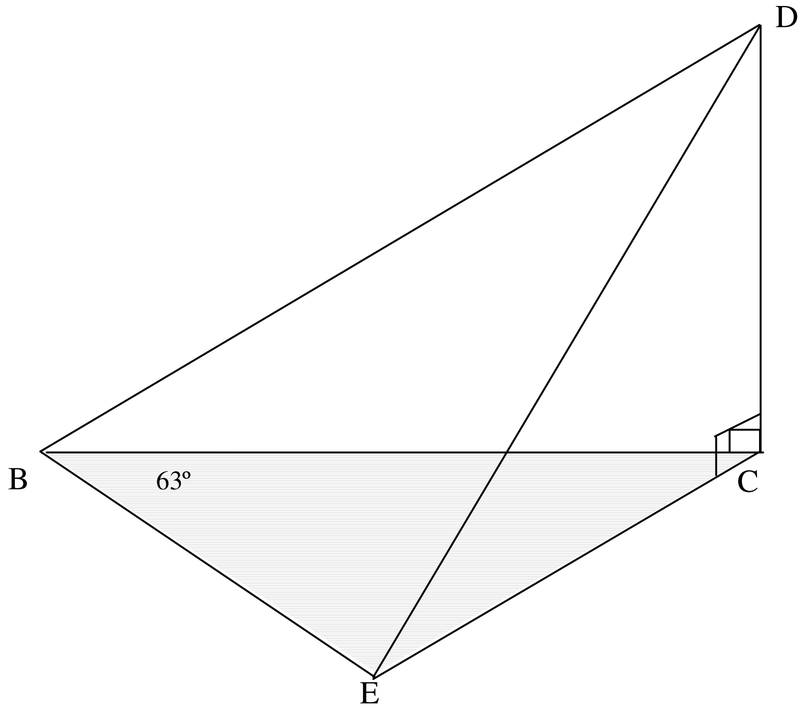
6.1 the bearing of the point P from the buoy, B and (1)

6.2 the distance competitors must swim (from P to A, then to B and then back to P). (6)

[7]

QUESTION 7

CD is a vertical mast. The points B, C and E are in the same horizontal plane. BD and ED are cables joining the top of the mast to pegs on the ground. DE = 28,1 m and BC = 20,7 m. The angle of elevation of D from B is 43,6º. $C\hat{B}E = 63°$; $B\hat{D}E = 35{,}7°$.



Give your answers correct to ONE decimal place in each of the following questions:

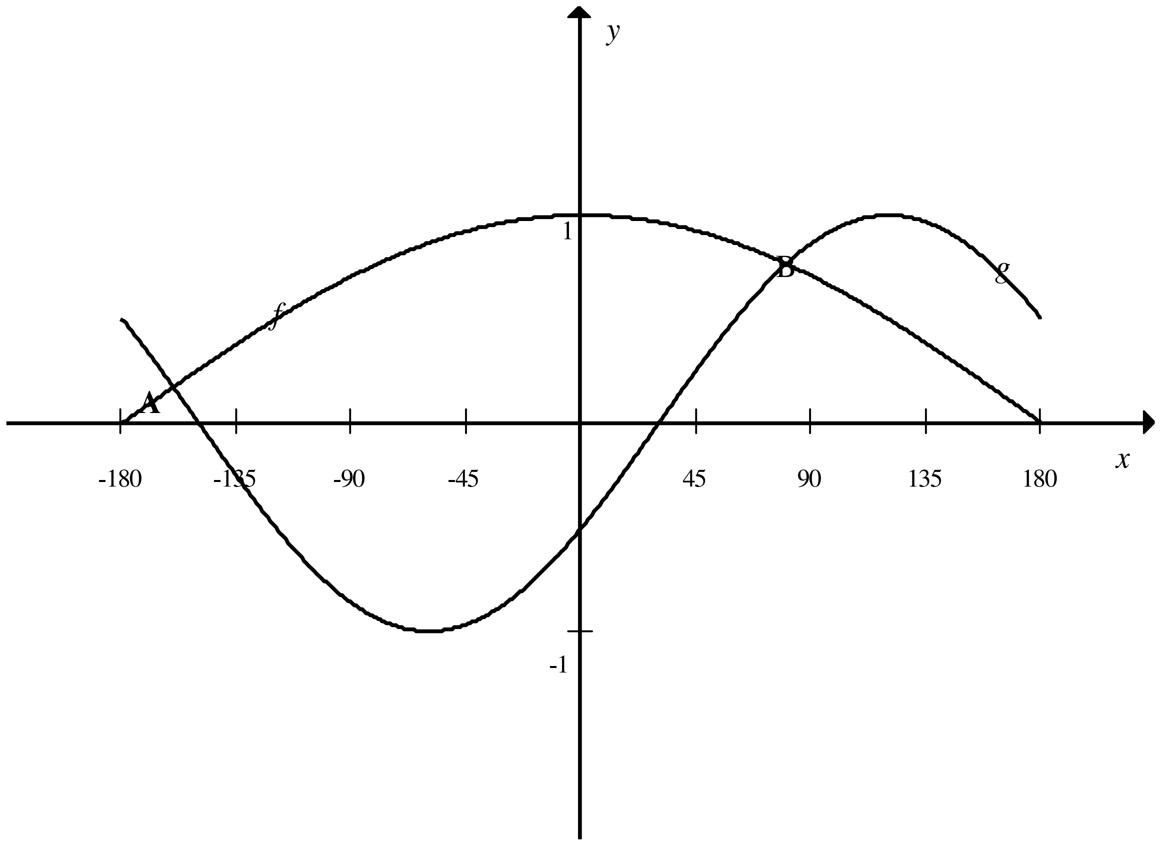
7.1 Calculate the length of BD. (3)

7.2 Show that the length of BE rounds to 17,4 m. (4)

7.3 Calculate the area of ΔBEC. (2)
[9]

QUESTION 8

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



8.1 Determine the coordinates of the points A and B. (7)

8.2 For which values of x is $f(x) > g(x)$? (2)

[9]

QUESTION 9

The masses, correct to the nearest 10 g of eight tomatoes are: 190, 160, 150, 230, 220, 180, 180 and 170.

Use the formula $\sum_{i=1}^{n}\frac{(x_i-\bar{x})^2}{n}$ for variance to calculate the standard deviation of the eight tomatoes. (4)

[4]

QUESTION 10

When data is normally distributed about the mean, 68% of the data is within one standard deviation of the mean. Decide whether the following statements are true or false and explain your answer:

10.1 There are more data items within one standard deviation of the mean than in the inter-quartile range of normally distributed data. (2)

10.2 When the mean is less than the median, the data is said to be negatively skewed. (2)

10.3 A cylindrical dam is emptying at a rate of x *litres* per hour and the height of the water is recorded at regular time intervals. A scatter plot of height against time will show a positive correlation. (2)

[6]

QUESTION 11

The following data was collected and recorded as shown in the table

Marks	Frequency	Cumulative frequency
0 to 29	2	2
30 to39	10	12
40 to 49	43	55
50 to 59	72	127
60 to 69	53	180
70 to 89	37	217
80 to 99	25	242
90 to 100	3	245

11.1 Draw an ogive to illustrate the data in the table. (8)

11.2 Read from your graph the median and lower and upper quartiles, showing where readings have been taken. (6)

11.3 Calculate the approximate mean from the data, showing how your answer was obtained. (6)

11.4 Compare the approximate mean, median and mode and hence comment on the nature of the distribution of the data. (3)

[23]

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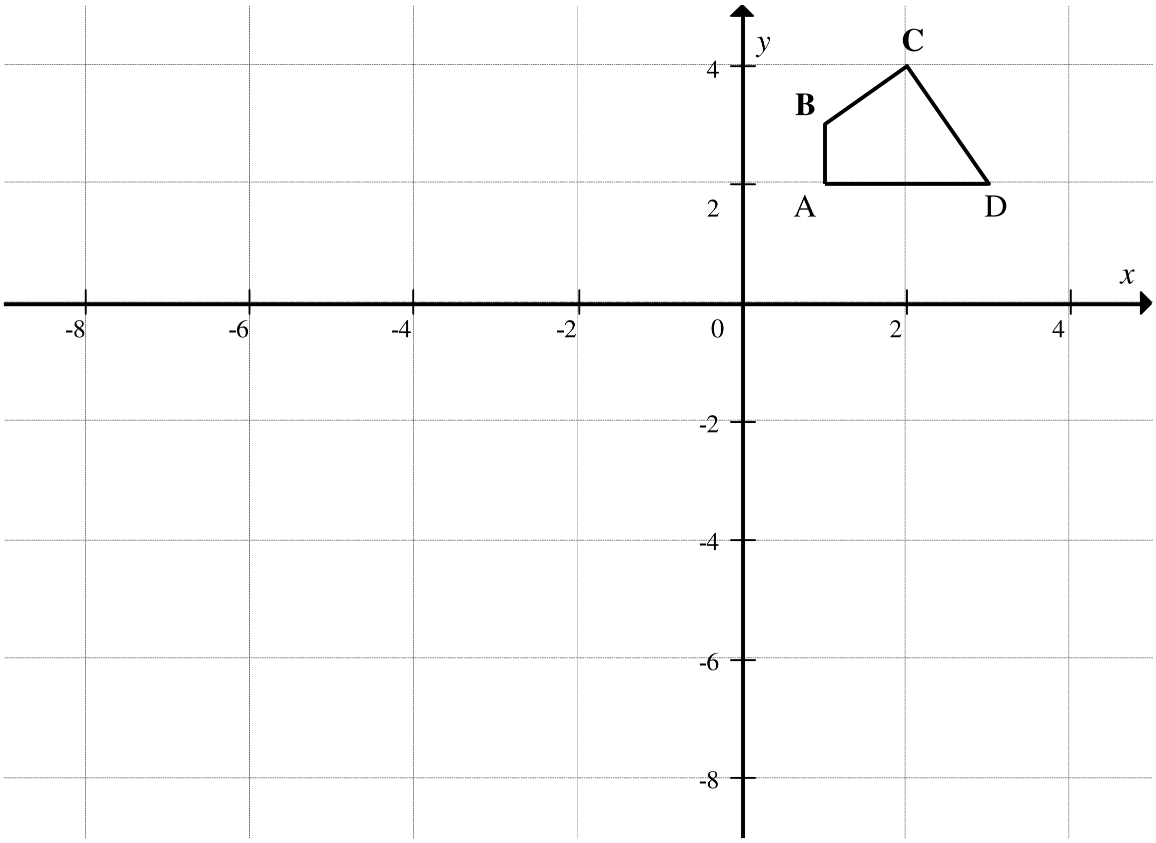
DIAGRAM SHEET 1

QUESTION 3

3.2.1



FORMULEBLAD: WISKUNDE
FORMULA SHEET: MATHEMATICS

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

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

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

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

$\sum_{i=1}^{n} ar^{i-1} = \frac{a(r^n - 1)}{r-1}$; $r \neq 1$ $\quad$ $\sum_{i=1}^{n} ar^{i-1} = \frac{a}{r-1}$; $-1 < r < 1$

$F = \frac{x[(1+i)^n - 1]}{i}$ $\quad$ $P = \frac{x[1-(1+i)^{-n}]}{i}$ $\quad$ $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$

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

$y - y_1 = m(x - x_1)$ $\quad$ $m = \frac{y_2 - y_1}{x_2 - x_1}$ $\quad$ $m = \tan\theta$ $\quad$ $(x-a)^2 + (y-b)^2 = r^2$

$In\ \Delta ABC$; $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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

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

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

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

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

$\cos 2\alpha = \cos^2\alpha - \sin^2\alpha$ $\quad$ $\cos 2\alpha = 1 - 2\sin^2\alpha$ $\quad$ $\cos 2\alpha = 2\cos^2\alpha - 1$

$\sin 2\alpha = 2\sin\alpha.\cos\alpha$

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

$SD = \sqrt{\frac{\sum_{i=1}^{n} (x - \bar{x})^2}{n}}$ $\quad$ $P(A) = \frac{n(A)}{n(s)}$ $\quad$ $P(A\ of\ B) = P(A) + P(B) - P(A\ en\ B)$