education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS P2

NOVEMBER 2007

MARKS: 150

TIME: 3 hours

This question paper consists of 13 pages, 5 diagram sheets and a 1-page formula 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. Some of the questions have to be answered on the attached diagram sheets. Write your name/examination number in the space provided and hand in ALL FIVE diagram sheets with your ANSWER BOOK.

3. Show clearly ALL calculations, diagrams, graphs, etc. which you have used in determining the answers.

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.

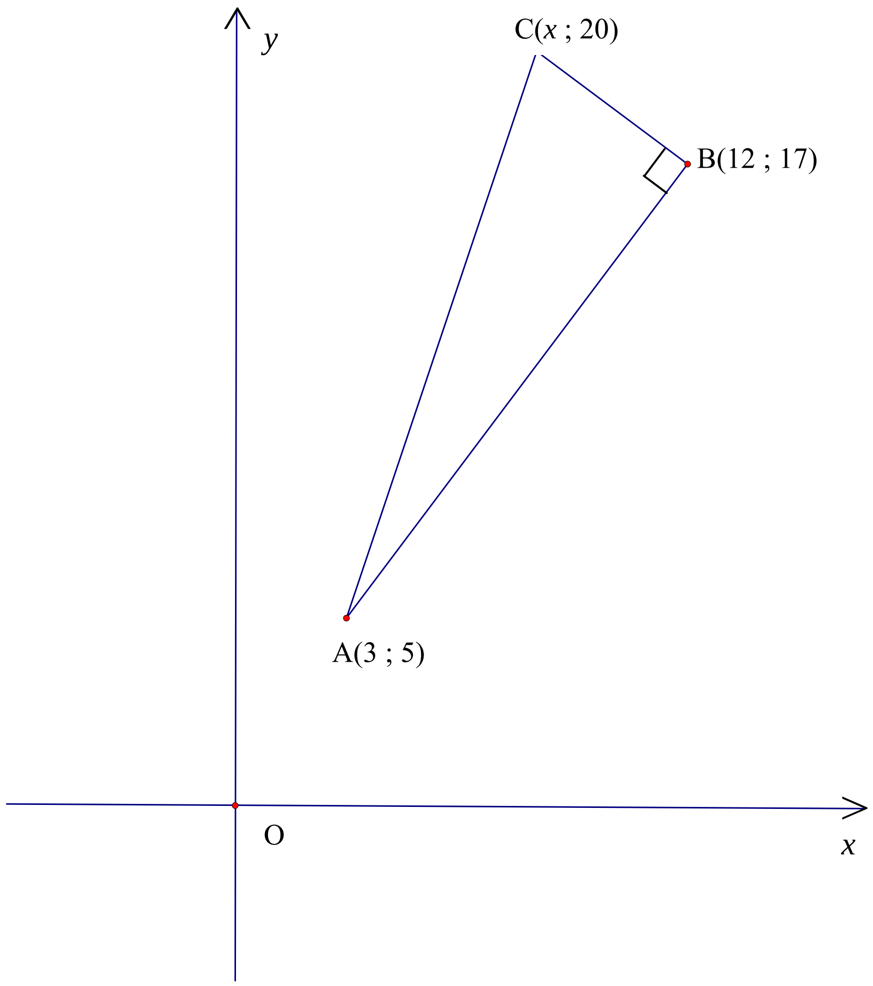
7. Diagrams are NOT necessarily drawn to scale.

8. It is in your own interest to write legibly and to present the work neatly.

9. An information sheet with formulae is attached.

QUESTION 1

In the diagram below, ΔABC is a right-angled triangle with $CB \perp AB$. ΔABC has vertices A(3 ; 5), B(12 ; 17) and C(x ; 20) in the Cartesian plane.



1.1 Determine the gradient of AB. (2)

1.2 Hence, write down the gradient of BC. (1)

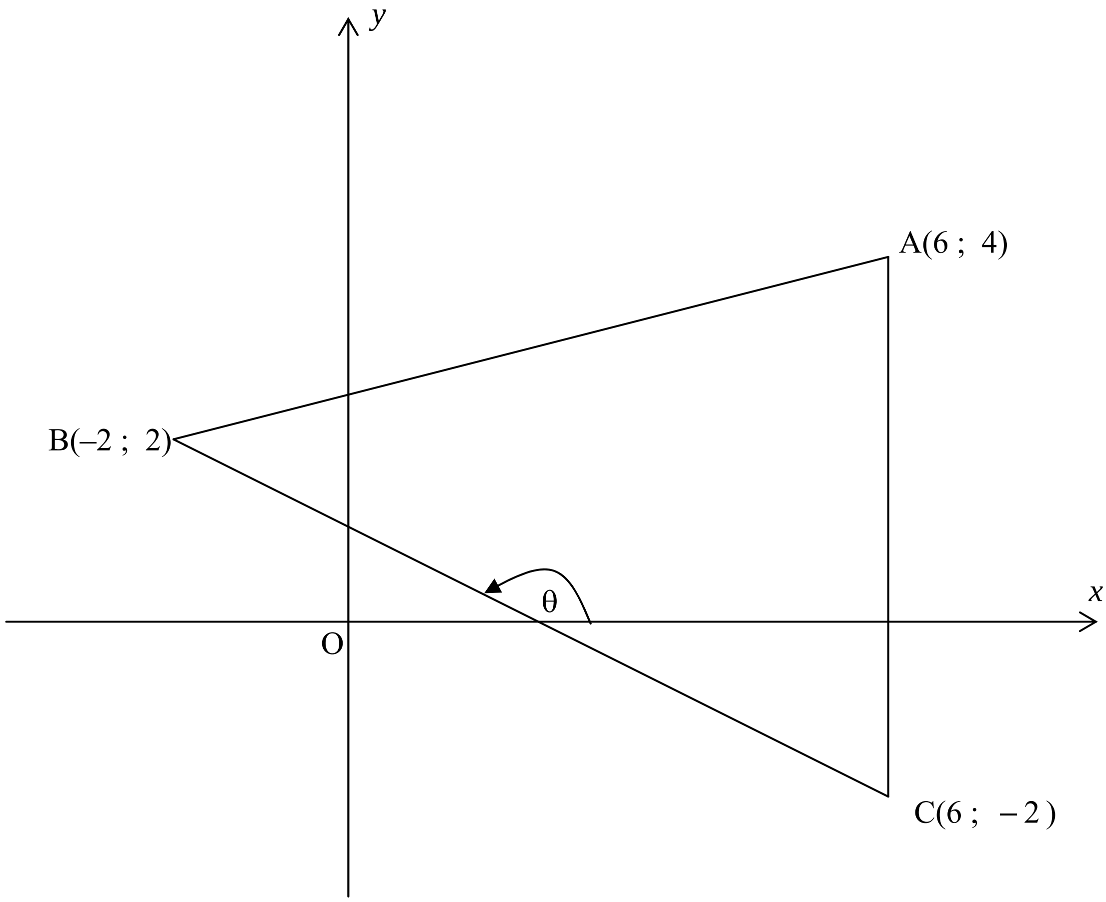
1.3 Now, determine the value of x. (3)

1.4 If BC = 5 units, calculate the perimeter of ΔABC. (Leave the answer in simplest surd form.) (6)

[12]

QUESTION 2

In the diagram below, Δ ABC has vertices A(6 ; 4), B(–2 ; 2) and C(6 ; –2) in the Cartesian plane.
The angle of inclination of BC is θ.



2.1 Determine the coordinates of midpoint D of AC. (3)

2.2 Determine the equation of straight line BD. (5)

2.3 Determine the equation of the straight line which is parallel to $y + 2x = 8$ and which passes through point A. (3)

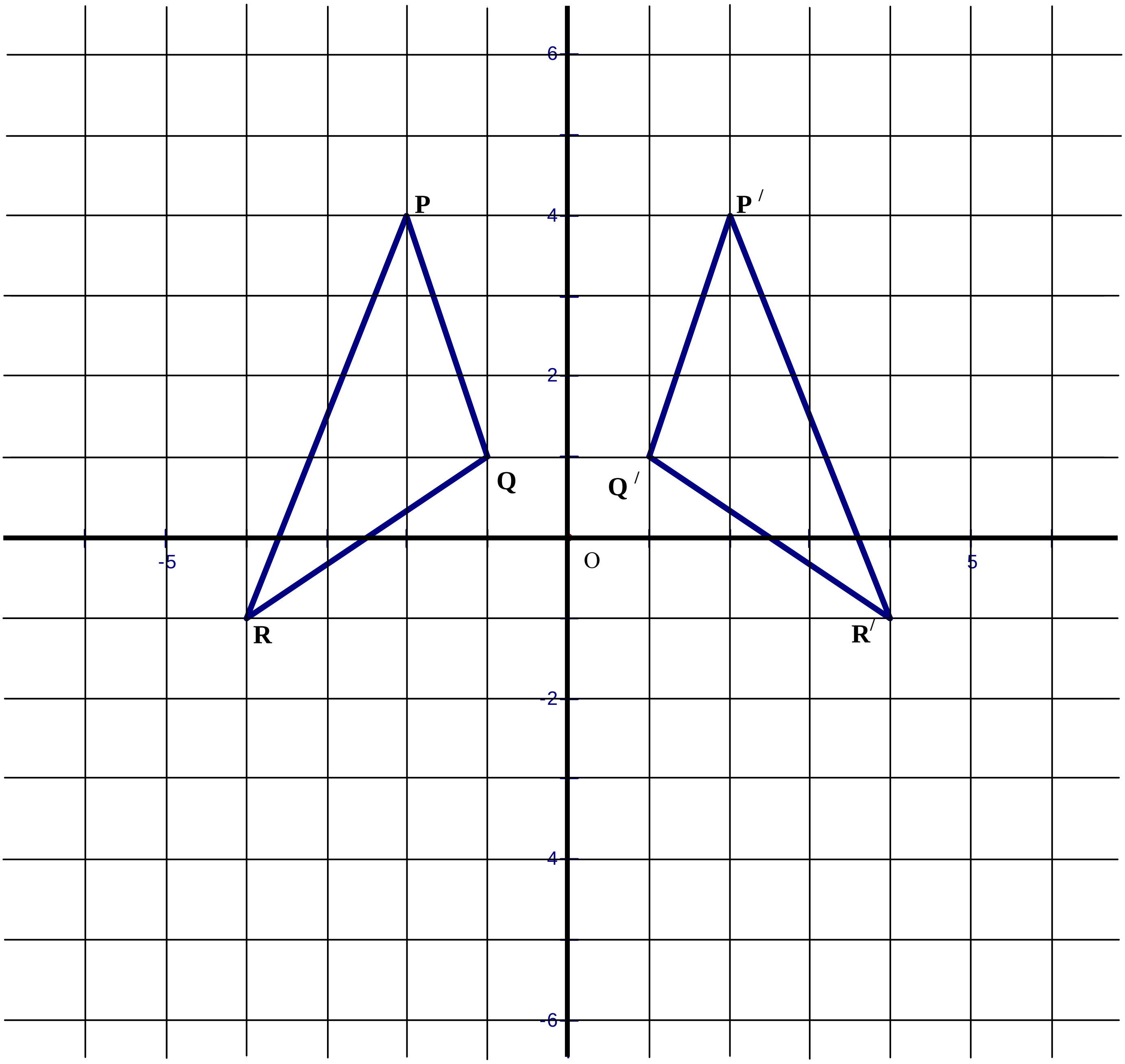
2.4 Determine the size of θ. (5)

2.5 Hence calculate the size of $\hat{C}$. (3)

[19]

QUESTION 3

3.1 The diagram below shows ΔPQR with its transformation $\Delta P^{/}Q^{/}R^{/}$.



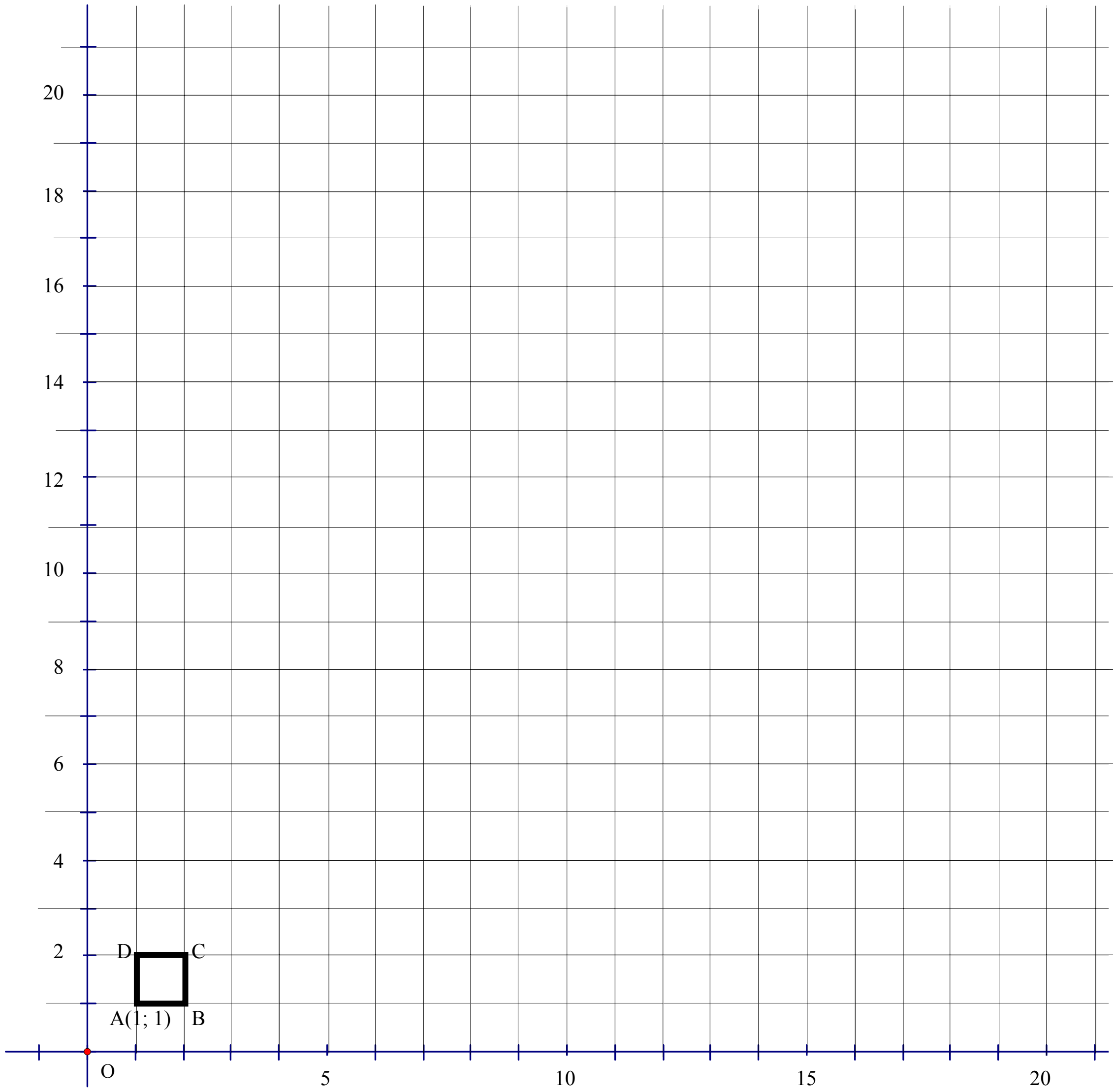
3.1.1 Describe the above transformation. (2)

3.1.2 $\Delta P^{//}Q^{//}R^{//}$ is the rotation of ΔPQR through 90º in an anti-clockwise direction, with respect to the origin. Sketch $\Delta P^{//}Q^{//}R^{//}$ using the diagram sheet. (3)

3.1.3 State the coordinates of vertex $R^{//}$. (1)

3.1.4 Write down the general coordinates of the transformation as described in QUESTION 3.1.2. (2)

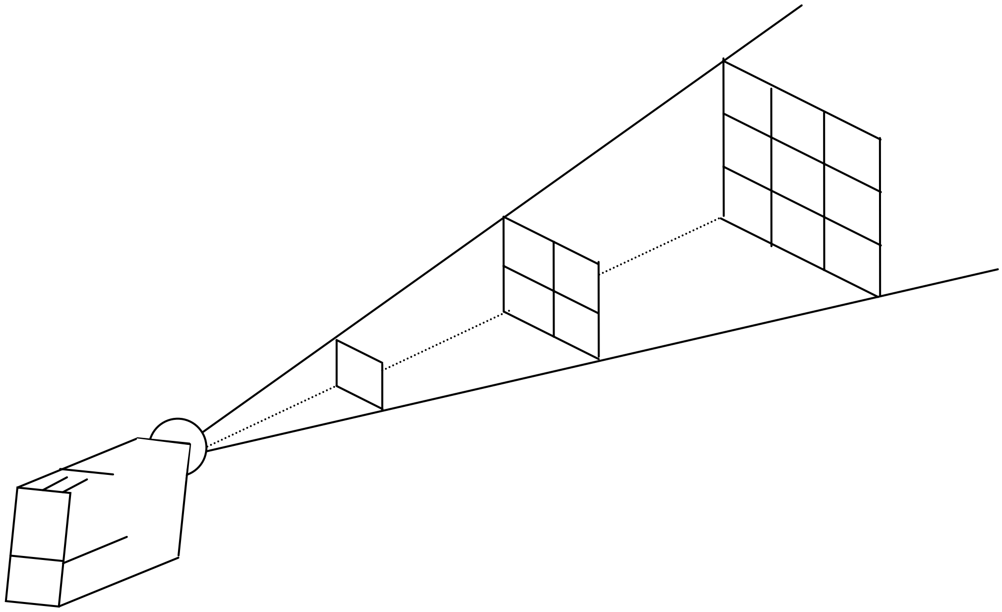
3.2 The diagram below shows square ABCD with A(1; 1) on the Cartesian plane.



3.2.1 Sketch, using a scale factor of 3, the first and the second enlargements of ABCD through the origin using the grid on the diagram sheet. (4)

3.2.2 Write down the coordinates of $C^{/}$ and $B^{//}$ on the sketches. (2)

3.3 If a square colour slide is projected onto a vertical screen, then the area of the projected image depends upon the distance of the projector from the screen as illustrated in the diagram below.



If the screen is 1 m from the projector, then the image measurements are 20 cm × 20 cm.
If the screen is 2 m from the projector, then the image measurements are 40 cm × 40 cm.
If the screen is 3 m from the projector, then the image measurements are 80 cm × 80 cm.

Determine the factor *k* with which successive images are increased in size if the projector is placed further away from the screen. (2)

[16]

QUESTION 4

Simplify the following expressions and show ALL the calculations:

4.1 $\dfrac{3\cos 150^\circ \,.\, \sin 270^\circ}{\tan(-45^\circ) + \cos 600^\circ}$ (5)

4.2 $\dfrac{\tan(180^\circ - x)\,.\,\sin(90^\circ + x)}{\sin(-x)} - \sin y \,.\, \cos(90^\circ - y)$ (7)

[12]

QUESTION 5

5.1 Given: $k.\cos\alpha + 2 = 0$ and $k.\sin\alpha = 3$, where $k > 0$.

5.1.1 Explain why $\alpha \in (90^\circ\ ;\ 180^\circ)$. (3)

5.1.2 Show that $\tan\alpha = -\dfrac{3}{2}$ (2)

5.1.3 Determine the numerical value of *k*.
(Leave your answer in surd form.) (4)

5.2 Solve for *x*:

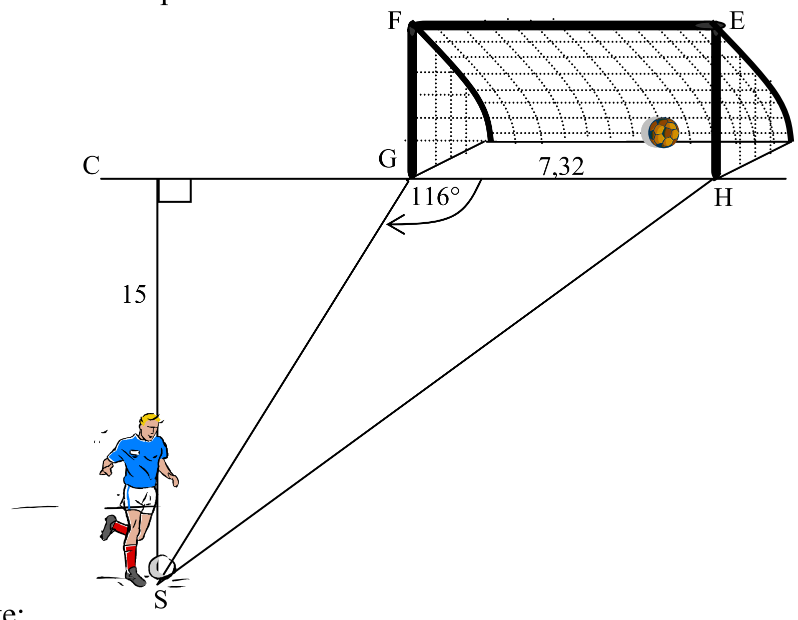
$5^{\tan x} = 125$ if $x \in [0\ ;\ 360^\circ]$ (5)

5.3 Determine the general solution for $\sin x\,.\,(2\cos x - 1) = 0$ (7)

[21]

QUESTION 6

6.1 A soccer player aims towards a goal post which is 15 metres from the back line CH on a soccer field. The angle from the left goal post, FG, to the soccer player, S, is 116°. The goal posts are 7,32 m wide.
The diagram below represents the above situation.



Calculate:

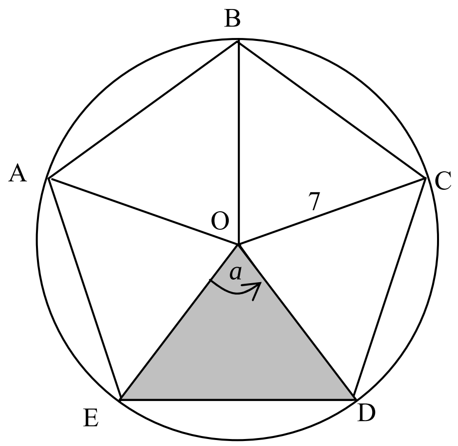
6.1.1 How far the soccer player is from the left goal post FG (3)

6.1.2 How far the soccer player is from the right goal post EH (3)

6.1.3 The approximate size of $G\hat{S}H$, the angle within which the soccer player could possibly score a goal (4)

6.2 In the diagram alongside, the vertices of a regular pentagon ABCDE lie on a circle with centre O and radius 7 cm.

Let $D\hat{O}E = a$.



6.2.1 Determine the size of $D\hat{O}E$. (2)

6.2.2 Calculate the length of the side of the pentagon. (4)

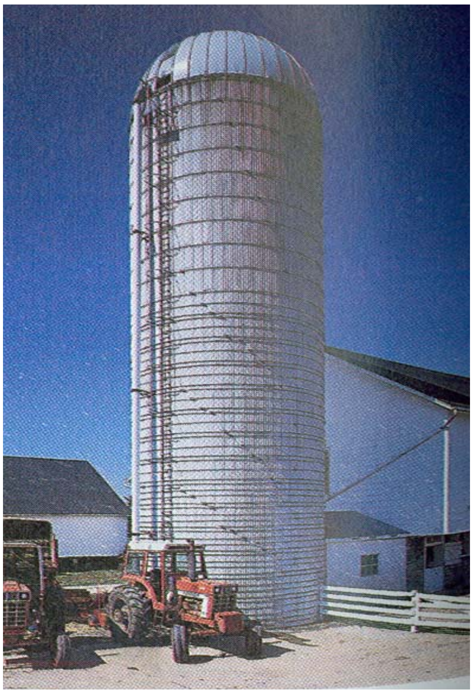
6.2.3 Determine the area of ΔOED. (3)

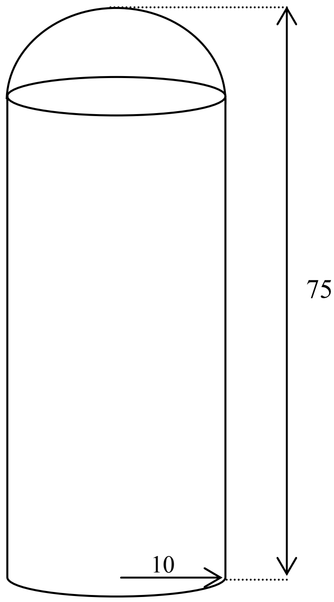
[19]

QUESTION 7

Surface Area = $2\pi rh$	Surface Area = $4\pi r^2$
Volume $= \frac{1}{3} lbh$	Volume = lbh

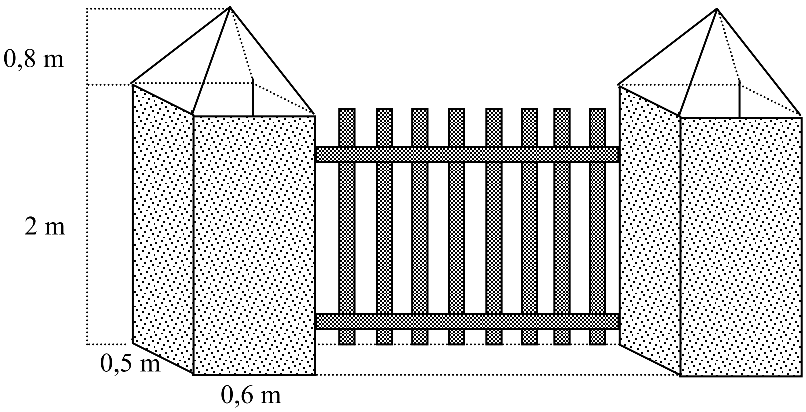
7.1 The picture below shows a storage tank in which a farmer stores his grain. The tank is made up of a right cylinder with a hemisphere on top. The perpendicular height of the tank to the top is 75 m and the radius of the tank is 10 m.





Calculate the total exterior surface area of the tank. (6)

7.2 Two identical cement pillars are placed at the entrance of a building. They are made up of a rectangular prism and a right pyramid placed on it. The rectangular prism is 2 metres high, 0,6 metres long and 0,5 metres wide. The perpendicular height of the pyramid is 0,8 metres.



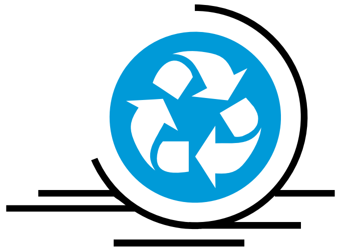
Determine the volume of cement needed to make up the two pillars. (6)

[12]

QUESTION 8

The tuck shop at a school sells soft drinks in cans. The Geography club collected cans for recycling for a period of 20 school days. The number of cans collected was recorded and the data is given below:

76	60	79	82	81	50	48	92	98
73	52	80	82	76	78	91	76	59
68	84							



8.1 Determine the median number of cans collected. (2)

8.2 Determine the lower and upper quartiles. (2)

8.3 Represent the above-mentioned data using a box and whisker diagram. (3)

8.4 Use the box and whisker diagram to describe the distribution of the data. (1)
[8]

QUESTION 9

A survey was done on 240 people to determine the distances that they travel to work daily. The following table shows the results of the survey:

DISTANCE, *d* (in km)	**FREQUENCY**	**CUMULATIVE FREQUENCY**
$0 < d \leq 5$	5	
$5 < d \leq 10$	41	
$10 < d \leq 15$	77	
$15 < d \leq 20$	58	
$20 < d \leq 25$	39	
$25 < d \leq 30$	17	
$30 < d \leq 35$	3	

9.1 Complete the cumulative frequency column using the table on the diagram sheet. (3)

9.2 Represent the information in the table by drawing an ogive (cumulative frequency curve) on the grid provided on the diagram sheet. (4)

9.3 Use your graph to determine the median distance. Now indicate on your graph using the letter M where you would read off your answer. (3)

[10]

QUESTION 10

The manager of a women's clothing store was curious about the amount of money women of various ages spent monthly on clothing items. He obtained the following information from a representative sample of women who regularly buy from his store:

Women's ages (in years)	18	21	23	25	30	32	36	38	39	45
Amount spent (in rand)	330	300	300	240	250	190	180	310	150	120

10.1 Identify and estimate any outliers in this data. (1)

10.2 Draw a scatter-plot to represent the above data on the diagram sheet. (4)

10.3 Draw the line of best fit for the given data on your graph. (2)

10.4 Describe the general trend between the age of the women and the amount of money spent. (1)

10.5 Use the scatter plot to predict the amount that a 40-year-old woman will spend. (2)

[10]

QUESTION 11

The data below gives the waist size (in cm) of each player of a school soccer squad consisting of 11 players.

72	75	76	64	62	69
77	78	93	100	81	

11.1 Calculate the mean waist size of the players. (2)

11.2 Complete the following table on the diagram sheet: (4)

DATA	$(x_i - \bar{x})$	$(x_i - \bar{x})^2$
72		
77		
75		
78		
76		
93		
64		
100		
62		
81		
69		
$\sum_{i=1}^{n}(x_i - \bar{x})^2 =$		

11.3 Calculate the variance of the waist sizes. (2)

11.4 Calculate the standard deviation of the waist sizes. (1)

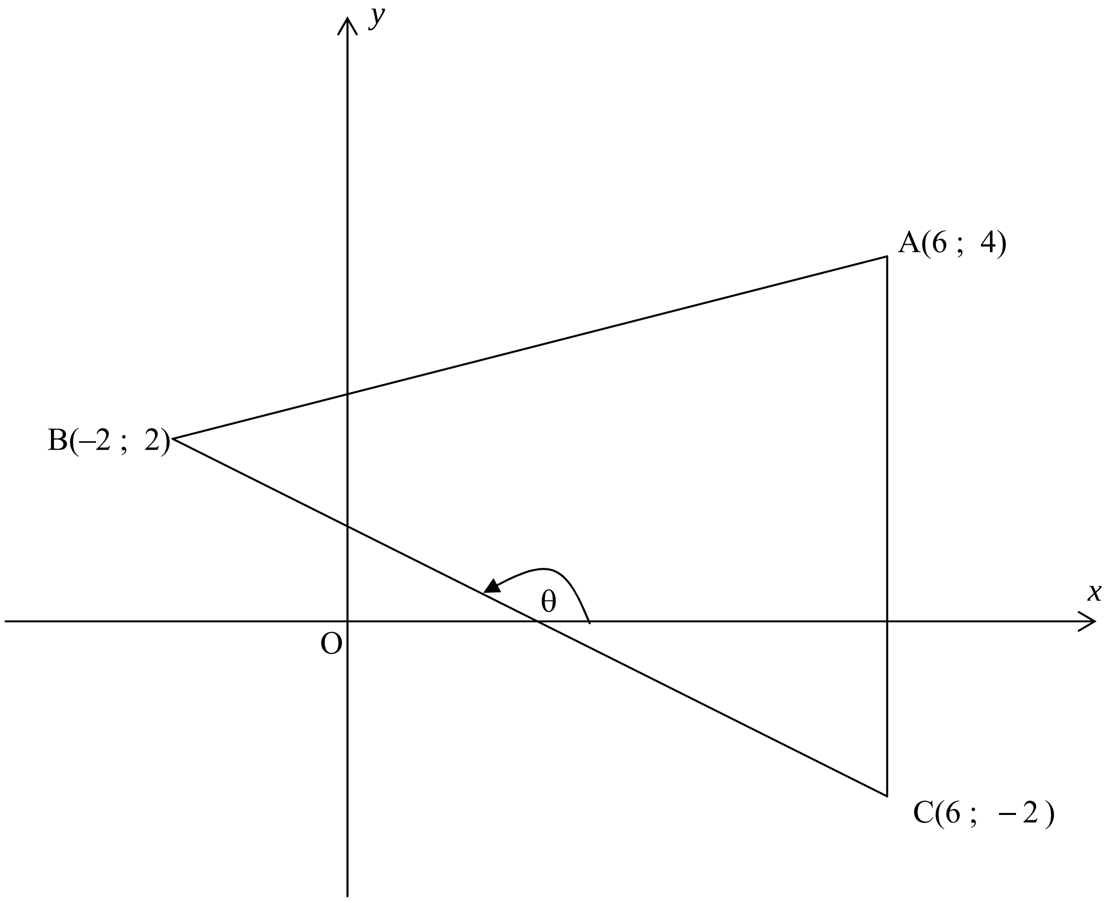
11.5 Make a relevant statement about the waist size of the soccer players in the squad based on the standard deviation. (2)
[11]

TOTAL: 150

NAME/EXAMINATION NUMBER:

DIAGRAM SHEET 1

QUESTION 1

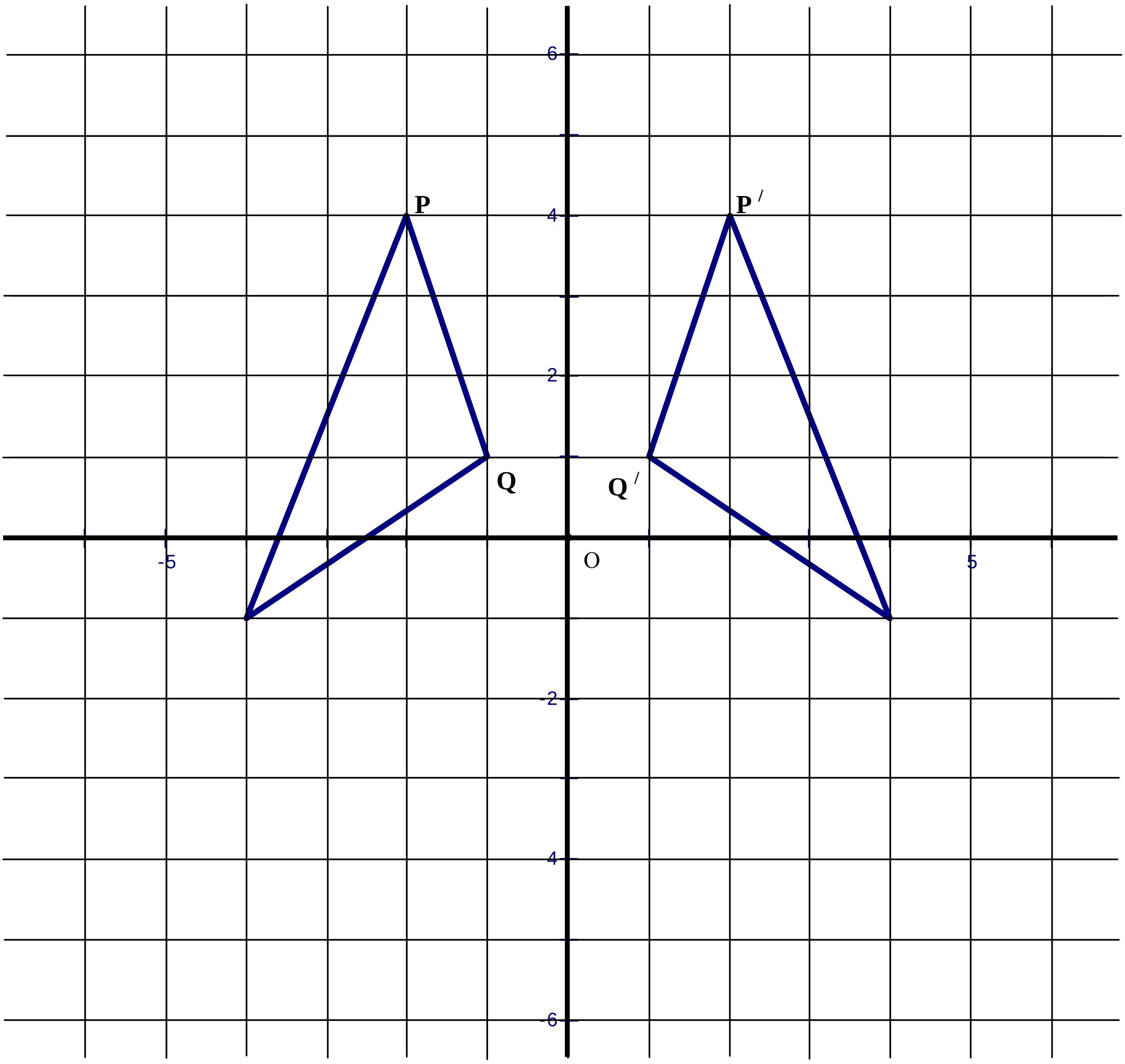


NAME/EXAMINATION NUMBER:

DIAGRAM SHEET 2

QUESTION 3

3.1

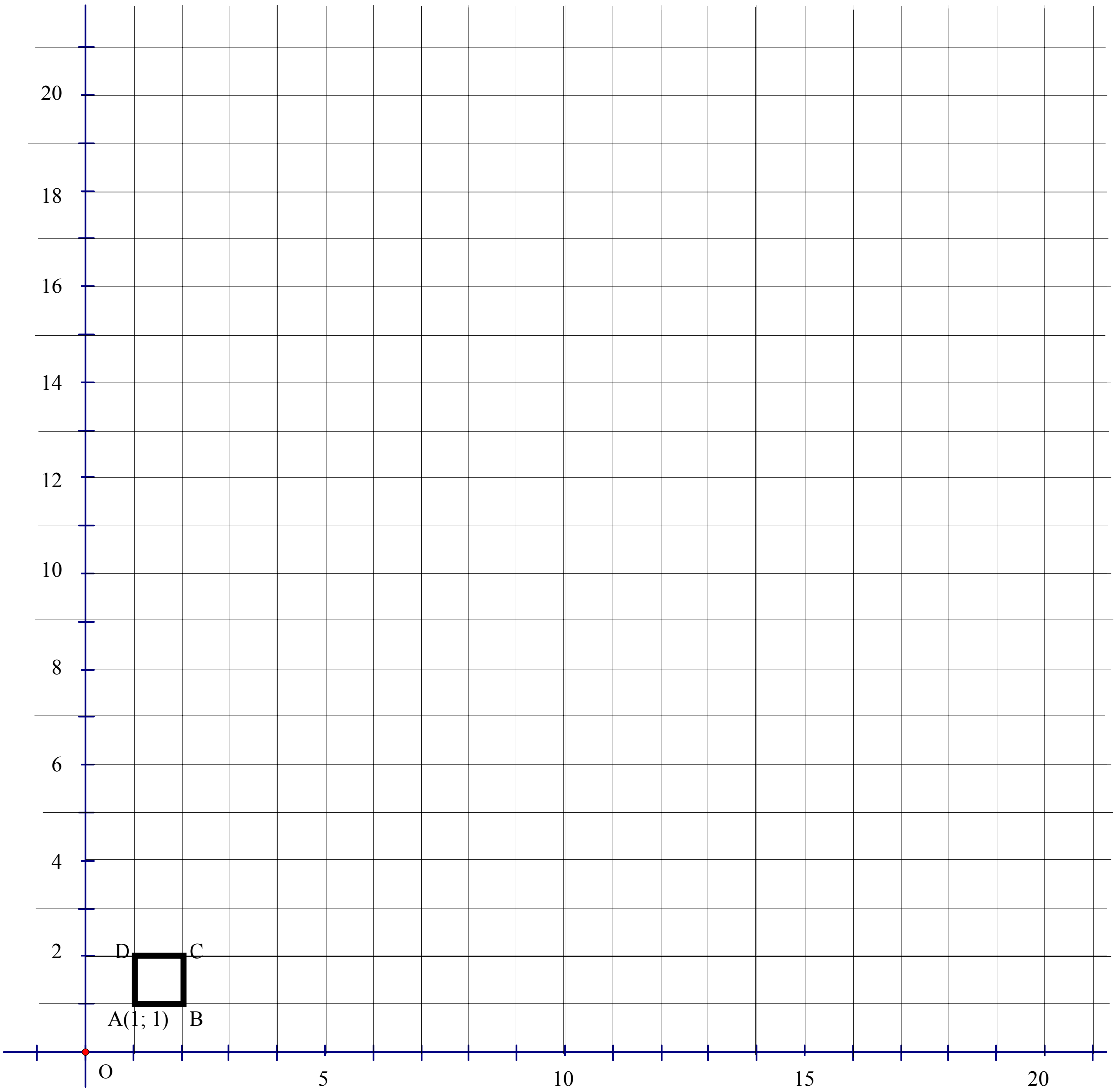


NAME/EXAMINATION NUMBER:

DIAGRAM SHEET 3

QUESTION 3 (continued)

3.2



NAME/EXAMINATION NUMBER:

DIAGRAM SHEET 4

QUESTION 9

9.1

DISTANCE *d* (km)	FREQUENCY	CUMULATIVE FREQUENCY
$0 < d \leq 5$	5	
$5 < d \leq 10$	41	
$10 < d \leq 15$	77	
$15 < d \leq 20$	58	
$20 < d \leq 25$	39	
$25 < d \leq 30$	17	
$30 < d \leq 35$	3	

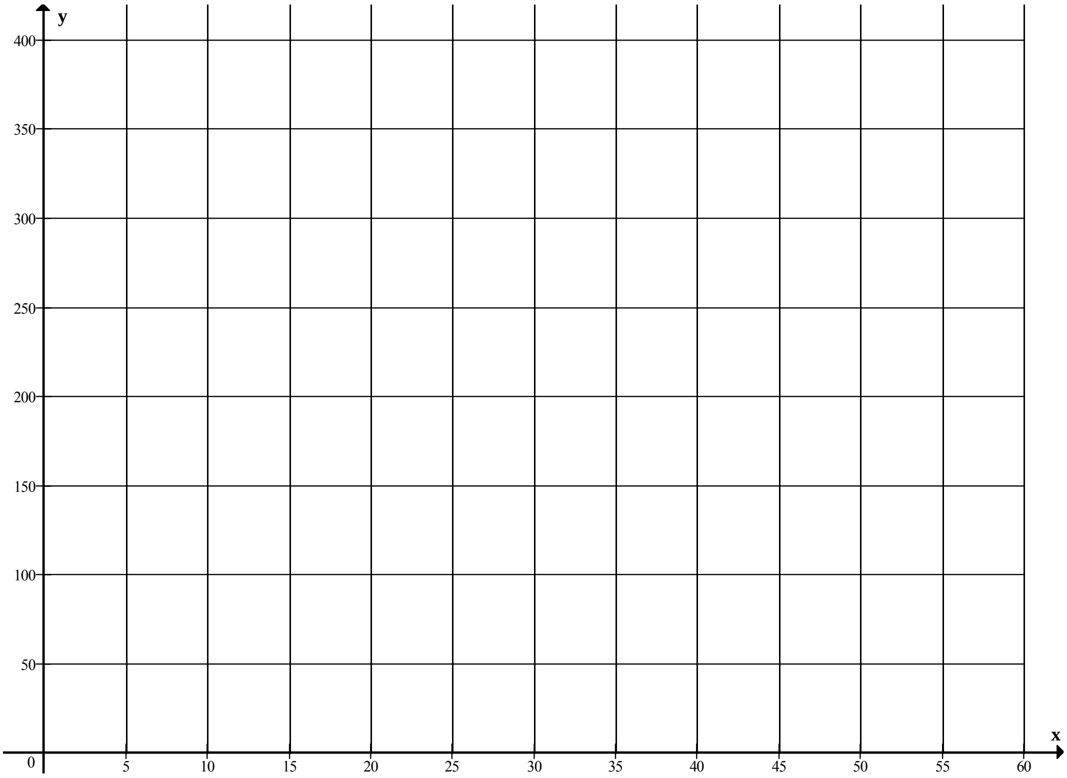
9.2

NAME/EXAMINATION NUMBER:

DIAGRAM SHEET 5

QUESTION 10

10.2



QUESTION 11

11.2

DATA	$(x_i - \bar{x})$	$(x_i - \bar{x})^2$
72		
77		
75		
78		
76		
93		
64		
100		
62		
81		
69		
$\sum_{i=1}^{n}(x_i - \bar{x})^2 =$		

INFORMATION SHEET: MATHEMATICS
INLIGTINGSBLAD: WISKUNDE

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

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

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

$\sum_{i=1}^{n} 1 = n$ $\qquad$ $\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$

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

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

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

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

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

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

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

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

In ΔABC:

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $\qquad$ $a^2 = b^2 + c^2 - 2bc.\cos A$ $\qquad$ $area\ \Delta ABC = \frac{1}{2} ab.\sin C$

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

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

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

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

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