basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

# NATIONAL SENIOR CERTIFICATE

## GRADE 12

## MATHEMATICS P3

## NOVEMBER 2013

**MARKS: 100**

**TIME: 2 hours**

**This question paper consists of 9 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 12 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining the 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. THREE diagram sheets for QUESTION 1.1, QUESTION 1.3, QUESTION 9, QUESTION 10, QUESTION 11 and QUESTION 12 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 shows the number of calories and the total fat content (in grams) for some sandwiches sold in restaurants.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Number of calories | 620 | 360 | 580 | 450 | 440 | 310 | 270 | 340 |
| Total fat content (in grams) | 43 | 21 | 32 | 24 | 28 | 12 | 14 | 25 |

1.1 Draw a scatter plot of the above 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 the scatter plot on DIAGRAM SHEET 1. (2)

1.4 A sandwich that has 300 calories and a total fat content of 34 grams was bought from Pinky's restaurant. Explain how this sandwich compares against the fitted model. (2)

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

1.6 Explain the correlation between the number of calories and the total fat content (in grams) of the sandwiches. (2)

**[15]**

## QUESTION 2

A school decides to investigate the use of cellphones at the school. The school has 800 boys and girls from Grade 8 to Grade 12. A sample of 80 learners is required for this investigation. Jade decides to compile an alphabetical list of names of the entire school population and then randomly selects 80 learners from this list.

2.1 Name the sampling method that Jade used in obtaining her sample. (1)

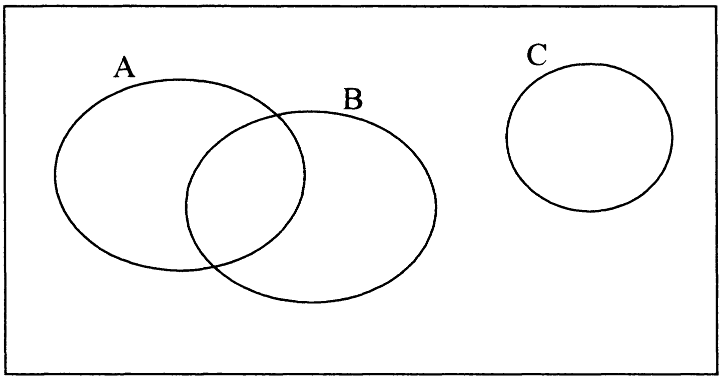
2.2 State ONE possible drawback of the method Jade has used. (1)

2.3 Explain how you would select a sample for this investigation in order to ensure that the sample chosen is representative of the school population. (2)

**[4]**

## QUESTION 3

Consider events A, B and C represented in the Venn diagram below. Events A and B are independent.




It is given that P(A) = 0,45, P(B) = 0,3 and P(C) = 0,32.

3.1 Mary claims that events A and B are mutually exclusive. Explain why you agree or disagree with Mary. (2)

3.2 Calculate the probability that of the three events:

3.2.1 At least one of B or C occurs (2)

3.2.2 At least one of A or B occurs (2)

**[6]**

## QUESTION 4

The nine letters of the word 'EQUATIONS' are used to form different five-letter codes.

4.1 How many different five-letter codes can be formed from the nine different letters in the word 'EQUATIONS'? (2)

4.2 How many different five-letter codes can be formed from the letters in the word 'EQUATIONS' by using all the consonants and one vowel? (3)

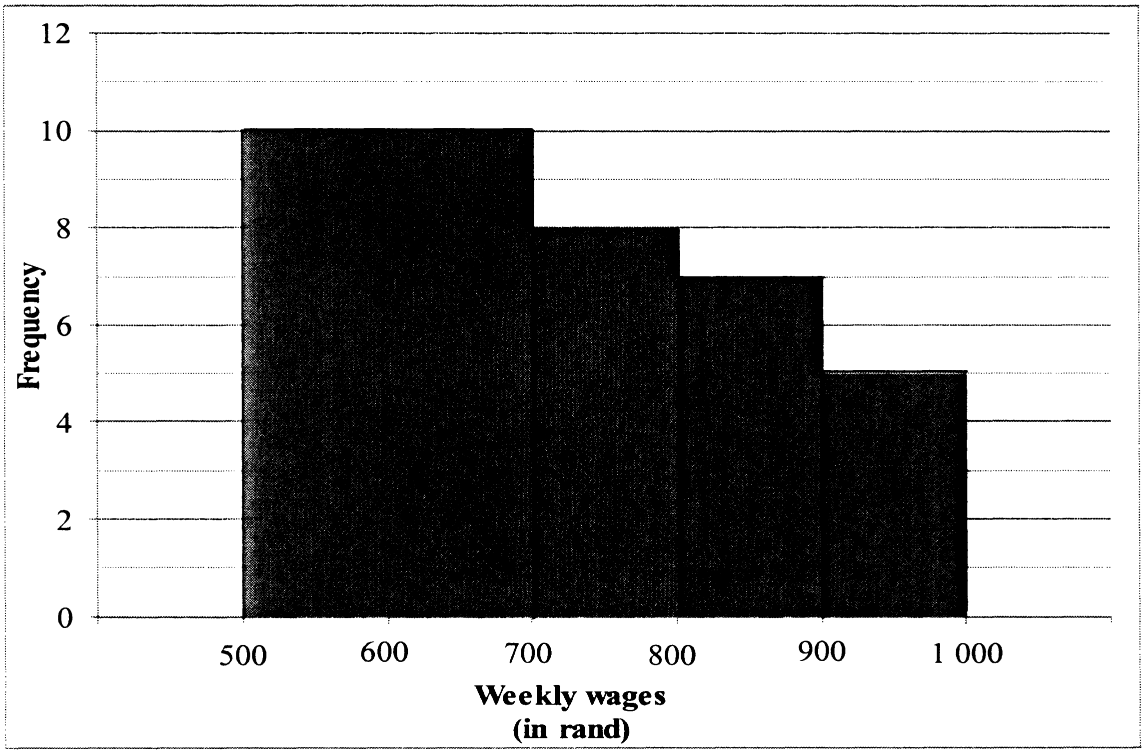
**[5]**

## QUESTION 5

The weekly wages, in rand, paid to 30 workers in a company are shown in the frequency table below.

| WEEKLY WAGES (IN RAND) | FREQUENCY |
|---|---|
| $500 \leq x < 700$ | 10 |
| $700 \leq x < 800$ | 8 |
| $800 \leq x < 900$ | 7 |
| $900 \leq x < 1\ 000$ | 5 |

A manager drew the histogram below to represent the information given in the frequency table above.




5.1 Explain why the histogram is incorrect. (2)

5.2 Explain how you would correct the histogram so that the data is represented fairly. (2)
**[4]**

## QUESTION 6

A survey of 2 140 teachers revealed that certain learners experience problems that negatively affect their learning. The following data on the various problems was obtained:

- 890 teachers said that learning was negatively affected by children being **abused** (A).
- 680 teachers said that learning was negatively affected by **malnutrition** (N).
- 120 teachers said that learning was negatively affected by a **lack of parental support** (P) and children being **abused** (A).
- 40 teachers said that learning was negatively affected by a **lack of parental support** (P), **malnutrition** (N) and children being **abused** (A).
- 110 teachers said that learning was negatively affected by a **lack of parental support** (P) and **malnutrition** (N).
- 140 teachers said that learning was negatively affected by children being **abused** (A) and **malnutrition** (N).
- An unknown number of teachers ($x$) said that learning was negatively affected only by a **lack of parental support** (P).
- Every teacher said that learning was negatively affected by at least one problem.

6.1 Draw a Venn diagram to represent the above situation. (6)

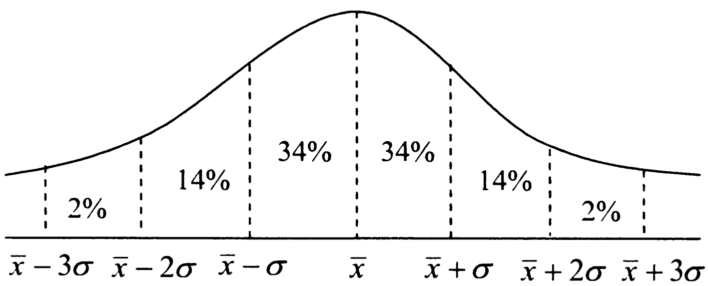
6.2 Calculate the number of teachers who said that a lack of parental support was a problem. (3)

6.3 Calculate the probability that a teacher selected at random from this group said that learners had exactly two problems. (3)

**[12]**

## QUESTION 7

7.1 Learners in a primary school are tested to measure how good their fine motor skills are. The results of a standard test for fine motor skills follow a normal distribution with a mean number of points of 10 and a standard deviation of 3.




7.1.1 If a learner is selected at random to take the test, calculate the percentage of learners that will score more than 16 points on the test. (2)

7.1.2 If 200 learners took the same test, how many learners would score less than 13 points on the test? (2)

7.2 The results of a Mathematics test are such that the mean mark is 55% and the standard deviation is 15%. The same group of learners scored a mean of 55% with a standard deviation of 7,5% on an English test. The results of both the Mathematics test and the English test are normally distributed. If Matilda scores 67% in both tests, in which test did she do better relative to her classmates? Give relevant calculations to support your answer. (3)

**[7]**

## QUESTION 8

Consider the recursive sequence: $T_n = T_{n-1} + 3n - 4$; $T_1 = -5$ ; $n \geq 2$ ; $n \in N$

8.1 Write down the first FOUR terms of the sequence. (3)

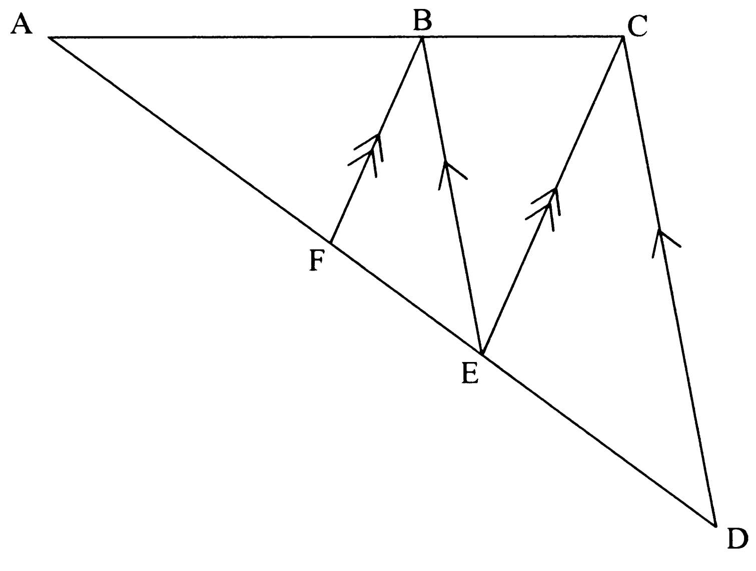
8.2 Calculate the 30$^{th}$ term of the sequence. (4)

**[7]**

**GIVE REASONS FOR YOUR STATEMENTS AND CALCULATIONS IN QUESTIONS 9 TO 12.**

## QUESTION 9

In ΔADC, E is a point on AD and B is a point on AC such that EB || DC.
F is a point on AD such that FB || EC. It is also given that AB = 2BC.




9.1 Determine the value of AF : FE (2)

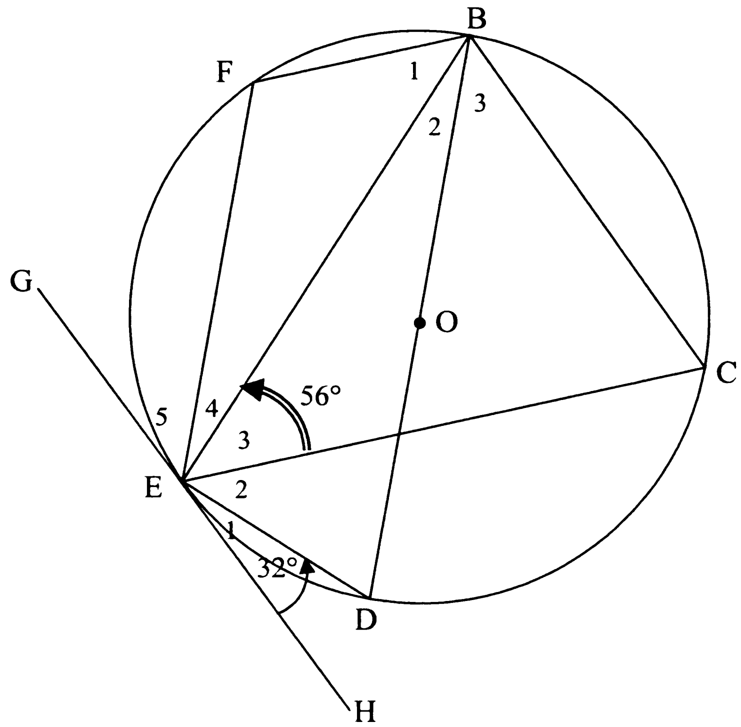
9.2 Calculate the length of ED if AF = 8 cm. (4)

**[6]**

## QUESTION 10

In the diagram below, O is the centre of the circle. BD is a diameter of the circle. GEH is a tangent to the circle at E. F and C are two points on the circle and FB, FE, BC, CE and BE are drawn.

$\hat{E}_1 = 32°$ and $\hat{E}_3 = 56°$.




Calculate, with reasons, the values of:

10.1 $\hat{E}_2$ (2)

10.2 $E\hat{B}C$ (3)

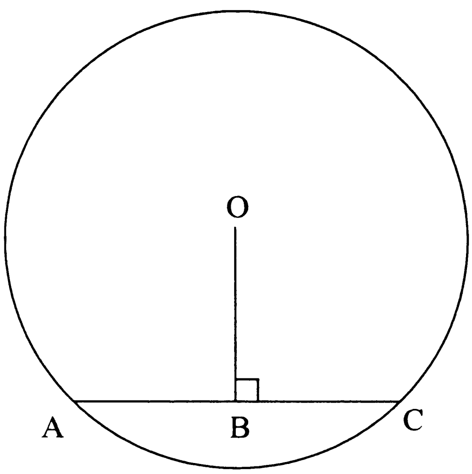
10.3 $\hat{F}$ (4)

**[9]**

## QUESTION 11

In the diagram below, O is the centre of the circle and OB is perpendicular to the chord AC.

Prove, using Euclidean geometry methods, the theorem that states AB = BC.

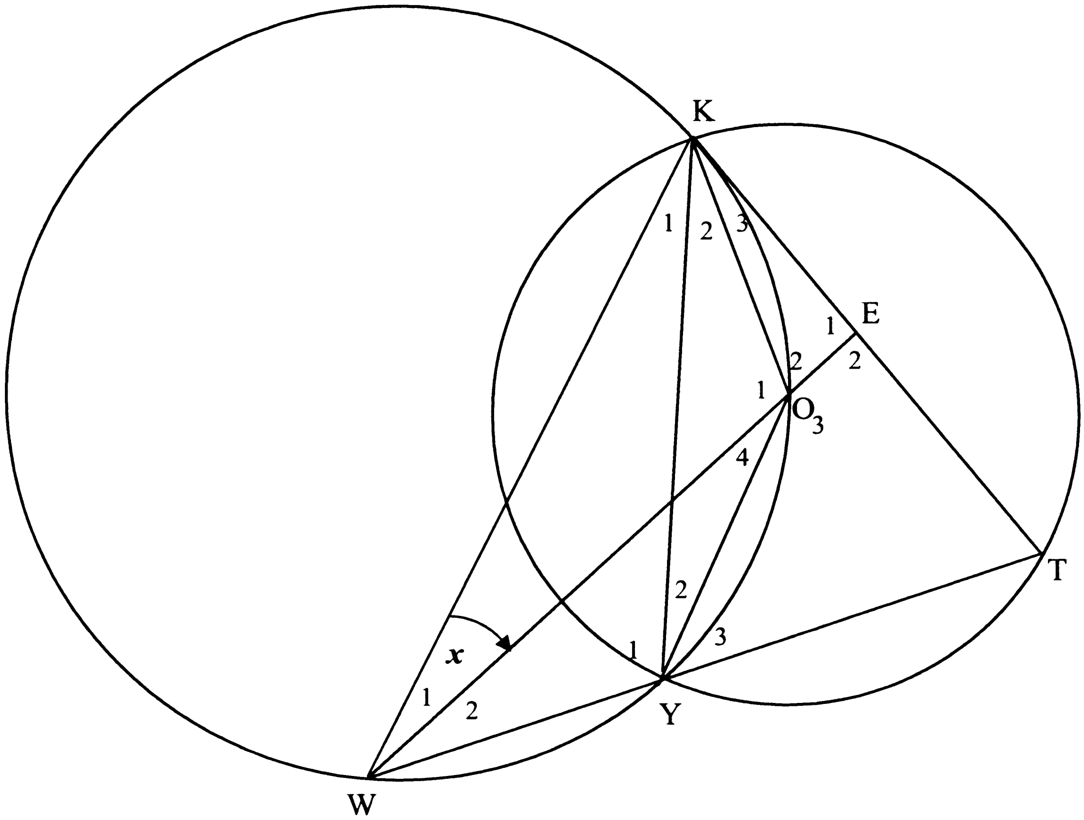



**[5]**

**QUESTION 12**

In the diagram below, two circles intersect at K and Y. The larger circle passes through O, the centre of the smaller circle. T is a point on the smaller circle such that KT is a tangent to the larger circle. TY produced meets the larger circle at W.
WO produced meets KT at E.

Let $\hat{W}_1 = x$




12.1 Determine FOUR other angles, each equal to $x$. (8)

12.2 Prove that $\hat{T} = 90° - x$. (3)

12.3 Prove that KE = ET. (3)

12.4 Prove that $KE^2 = OE.WE$ (6)

**[20]**

**TOTAL: 100**

**CENTRE NUMBER:**

**EXAMINATION NUMBER:**

**DIAGRAM SHEET 1**

**QUESTIONS 1.1 AND 1.3**

**Scatter plot showing the number of calories versus total fat content (in grams) in sandwiches**

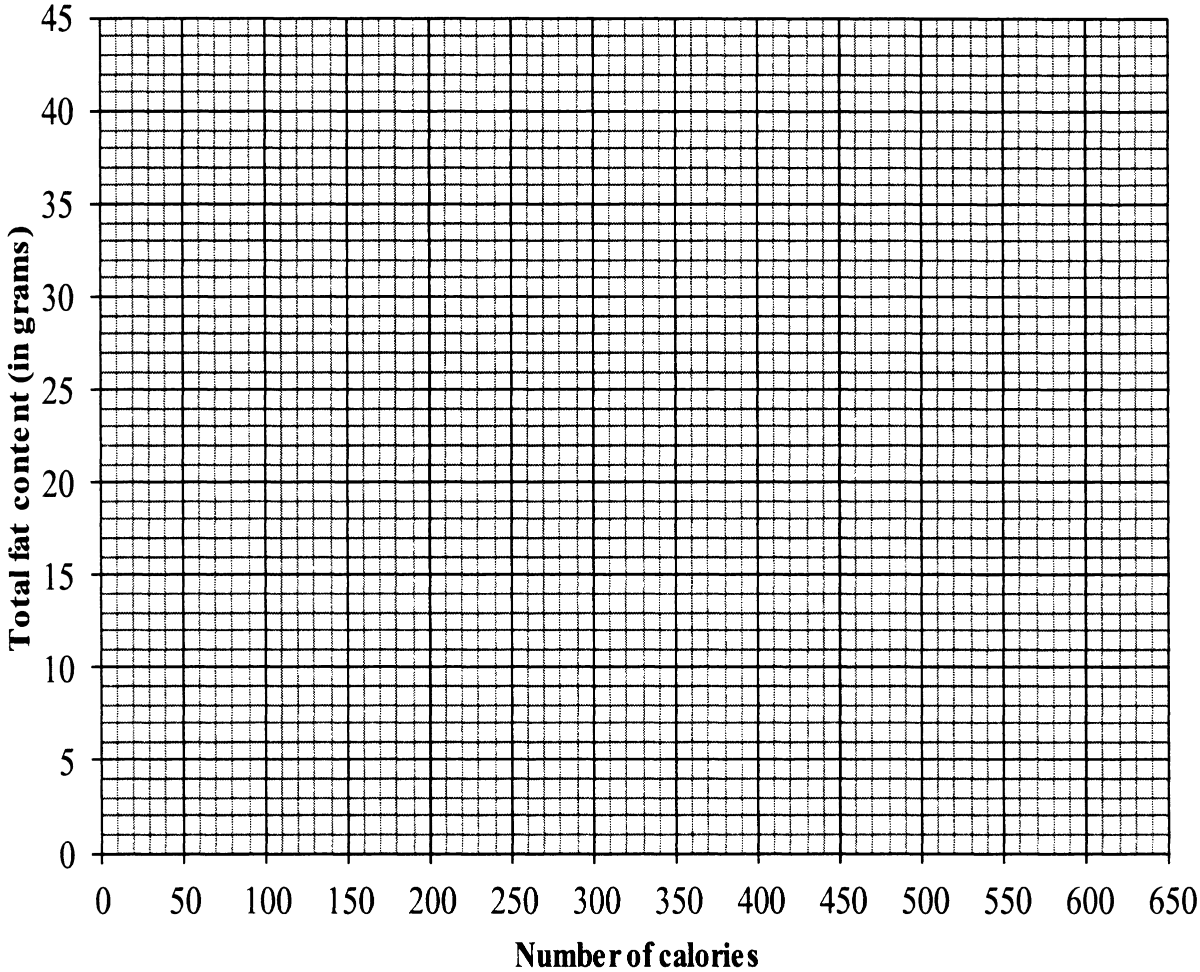


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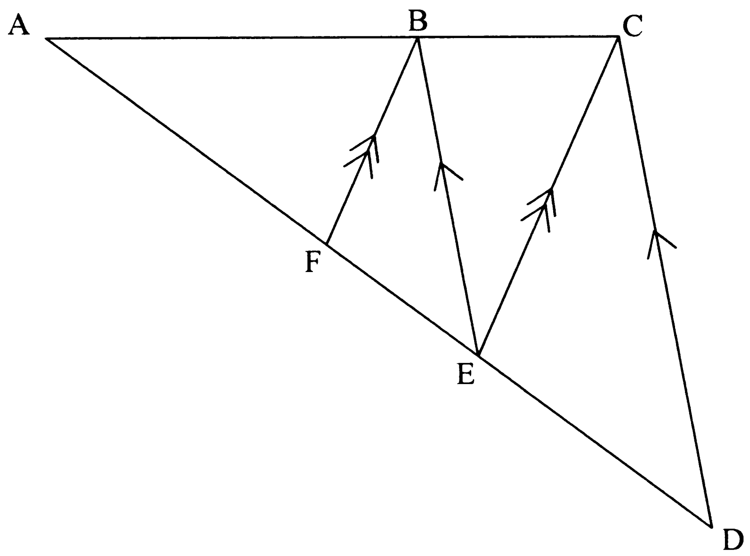
**DIAGRAM SHEET 2**

**QUESTION 9**




**QUESTION 10**

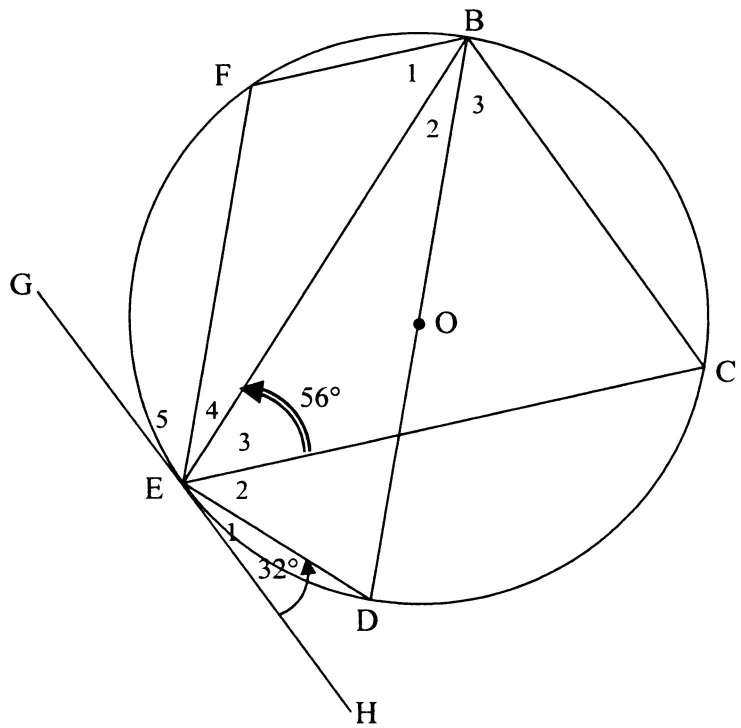


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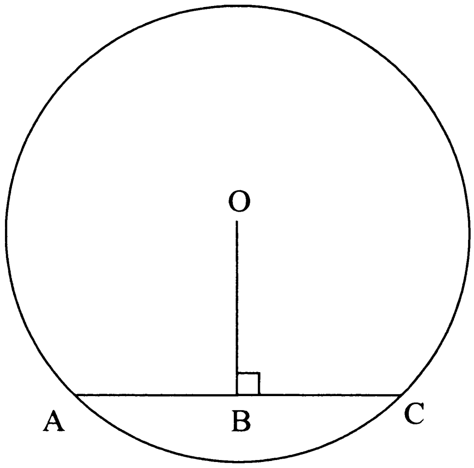
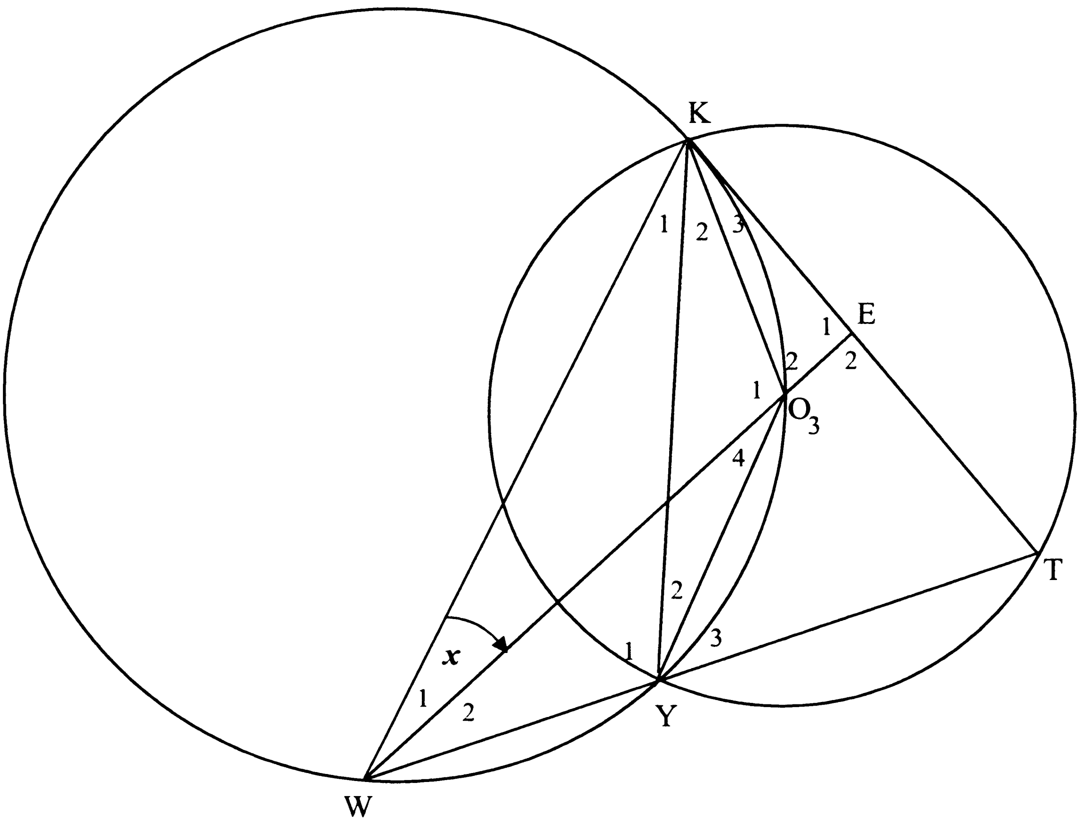
**DIAGRAM SHEET 3**

**QUESTION 11**




**QUESTION 12**



# INFORMATION SHEET

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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