basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P3

FEBRUARY/MARCH 2011

MARKS: 100

TIME: 2 hours

This question paper consists of 8 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 11 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 without the necessary calculations will not necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical) unless stated otherwise.
6. Round off your answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. THREE diagram sheets for answering QUESTION 4.1, QUESTION 4.3, QUESTION 8, QUESTION 9.1, QUESTION 9.2, QUESTION 10 and QUESTION 11 are attached at the end of this question paper. Write your centre number and examination number on these sheets in the spaces provided and staple them inside the back cover of your ANSWER BOOK.
9. An information sheet, with formulae, is included at the end of the question paper.
10. Number the answers correctly according to the numbering system used in this question paper.
11. Write legibly and present your work neatly.

QUESTION 1

The following data was collected for a company for the annual percentage wage increase for 11 staff members:

Employee	1	2	3	4	5	6	7	8	9	10	11
% Increase	3,2	3,2	3,2	4,2	4,5	4,9	8,3	9,5	11,7	12,2	12,5

1.1 Calculate the mean, mode and median of the above data. (3)

1.2 The union wants to highlight the poor annual increases that workers receive. Which measure of central tendency would be used in this scenario? Motivate your answer. (2)

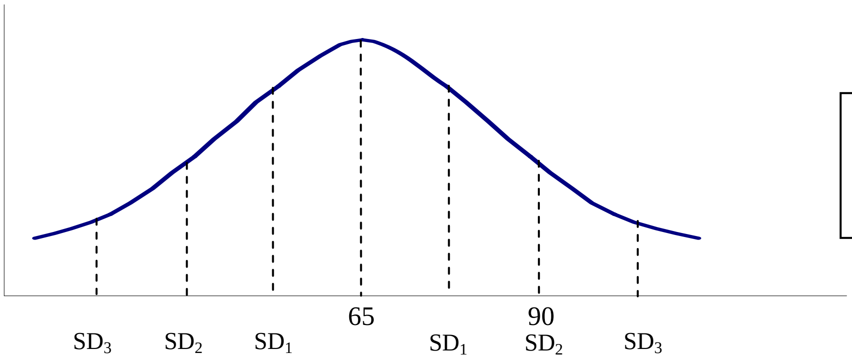
1.3 The employer uses the same information to justify the fact that the company has given decent increases to their workers. Which measure of central tendency will be used in this scenario? Motivate your answer. (2)
[7]

QUESTION 2

Two universities administer Mathematics entrance examinations for prospective first-year students. Renata wrote the entrance examinations at both universities.

The normal distribution graph below represents the results for University A.

University A



σ = SD
= standard deviation

University B revealed the following:

Mean ($\bar{x}$) = 49
Standard deviation $(\sigma) = 5$

2.1 Calculate the standard deviation for University A's entrance examination results. (2)

2.2 Renata's results were as follows:

University A: 78
University B: 60

In which entrance examination did she perform better in comparison with the other students who took the test? Motivate your answer with relevant calculations. (3)
[5]

QUESTION 3

The probability that it will rain on a given day is 63%. A child has a 12% chance of falling in dry weather and is three times as likely to fall in wet weather.

3.1 Draw a tree diagram to represent all outcomes of the above information. (6)

3.2 What is the probability that a child will not fall on any given day? (3)

3.3 What is the probability that a child will fall in dry weather? (2)
[11]

QUESTION 4

The data below shows the marks of the Grade 12 trial examination and the corresponding final examination marks for 11 learners.

Trial examination marks	80	68	94	72	74	83	56	68	65	75	88
Final examination marks	72	71	96	77	82	72	58	83	78	80	92

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

4.2 Calculate the equation of the least squares regression line for this data. (4)

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

4.4 Calculate the correlation coefficient for the above data. (2)

4.5 What will the predicted final examination mark be for a learner averaging 75 in the trial examination? (2)
[13]

QUESTION 5

In a survey 1 530 skydivers were asked if they had broken a limb. The results of the survey were as follows:

	Broken a limb	**Not broken a limb**	**TOTAL**
Male	463	*b*	782
Female	*a*	*c*	*d*
TOTAL	913	617	1 530

5.1 Calculate the values of a, b, c and d. (4)

5.2 Calculate the probability of choosing at random in the survey, a female skydiver who has not broken a limb. (2)

5.3 Is being a female skydiver and having broken a limb independent? Use calculations, correct to TWO decimal places, to motivate your answer. (4)

[10]

QUESTION 6

There are 7 different shirts and 4 different pairs of trousers in a cupboard. The clothes have to be hung on the rail.

6.1 In how many different ways can the clothes be arranged on the rail? (2)

6.2 In how many different ways can the clothes be arranged if all the shirts are to be hung next to each another and the pairs of trousers are to be hung next to each another on the rail? (3)

6.3 What is the probability that a pair of trousers will hang at the beginning of the rail and a shirt will hang at the end of the rail? (4)

[9]

QUESTION 7

Consider the following recursive sequence: 7 ; 4 ; – 5 ; – 32 ; …

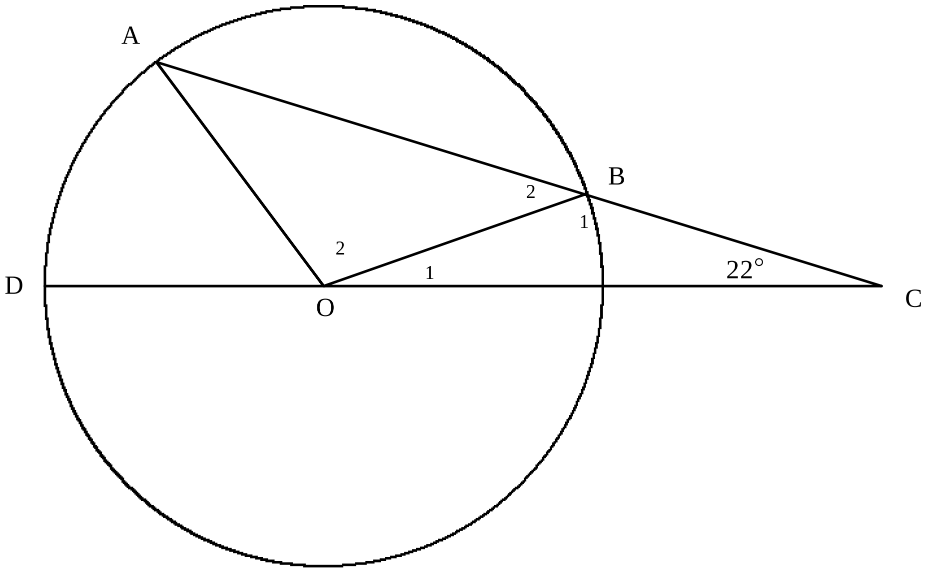
7.1 Write down the next TWO terms of the sequence. (2)

7.2 Hence, or otherwise, determine a recursive formula for the sequence. (3)

[5]

QUESTION 8

O is the centre of the circle. AB produced and DO produced meet at C.
BC = OA and $A\hat{C}O = 22°$.

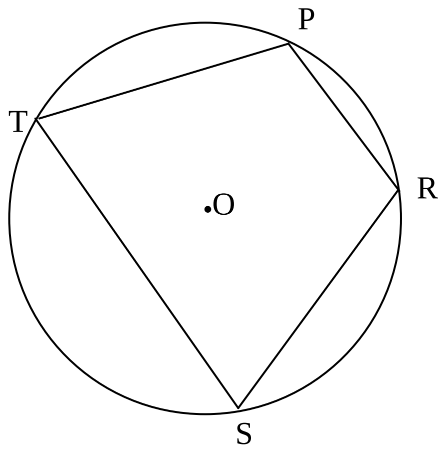


Calculate, with reasons, $A\hat{O}D$. **[5]**

QUESTION 9

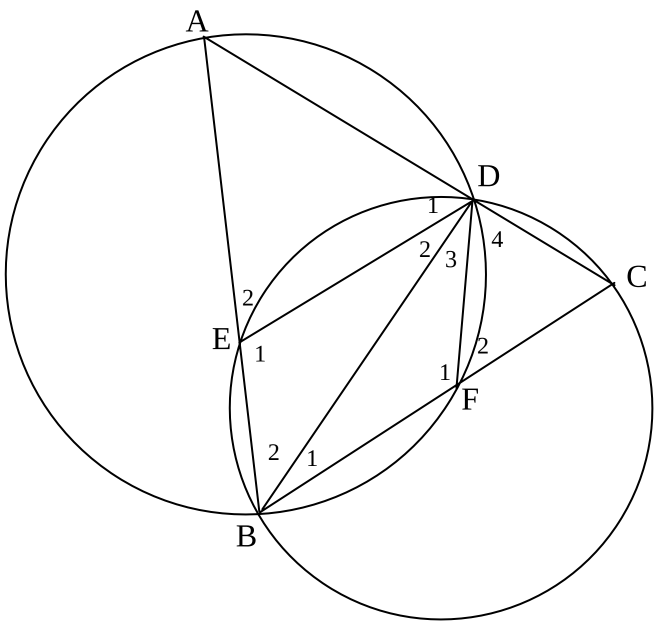
9.1 In the figure below O is the centre of the circle and PRST is a cyclic quadrilateral.

Prove the theorem that states $P\hat{R}S + P\hat{T}S = 180°$.



(5)

9.2 In the diagram below two circles intersect one another at D and B. AB is a straight line such that it intersects the circle BCD at point E. BC is a straight line such that it intersects the circle ABD at F. DE, DB and DF are joined.
$\hat{F}_2 = 180° - 2x$
FC = FD



9.2.1 Calculate, with reasons, in terms of x:

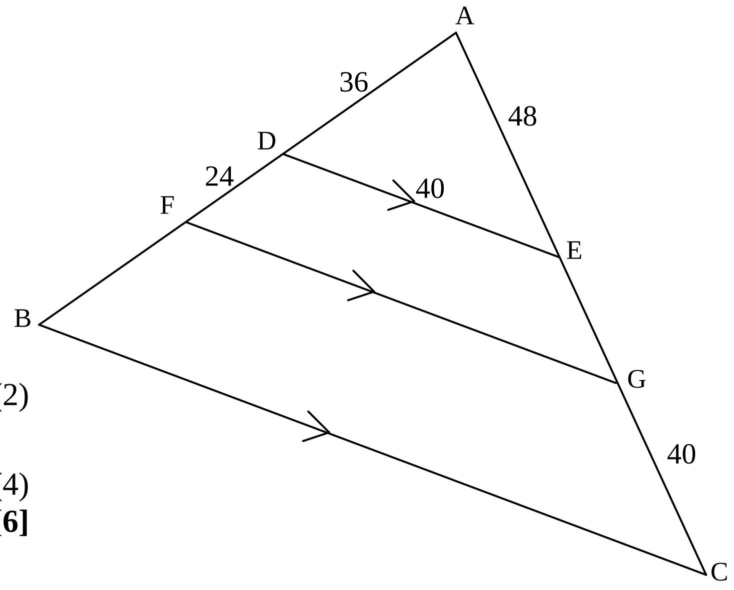
(a) $D\hat{E}B$ (3)

(b) $\hat{A}$ (2)

9.2.2 Hence, or otherwise, prove ED || BC. (3)
[13]

QUESTION 10

In the figure below DE || FG || BC.
AD = 36 cm, DF = 24 cm, AE = 48 cm and DE = GC = 40 cm.



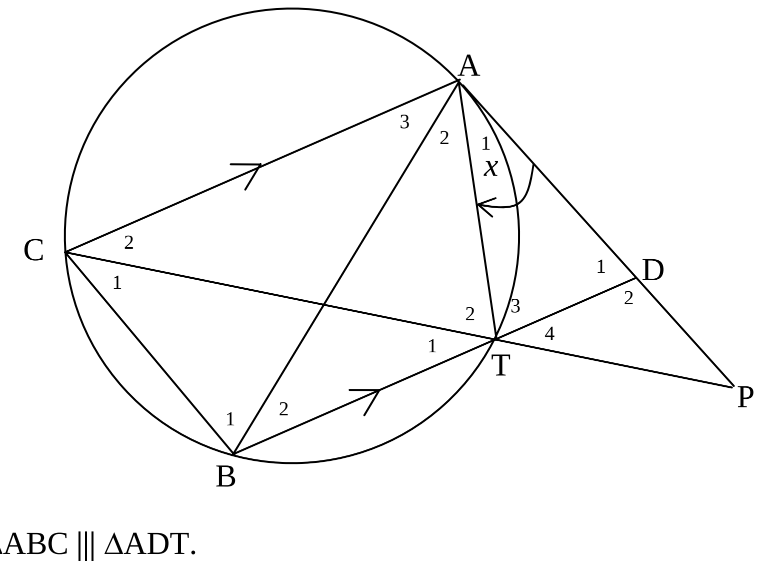
Determine, with reasons, the lengths of:

10.1 EG (2)

10.2 BC (4)
[6]

QUESTION 11

In the diagram below DA is a tangent to the circle ACBT at A. CT and AD are produced to meet at P. BT is produced to cut PA at D. AC, CB, AB and AT are joined.
AC || BD
Let $\hat{A}_1 = x$



11.1 Prove that ΔABC ||| ΔADT. (6)

11.2 Prove that PT is a tangent to the circle ADT at T. (3)

11.3 Prove that ΔAPT ||| ΔTPD. (3)

11.4 If AD = $\frac{2}{3}$AP, show that $AP^2 = 3PT^2$. (4)
[16]

TOTAL: 100

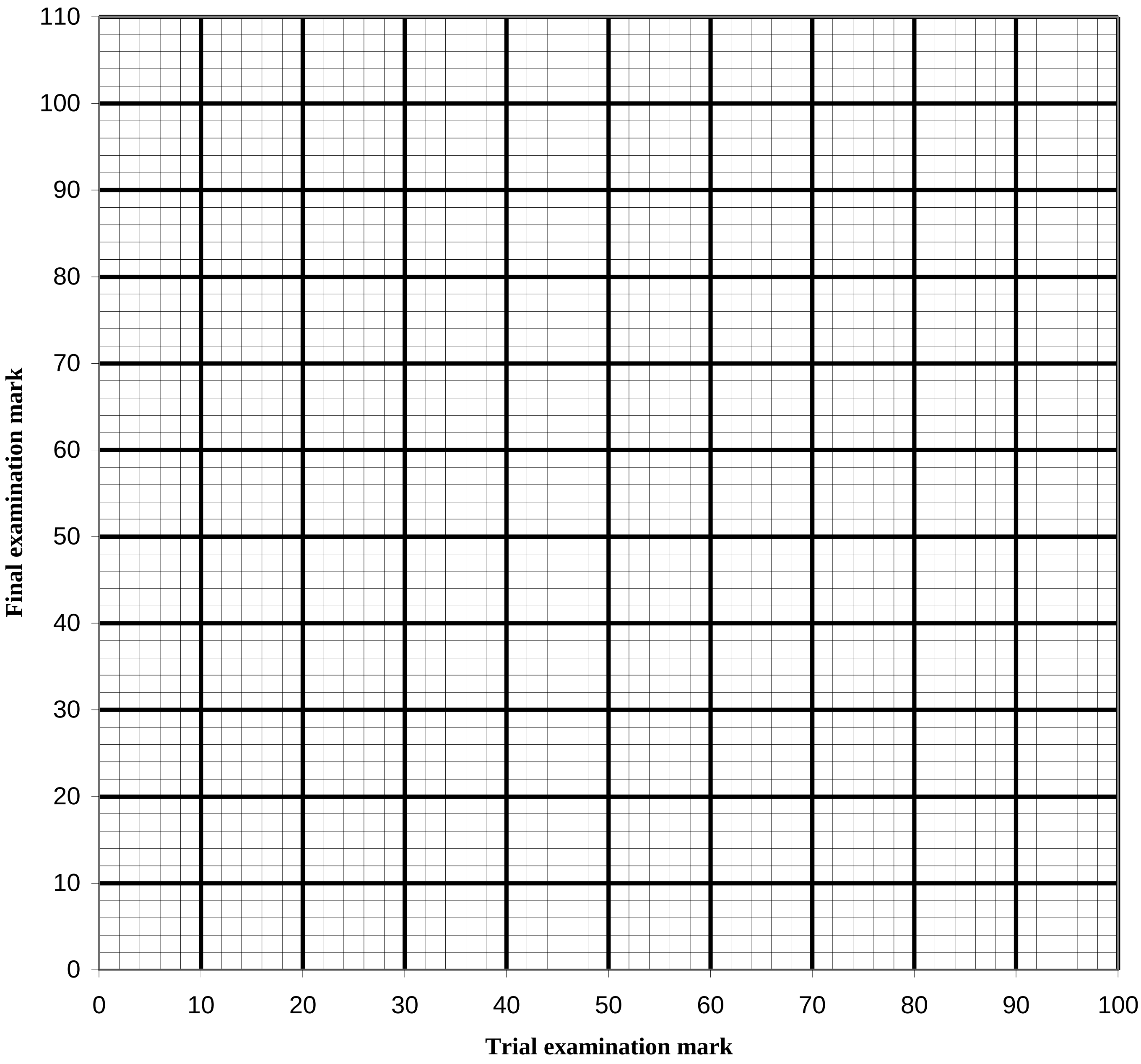
CENTRE NUMBER:

EXAMINATION NUMBER:

DIAGRAM SHEET 1

QUESTIONS 4.1 and 4.3

Scatter plot showing the trial examination mark vs the final examination mark

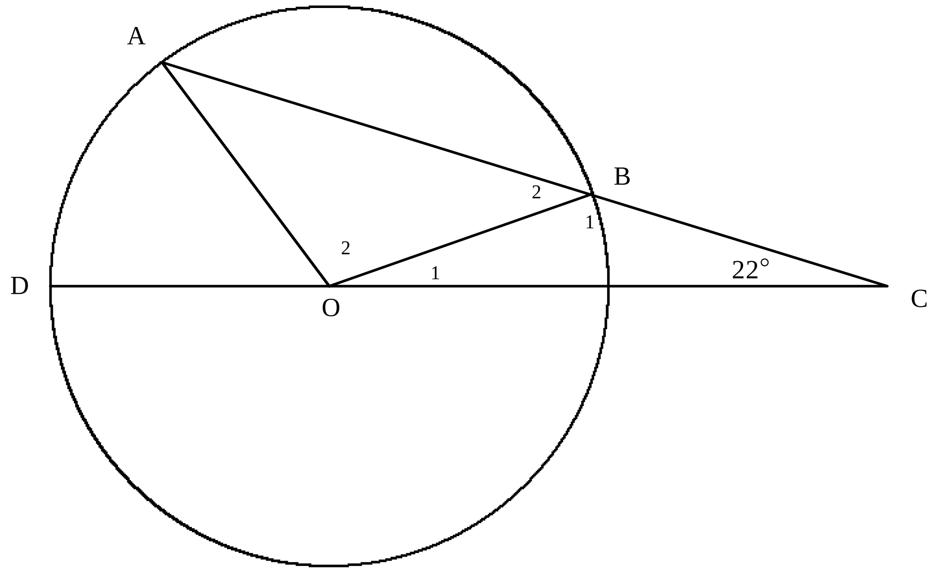


CENTRE NUMBER:

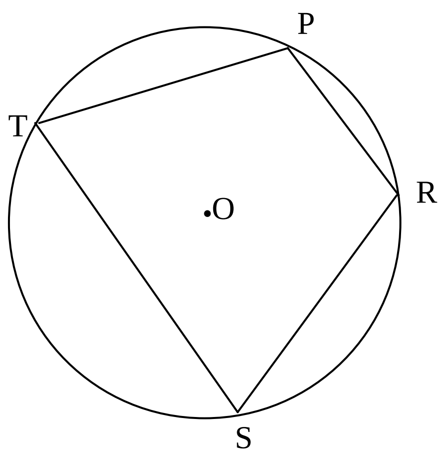
EXAMINATION NUMBER:

DIAGRAM SHEET 2

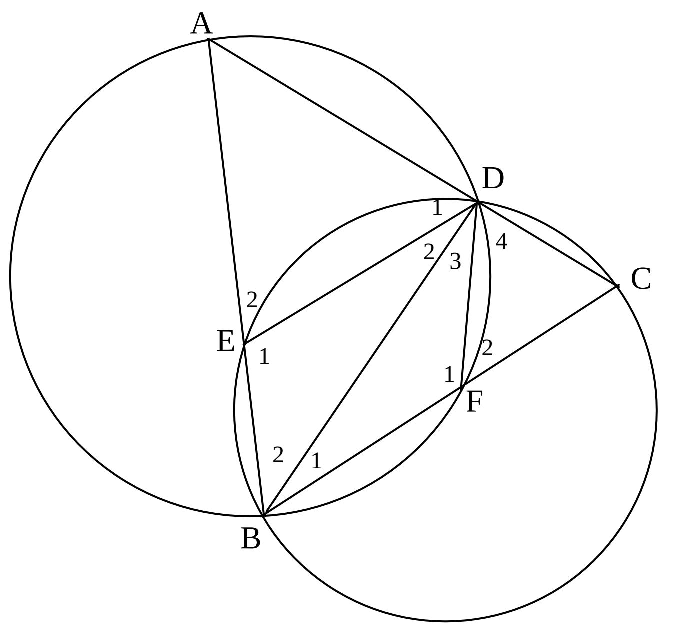
QUESTION 8



QUESTION 9.1



QUESTION 9.2

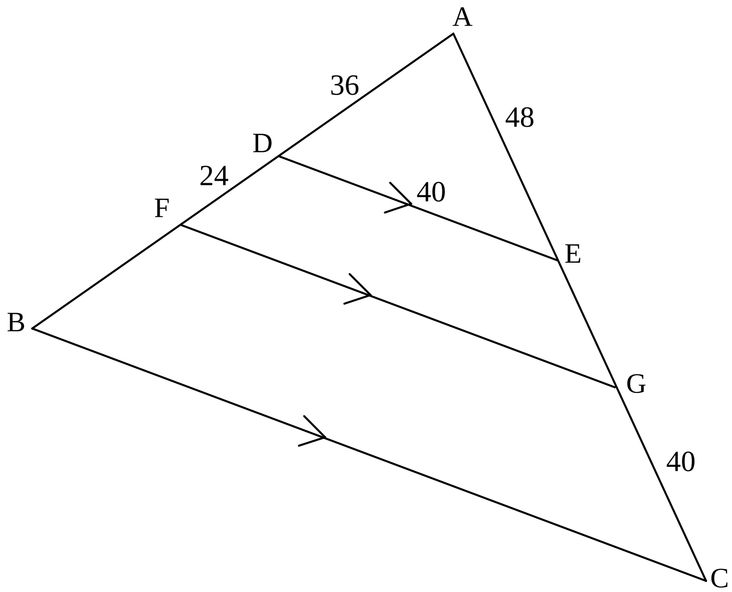


CENTRE NUMBER:

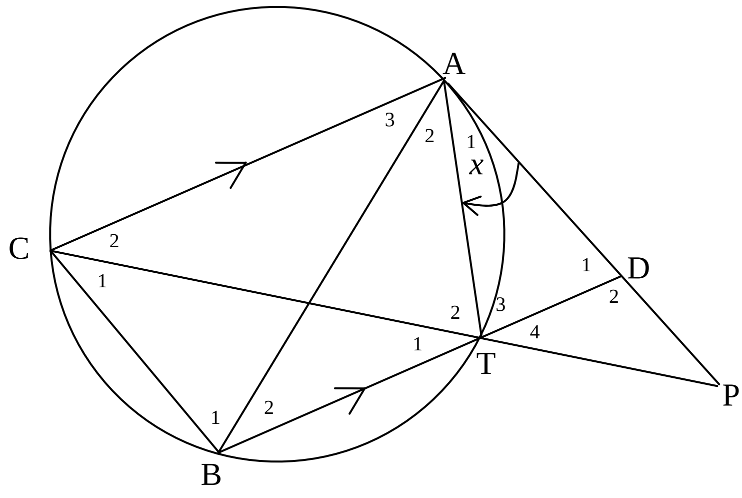
EXAMINATION NUMBER:

DIAGRAM SHEET 3

QUESTION 10



QUESTION 11



INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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