NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2009

MATHEMATICS: PAPER III

EXAMINATION NUMBER

Time: 2 hours 100 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 15 pages, and a 4-page Diagram and Information Sheet (Pages i – iv). Detach the Diagram and Information Sheet from the centre of the question paper for your own use. Please check that your paper is complete.

2. Read the questions carefully.

3. **Answer ALL the questions on the question paper and hand this in at the end of the examination. You do not need to hand in the Diagram and Information Sheet.**

4. You may use an approved non-programmable and non-graphical calculator, unless otherwise stated.

5. Round off your answers to two decimal digits where necessary.

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

SECTION A

QUESTION 1

(a) Determine the recursive formula for T_{k+1} of the sequence 8; 14; 20; 26 …

(2)

(b) The recursive formula for the sequence 1; 2; 5; 12; 29; … is defined by $T_k = a.T_{k-1} + b.T_{k-2}$; $k \geq 3, \quad k \in \mathrm{Z}$.
Show all working to find the values of a and b.

(6)

8 marks

QUESTION 2

All answers containing factorials must be calculated, e.g. $5! = 120$.

(a) Three cards are selected at random (without replacement) from a standard full pack of playing cards. There are 52 cards in the pack, jokers are excluded.

Find the probability that the cards are all the same colour.

(5)

(b) If $P(A) = \frac{3}{8}$ and $P(B) = \frac{1}{4}$,
find:

(1) $P(A \cup B)$ if A and B are mutually exclusive events.

(2)

(2) $P(A \cup B)$ if A and B are independent events.

(5)

(c) Three married couples – Mr and Mrs Smythe, Mr and Mrs Bothma and Mr and Mrs Keseke are to be seated on a bench.

(1) How many different arrangements are possible?

_____

_____ (2)

(2) Find the probability that Mr and Mrs Keseke land up sitting next to each other.

_____

_____

_____

_____

_____

_____

_____ (4)

18 marks

QUESTION 3

A research firm wants to determine the maximum distance at which each of 12 drivers can read a newly designed road sign. They hope to improve road safety by examining the relationship between age (x) and sign legibility distance (y). The table below lists the data.

x (Age)	18	24	28	29	32	35	49	55	63	74	79	82
y (Distance in metres)	155	149	155	140	128	137	116	128	106	109	94	92

(a) Use your calculator to find the regression line which best fits the given data. Round off your answers to two decimal digits where necessary.

_____

_____

_____ (4)

(b) Use your model found in (a) to calculate the legibility distance for a 33 year old. Give your answer to the nearest metre.

_____

_____ (2)

(c) Calculate the correlation coefficient r for the data.

_____

_____ (2)

(d) By referring to your answer in (c) above, select the correct interpretation of the value of r from one of the options given below. Write down only the number of your selection.

1	A strong positive linear relationship
2	No linear relationship
3	A weak negative relationship
4	A moderate positive relationship
5	A strong negative relationship

_____ (1)

(e) Calculate the decrease in legibility distance for an age increase of 15 years, for people over 18. Give your answer to the nearest metre.

_____

_____ (3)

12 marks

QUESTION 4

A grouped distribution of the running time in minutes for 96 DVDs is shown in the table below.

Playing time x (min)	Frequency
40 – 44	2
45 – 49	8
50 – 54	14
55 – 59	27
60 – 64	21
65 – 69	13
70 – 74	6
75 – 79	3
80 – 84	2

(a) The DVD distributors claim that the average running time for a DVD is over an hour. By referring to both the mean and the median, substantiate whether their claim is correct or not.

_____

_____

_____

_____

_____

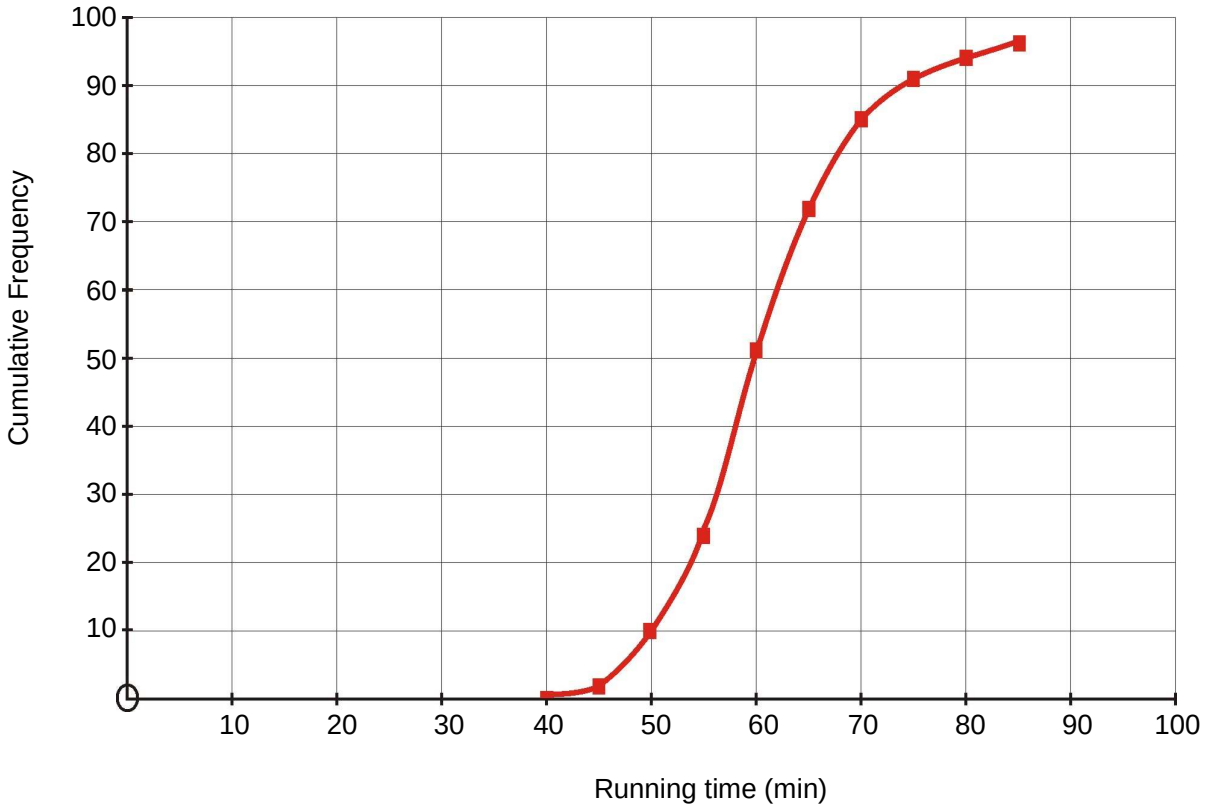
_____ (5)

(b) Estimate the standard deviation of the data given in the table, correct to 1 decimal digit.

_____

_____ (3)

(c) An ogive curve of the data is drawn below.



Answer the following by referring to the table and/or the ogive:

(1) Estimate the inter-quartile range for the data. Show all your working.

_____

_____

_____

_____ (4)

(2) By interpreting your answer to (1) above (and using any other evidence), comment on the spread of the data.

_____

_____

_____

_____ (2)

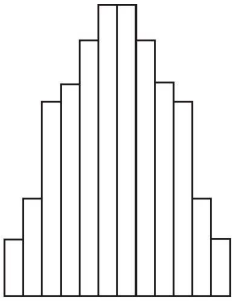
14 marks

QUESTION 5

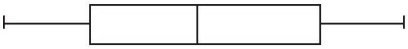
Match each Box-and-whisker plot (a), (b) or (c) with one of the Histograms A, B or C below.

(a)

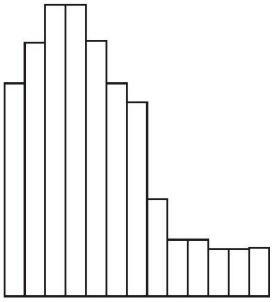
A



(b)

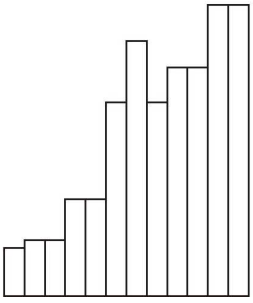


B



(c)

C



(a) _____

(b) _____

(c) _____

3 marks

QUESTION 6

For each of the following, explain why the statement could be misleading:

(a) This new diet pill is a breakthrough in medical technology. 510 trial patients reported a substantial weight loss after using it.

_____

_____

_____

_____ (1)

(b) The numeracy level of people with big feet was tested and then compared to that of people with small feet. It was found that the numeracy level of people with big feet was significantly greater. We can therefore conclude that people with big feet are more numerate.

_____

_____

_____

_____

_____

_____

_____ (2)

3 marks

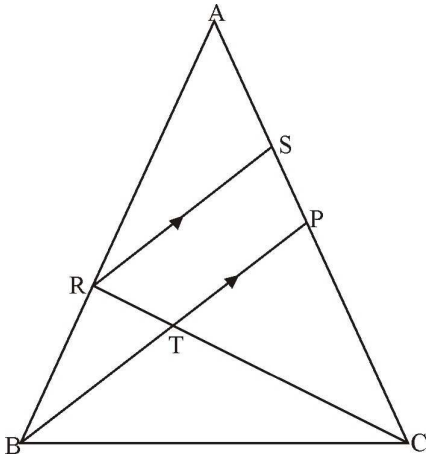
SECTION B

QUESTION 7

NO REASONS ARE NEEDED IN THIS QUESTION

Refer to the diagram.

In ΔABC, P is the midpoint of side AC.
RS is parallel to BP and $\frac{AR}{AB} = \frac{5}{7}$.
CR and BP intersect at T.



Determine:

(a) $\frac{AS}{SC}$

_____

_____

_____

_____

_____

_____ (3)

(b) RT if $RC = 20$ cm.

_____

_____

_____

_____

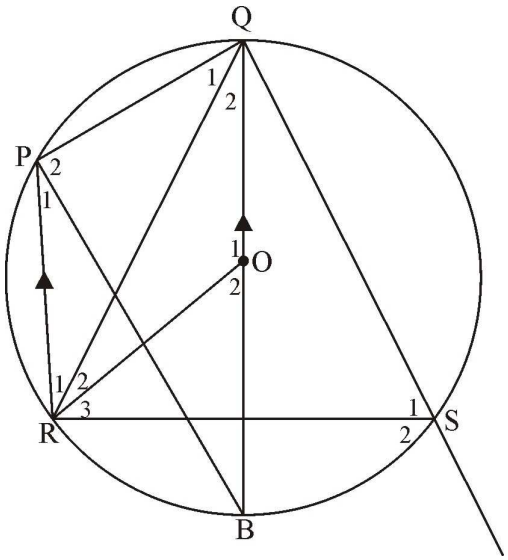
_____

_____ (3)

6 marks

QUESTION 8

Refer to the diagram.
O is the centre of the circle. PR is parallel to QB.
QOB is a diameter.
$\hat{B} = 20°$.



(a) Write down the size of $\hat{P}_1; \hat{Q}_2$ and $\hat{O}_2$. (No reasons needed)

_____

_____

_____

_____

_____ (3)

(b) Calculate, giving reasons, the size of $\hat{S}_2$.

_____

_____

_____

_____

_____ (4)

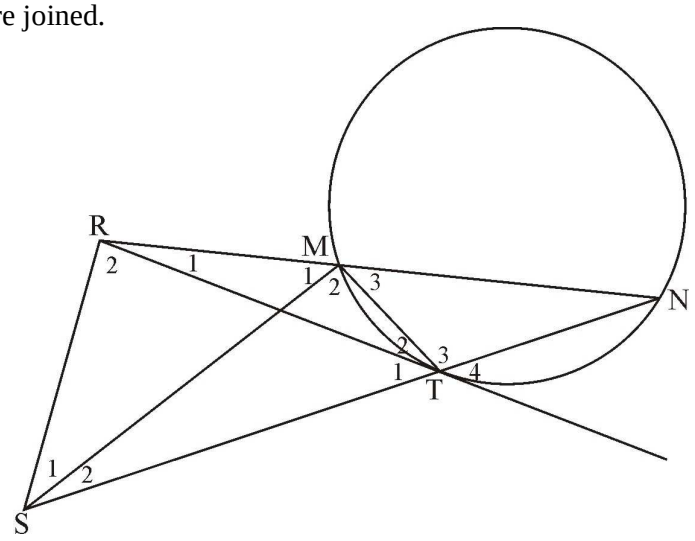
7 marks

QUESTION 9

REASONS MUST BE GIVEN IN THIS QUESTION

Refer to the diagram.

RT is a tangent to the circle at *T*.
Lines *NM* and *NT* are produced to *R* and *S* respectively, so that *RS* = *RT*.
S and M are joined.
Let $\hat{T}_4 = x$



(a) Give 3 other angles that are equal to *x*.

_____

_____

_____

_____

_____

_____ (6)

Prove that

(b) $R\hat{S}T = \hat{M}_3$

_____

_____ (1)

(c) *RSTM* is a cyclic quadrilateral.

_____

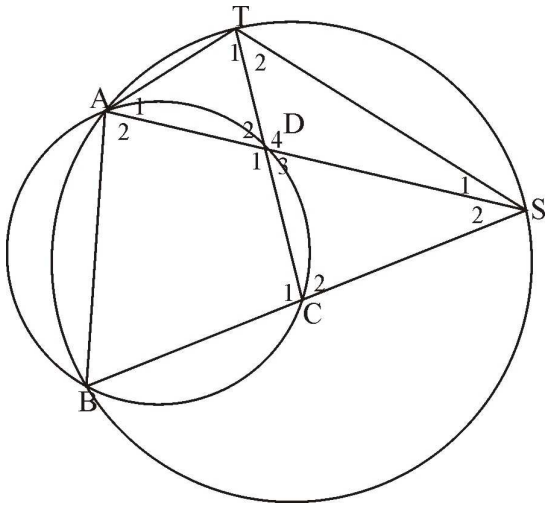
_____

_____ (2)

9 marks

QUESTION 10

REASONS MUST BE GIVEN IN THIS QUESTION



Refer to the diagram.
Two circles intersect at A and B.
Chords AS and BS of the larger circle meet the smaller circle at D and C respectively.
CD produced meets the larger circle at T. AT and TS are joined.

Prove that:

(a) $\hat{T}_1 + \hat{T}_2 = \hat{D}_4$

_____

_____

_____

_____

_____

_____

_____ (4)

(b) $\Delta STD /// \Delta SAT$

_____

_____

_____

_____

_____ (3)

(c) $TS^2 = BS \,.\, CS$

_____

_____

_____

_____

_____

_____

_____

_____

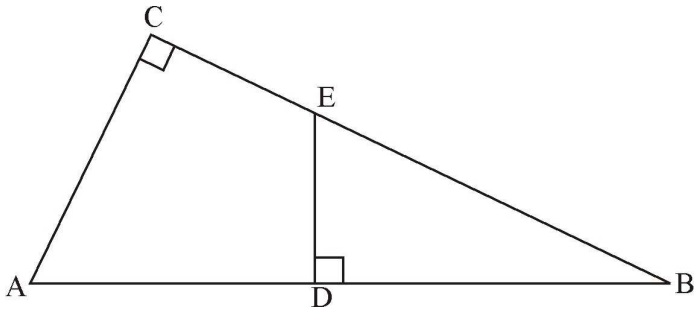
_____

_____ (5)

12 marks

QUESTION 11

Refer to the diagram.
ΔABC is right angled at $\hat{C}$.
The perpendicular bisector DE of side AB meets BC at E.



If $AC = 4{,}8$ cm and $AB = 8$ cm

(a) calculate BC, correct to 1 decimal digit.

_____

_____

_____

_____ (2)

(b) name a triangle which is similar to ΔBED.

_____ (1)

(c) calculate the area of $ADEC$.

_____

_____

_____

_____

_____

_____

_____

_____ (5)

8 marks

Total: 100 marks