NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2013

MATHEMATICS: PAPER III

MARKING GUIDELINES

Time: 2 hours 100 marks

These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.

The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.

SECTION A

QUESTION 1

(a) $T_5 = 3T_4 + 4$
$220 = 3T_4 + 4$ a
$T_4 = 72$ c/a

$T_4 = 3T_3 + 3$
$72 = 3T_3 + 3$
$T_3 = 23$ c/a c/a (4)

(b) (1) $T_3 = T_2 \times \frac{1}{2}T_1 + p$
$4 = 3\times\frac{1}{2}(2) + p$ a sub of 4,2 and 3 accurately nos must come from sequence to get c/a mark
$p = 1$c/a (2)

(2) $T_6 = 7\times\frac{15}{2} + 1$ or (write down)
$= 53\frac{1}{2}$
OR $\frac{105}{2} + p$ (1)

[7]

QUESTION 2

(a) (1) 1; _ ; _ ;_ ;_ ; 1
4 choices for second × 3 choices for third × 2 choices for fourth × 1 choices for fifth = 24 numbers.a (2)
OR 1 × 4!m concept of 4ness = 24 (6!-2! Gets 1 mark so does $\frac{6!}{2!}$)

(2) Total number of arrangements = $\frac{6\,!}{2\,!} = 360$. ($\frac{2!}{6!} = \frac{1}{360}$) gets 3 marks
Probability of 112 347 or 743 211 will be $\frac{2}{360}$ or $\frac{1}{180}$ (4)

(b) Number of arrangements of all n people = $n!$a
Number of arrangements with 1 standing next to 2 = $2\times(n-1)\,!$m(on the times by 2)

Number of arrangements with them not standing next to each other $= n\,! - 2\times(n-1)\,!$m on the idea of subtraction a on the correct answer (4)

[10]

QUESTION 3

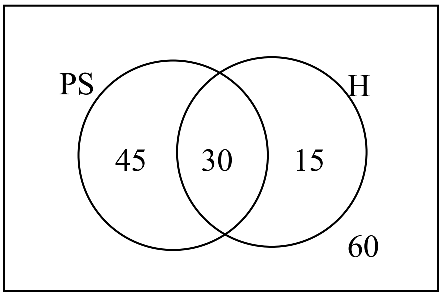
(a) Prob (female) = $\frac{1}{2}$ a (1)

(b) Prob (female, female) = $\frac{1}{2} \times \frac{3}{5} = \frac{3}{10}$ a (1)

(c) Prob (female, female, male, male) =a $\frac{1}{2} \times \frac{3}{5} \times \frac{2}{5} \times \frac{3}{5} = \frac{9}{125}$ second mark on multiplying by $\frac{6}{25}$ (2)

[4]

QUESTION 4



Half of 150 = 75 or adds up to 75 in venn diagram
40% of 75 = 30a
30% of 150 = 45

The number of the learners that study both Physical Science and History = 30 (2)

The probability that a learner does not study either Physical Science or History.
$\frac{60}{150} = \frac{2}{5}$ ca must be a prob or 0,4 (2)

[4]

QUESTION 5

$P(\text{A}) = \frac{1}{4}$ and $\text{P(A or B)} = \frac{1}{3}$

(1) $\text{P(A)} + \text{P(B)} = \text{P(A or B)}$ (using mutually exclusive)

$\frac{1}{4} + \text{P(B)} = \frac{1}{3}$ correct sub into correct formula

$P(B) = \frac{1}{12}$ (2)

(2) $\text{P(A)} \times \text{P(B)} = \text{P(A and B)}$ ac formula

$\text{P(A or B)} = \text{P(A)} + \text{P(B)} - \text{P(A and B)}$

$\frac{1}{3} = \frac{1}{4} + \text{P(B)} - \frac{1}{4}\text{P(B)}$ m sub into formulaa use of indep

$\frac{1}{12} = \frac{3}{4}P(B)$ or (4)

$P(B) = \frac{1}{9}$ c/a

[6]

QUESTION 6

(a) $A = 28{,}1412$ am(only 1 penalty if rounding incorrect)

$B = 0{,}0886$ am (if values round to 28 or 0,09 get 2 out of 4)

$y = 28{,}1412 + 0{,}0886x$ c/a (5)

(b) the value of r = 0,9135 (if rounds to 0,9 can get both marks) (2)

(c) $y = 28{,}1412 + 0{,}0886(560)$ c/a

y = 77,7572 or $\hat{y}$ = 77,7447 c/a

77,75 minutes is taken as $1\frac{1}{2}$ hours

Charges : 3(R50) + 150 = R300c/a (3)

(d) Noa – this x value is well outside the given data and so the regression line would not be reliable (extrapolation)interpretation or outlier

Noa – smaller lawns are not rectangular so they will take longer/not representative (2)

[12]

QUESTION 7

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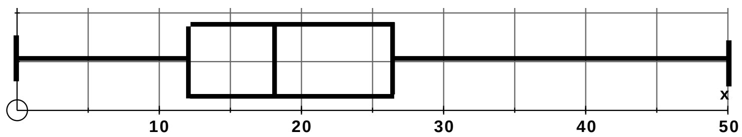
(a) (1) B 19,5a (3)

(2) D 10,71a (2)

(b) on min and max value a
on lower and upper quartile a
on median a (3)



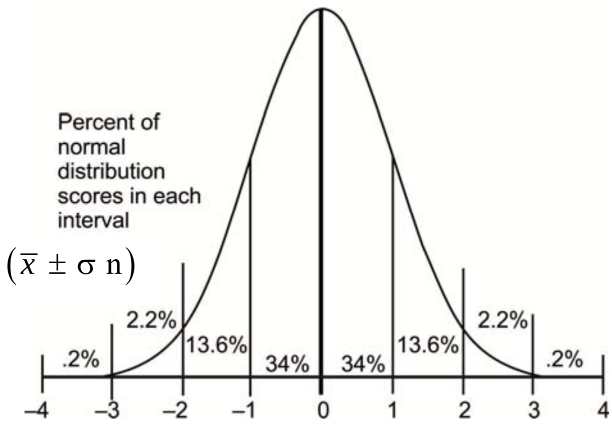
(c) (1) The distribution of these travelling times is skewed positively. TRUEa

(2) The inter-quartile range for this data is 25. FALSEa

(3) 35 of the employees take less than 20 minutes. FALSE/TRUE or left blank (3)

[11]

QUESTION 8



A biologist has collected data on the heights of a particular species of cactus. He observes that 2,4% of the cacti are below 12 cm and 16% are above 17,22 cm in height. He assumes that the heights are normally distributed.

(a) The standard deviation

3a standard deviations = 17,22 – 12 = 5,22m
1 standard deviation = 1,74 cmc/a (3)

(b) The mean of the distribution.

12 + 2(1,74) = 15,48c/a (1)

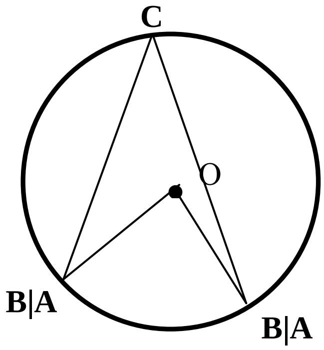
(c) $81,6\% \times 300$ a
= 244,8 = 245c/a(% value must come from normal dis table)(no penalty on rounding (2)

[6]

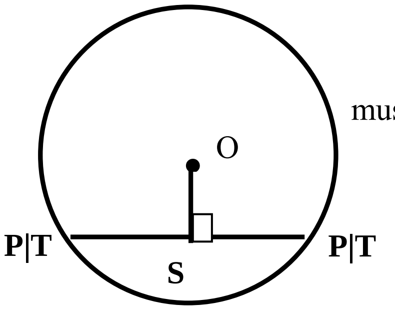
60 marks

SECTION B

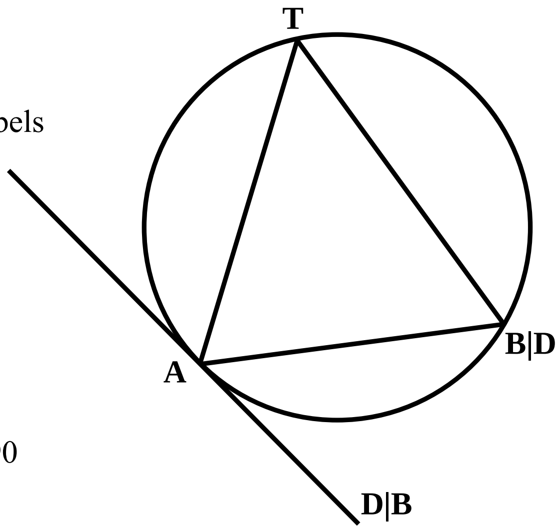
QUESTION 9



must have labels



must have 90



Alternative memo interchange A|B etc.(if lines PS marked equal to ST give mark)

[3]

QUESTION 10

(a)

Statement	Reason
(1) $\hat{ADO} = 90°$	Rad ⊥ tang diam perp tang
(2) $\hat{BVD} = 90°$	∠ In semi-circle angle at centre

(2)

VA = DA tangents from same point

(b) (1) $\hat{D}_2 = 70°$

angles of an isos triangle ΔAVD

$\hat{D}_1 = 20°$

radius ⊥ tangent (4)

If assume without proof that VODA is a cyclic quad or that VODA is a Kite then lose 2 method marks.

(2) $\hat{O}_1 = 40°$

∠ at centre 2x ∠ at circum

∠s of isosceles Δ (2)

(c) ΔVAM ≡ ΔDAM SAS(must prove first)

$\therefore \hat{M}_3 = \hat{M}_4 = 90°$

but $\hat{V}_1 + \hat{V}_2 = 90^o$ angle in a semicircle

so BV//OA cointerior ∠s supplementary / corresponding (alternate) ∠s equal

OR

VO = OD equal radii

VA = AD equal tangents

∴ VODA is a kite

$\therefore \hat{M}_1 = \hat{M}_2 = 90°$

But $\hat{V}_1 + \hat{V}_2 = 90°$

∴ BV || OA cointerior ∠s supplementary

OR

$\hat{V}_1 = \hat{B} = 70°$ [$\hat{O}_1 = 40°$ and ∠s opp equal sides BO = OV]

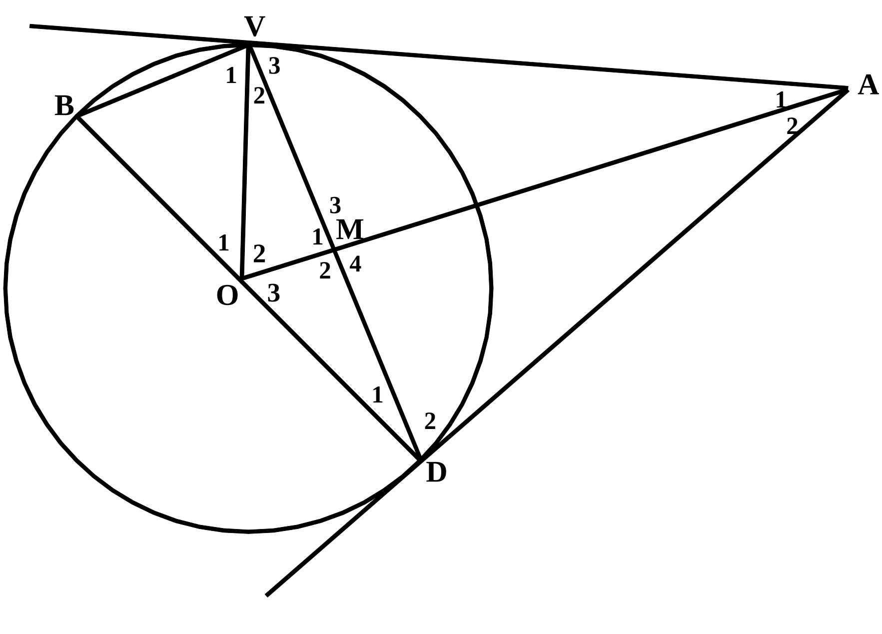
$\hat{A}_1 = \hat{D}_1 = 20°$ [OVAD cyclic quad]

$\therefore \hat{O}_2 = 70°$ [∠s of Δ]

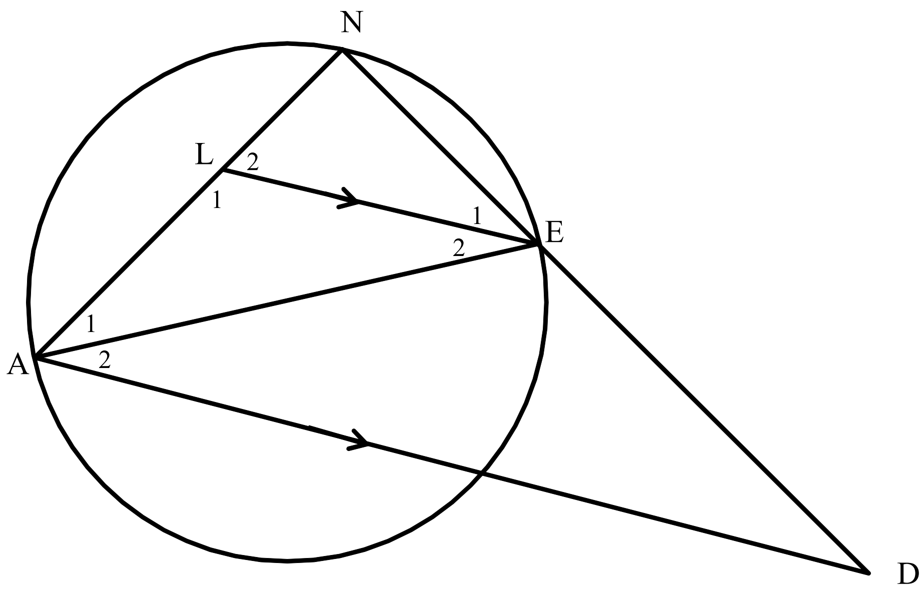
∴ BV || OA [equal alt ∠s]

(3)

[11]



QUESTION 11



(a)

Statement	Reason
$\hat{E}_1 = \hat{D}$	Corresponding angles LE//AD
$\hat{E}_2 = \hat{A}_2$	Alternate angles LE//AD
$\therefore AE = ED$	Sides opposite equal angles/isos triangle

(3)

(b) (1) $\hat{N} = 90°$ angle in semi circle a

$NA^2 = 20^2 - 12^2$ sub

$NA = 16$ a Theorem of Pythagoras (3)

(2) $\frac{DE}{DN} = \frac{LA}{AN}$ a line // one side of triangle / prop.in.theorem

But AE = ED proved isos triangle

$\frac{20}{32} = \frac{LA}{16}$ m

$LA = 10$c/a (4)

OR

$In \Delta ANE : \cos\theta = \frac{12}{20}$

$\theta = 53,13$

$\sin 53,13 = \frac{AN}{20}$

$AN = 16$

QUESTION 12

(a)

$\hat{N}_1 = \hat{E}_2$	$\angle$s in same segment angles sub by same chord	(1)
$\hat{E}_2 = \hat{A}_2$	Tan chord theorem alt seg theorem	(1)

(b) $\hat{D}_1 = \hat{V}$ ext $\angle$ cyclic quad
$\hat{V} = \hat{E}_1 + \hat{E}_2$ tan chord theorem
$\therefore \hat{D}_1 = \hat{E}_1 + \hat{E}_2$

OR

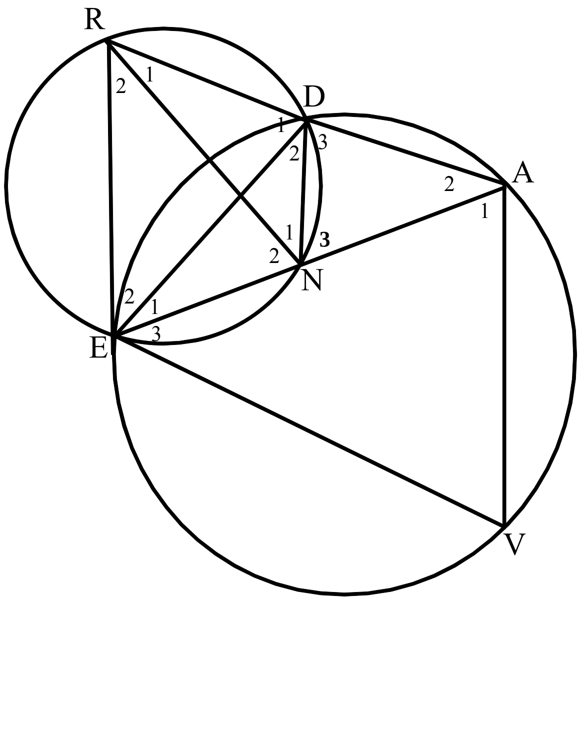
$\hat{D}_1 = \hat{E}_1 + \hat{A}_2$ [ext $\angle$ of Δ]
but $\hat{A}_2 = \hat{E}_2$ [proven in (a)]
$\therefore \hat{D}_1 = \hat{E}_1 + \hat{E}_2$ (2)

(c) In $\Delta EDR /// \Delta AER$
$\hat{R}_1 + \hat{R}_2$ is common
$\hat{D}_1 = \hat{E}_1 + \hat{E}_2$ proved
$\therefore \hat{E}_2 = \hat{A}_2$ third $\angle$ of Δ / tan chord thrm
$\therefore \Delta EDR /// \Delta AER$ AAA (3)

if prove c) in b) can get all marks.

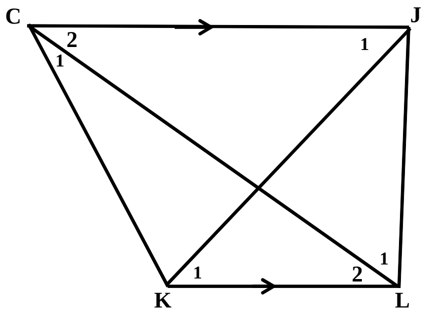
(d) If $2AV = DR.AR$ and ER = 3 cm find the length of AV.
$\frac{ER}{AR} = \frac{DR}{ER}$ sides in proportion

$DR.AR = ER^2$
m $\therefore 2AV = 3^2$ m sub
$\therefore AV = 4\frac{1}{2}$



(3)
[10]

QUESTION 13



KLJC is a trapezium with KL // CJ.
CK = 24 cm, KL = 8cm, LJ = 12 cm, JC = 32cm and KJ = 16 cm.

$$\frac{\text{Area of } \Delta\text{KLJ}}{\text{Area of CKLJ}}$$

$$\text{Area } \Delta\text{KLJ} = \frac{1}{2}(\text{KL})(\text{JK})\sin\hat{\text{K}}_1$$

$$\text{Area } \Delta\text{KLJ} = \frac{1}{2}(8)(16)\sin\hat{\text{K}}_1$$
$$= 64\sin\hat{\text{K}}_1$$

$$\text{Area CKLJ} = \text{Area } \Delta\text{KLJ} + \text{Area } \Delta\text{CJK} = 64\sin\hat{\text{K}}_1 + \frac{1}{2}(32)(16)\sin\hat{\text{J}}_1$$

But $\hat{\text{K}}_1 = \hat{\text{J}}_1$ alt$\angle$s CJ / /KL

$\therefore$ Area CKLJ $= 320\sin\hat{\text{K}}_1$

So $\frac{\text{Area of } \Delta\text{KLJ}}{\text{Area of CKLJ}} = \frac{64\sin\hat{\text{K}}_1}{320\sin\hat{\text{K}}_1}$

$= \frac{1}{5}$

OR

$\frac{\text{KL}}{\text{JK}} = \frac{8}{16} = \frac{1}{2}$ and $\frac{\text{LJ}}{\text{Kl}} = \frac{12}{24} = \frac{1}{2}$ and $\frac{\text{KJ}}{\text{JL}} = \frac{16}{32} = \frac{1}{2}$ should read $\frac{LJ}{KC}$ *and* $\frac{KJ}{JC}$

this means that $\Delta\text{KLJ} /// \Delta\text{JKL}$(ratio corresp sides are equal) should read ΔJKC

ratio of sides 1 : 2

ratio of areas 1:4

$$\frac{\text{Area of } \Delta\text{KLJ}}{\text{Area of CKLJ}} = \frac{x}{5x} = \frac{1}{5} \quad \text{OR} \quad \frac{\text{Area } \Delta \text{ KLJ}}{\text{Area of CKLJ}} = \frac{\frac{1}{2}(8) \times h}{\frac{1}{2}(8+32) \times h} = \frac{(\text{area of } \Delta)}{\text{area of trap}}$$
$$= \frac{8}{40} = \frac{1}{5}$$

If assume that trapezium has right angle at L and that height = 12 can get max of 4 out of 6.

[6]

40 marks

Total: 100 marks