NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2009

MATHEMATICS: PAPER II

MARKING GUIDELINES

Time: 3 hours 150 marks

These marking guidelines were used as the basis for the official IEB marking session. They were prepared for use by examiners and sub-examiners, all of whom were required to attend a rigorous standardisation meeting to ensure that the guidelines were consistently and fairly interpreted and applied in the marking of candidates' scripts.

At standardisation meetings, decisions are taken regarding the allocation of marks in the interests of fairness to all candidates in the context of an entirely summative assessment.

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, and different interpretations of the application thereof. Hence, the specific mark allocations have been omitted.

Please note that learners who provided alternate correct responses to those given in the marking guidelines will have been given full credit.

SECTION A

QUESTION 1

(a) (1) TL
(2) KL
(3) RT or OL (3)

(b) (1)

$\frac{-5+a}{2} = -1$ and $\frac{p+7}{2} = 3$

$\therefore -5 + a = -2$ $\therefore p + 7 = 6$ (4)

$\therefore a = 3$ $\therefore p = -1$

(2)

$EG = 5\sqrt{2}$

$\therefore (k+1)^2 + (2-3)^2 = (5\sqrt{2})^2$

$\therefore (k+1)^2 = 49$ (3)

$\therefore k + 1 = \pm 7$

$\therefore k = 6$ or $k = -8$

n/a

(c) (1) $y = -3x + 7\frac{1}{2}$

$\therefore \tan\theta = -3$

ref $\angle = 71{,}6°$

$\therefore \theta = 108{,}4°$ (4)

(2) $m_{AD} = -3$

$\therefore m_{AB} = \frac{1}{3}$

$\therefore y = \frac{1}{3}x + 7\frac{1}{2}$

For B, let $y = 0$

$\frac{1}{3}x + 7\frac{1}{2} = 0$

$\frac{1}{3}x = -\frac{15}{12}$

$x = \frac{-45}{2}$ (4)

18 marks

QUESTION 2

(a)

$$\begin{aligned} & \mathrm{M} - \mathrm{T} \\ = \quad & 0{,}2079116908 - (-0{,}2033683215) \\ = \quad & 0{,}411 \end{aligned}$$

(3)

(b)

$$\sqrt{1 - \sin \mathrm{A}.\cos \mathrm{A}.\tan \mathrm{A}}$$
$$= \sqrt{1 - \sin \mathrm{A}.\cos \mathrm{A}.\frac{\sin \mathrm{A}}{\cos \mathrm{A}}}$$
$$= \sqrt{1 - \sin^2 \mathrm{A}}$$
$$= \sqrt{\cos^2 \mathrm{A}}$$
$$= \cos \mathrm{A}$$

(3)

(c)

$$\cos\theta = \sqrt{3} - 2$$
$$\text{ref } \angle = 74{,}5^\circ$$
$$\therefore \quad \theta = 180^\circ + 74{,}5^\circ$$
$$\therefore \quad \theta = 254{,}5^\circ$$

(3)

(d)

$$\frac{\sin(180^\circ - 2\beta)}{2\cos(90^\circ - \beta)}$$
$$= \frac{\sin(2\beta)}{2\sin\beta}$$
$$= \frac{2\sin\beta.\cos\beta}{2\sin\beta}$$
$$= \cos\beta$$

(4)

(e) (1) $\frac{\mathrm{b}}{\mathrm{a}} = \tan 110^\circ = -2{,}75$ (2)

(2) $\frac{b}{\sqrt{a^2 + b^2}} = \sin 110^\circ = 0{,}94$ (2)

17 marks

QUESTION 3

(a) (1)

$$\frac{EF}{25} = \cos 75°$$

$\therefore$ EF = 6,47 units (2)

(2)

$$AB = 50 - 2(6,47)$$

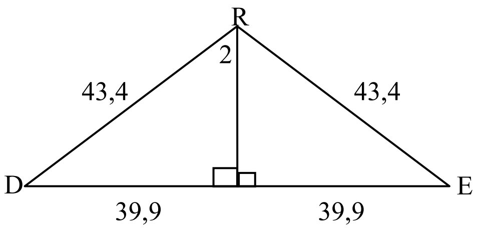
$\therefore$ AB = 37,06 m (4)

(b) (1) (i)

$$\cos D\hat{R}E = \frac{43,4^2 + 43,4^2 - 79,8^2}{2(43,4)(43,4)} = -0,6904266389$$ (4)

$\therefore$ $D\hat{R}E = 133,7°$

Alternative



$$\sin\theta = \frac{39,9}{43,4} \quad \therefore \theta = 66,85$$

$$\therefore D\hat{R}E = 2\theta = 133,7°$$

(ii)

$$\text{Area } \Delta DRE = \frac{1}{2} \times 43,4 \times 43,4 \times \sin 133,7°$$ (3)

$$= 680,9\,m^2$$

(2) (i)

$$S = 2\pi rh$$
$$= 2\pi(54,864)(45,72)$$ (2)
$$= 15760,63\,m^2$$

(ii)

Cost per square metre

$$= \frac{160000000}{15760,63}$$ (2)

= R10151,88 per square metre

17 marks

QUESTION 4

(a) (1) 19
(2) 11
(3) $11 - 3 = 8$
(4) $19 - 11 = 8$ (4)

(b) b = 46 000
c = 49 000
d = 70 000
e = 94 700 (4)

(c) (1) B
(2) A
(3) C
(4) B (4)

12 marks

QUESTION 5

(a) (1) $k = 2$

(2) R(1 ; 6)

(3) $\frac{1}{4}$ (4)

(b) (1) Reflection in $y = x$ line (2)

(2) Rotation about the origin through 180° (2)

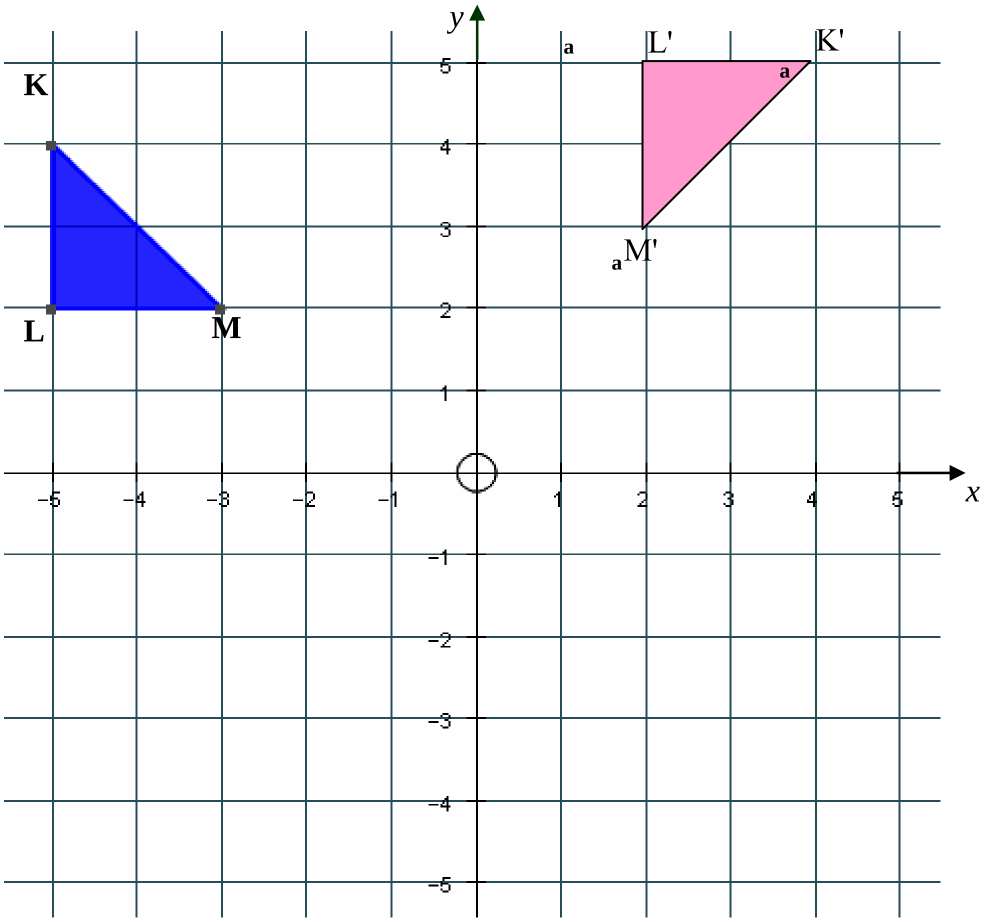
OR

Reflection about the origin

(c) On Answer Sheet (3)

11 marks

(c)



(3)

11 marks

Total for Section A: 73 marks

SECTION B

QUESTION 6

(a)

$$\frac{\sin(7D).\cos(3D)-\cos(7D).\sin(3D)}{\tan(2D)}-1$$
$$=\frac{\sin(4D)}{\tan(2D)}-1$$
$$=\frac{2\sin(2D).\cos(2D)}{1}\times\frac{\cos(2D)}{\sin(2D)}-1 \qquad (4)$$
$$=2\cos^2(2D)-1$$
$$=\cos(4D)$$

(b)

$$\tan^2\theta=\left(\frac{1}{\sqrt{3}}\right)^2 \qquad (5)$$
$$\therefore\ \tan\theta=\pm\frac{1}{\sqrt{3}}$$
$$\text{ref} <= 30°$$
$$\therefore \quad \theta=30°+180k \text{ or } \theta=150°+180k\ ;\ k\in Z$$

Alternative

$\tan\theta=\tan 150°$ **or** $\tan\theta=-\tan 150°$

$\therefore\ \theta=150+180k$ **or** $\theta=-150+180k\ ;\ K\in Z$

(c) (1)

$$\cos(A+B).\cos(A-B)$$
$$=[\cos A.\cos B-\sin A.\sin B][\cos A.\cos B+\sin A.\sin B]$$
$$=\cos^2 A.\cos^2 B-\sin^2 A.\sin^2 B$$
$$=\cos^2 A(1-\sin^2 B)-(1-\cos^2 A)\sin^2 B \qquad (5)$$
$$=\cos^2 A-\cos^2 A.\sin^2 B-\sin^2 B+\sin^2 B.\cos^2 A$$
$$=\cos^2 A-\sin^2 B$$

(2)

$$\cos^2 37{,}5°-\sin^2 7{,}5°$$
$$=\cos(45°).\cos(30°) \qquad (3)$$
$$=\frac{\sqrt{2}}{2}.\frac{\sqrt{3}}{2}=\frac{\sqrt{6}}{4}$$

17 marks

QUESTION 7

(a) (1) 60° $\left[\cos B\hat{C}A = \frac{BC}{CA} = \frac{1}{2}\right]$

(2) 30° $\left[\sin E\hat{C}O = \frac{1}{2}\right]$

(3)

$\theta = 90°$

$\therefore \tan\frac{\theta}{2} = \tan 45° = 1$ (6)

(b) (1) 15 cm

(2) $h = 15\cos\theta$

(3) $\theta = 72°$ $\therefore h = 4{,}63$ cm (4)

(c) (1) In ΔERT,

$$\frac{ET}{\sin 39°} = \frac{12}{\sin 95°}$$

$\therefore$ ET = 7,580691512

In ΔSET,

$$\frac{SE}{ET} = \tan 49°$$

$\therefore$ SE = 8,7 metres (4)

(2) Join E to Q , so that EQ is perpendicular to RT

$$\frac{EQ}{ET} = \sin 46°$$

$\therefore$ EQ = 5,7 metres (3)

17 marks

QUESTION 8

(a)

(1) 20

(2) (i) True

(ii) True

(iii) True

(iv) False (5)

(b) (1) 77

(2) 8 (2)

(c)

$\bar{x} = m+1$ $\left[\bar{x} = \dfrac{m-4+m+m+1+m+3+m+5}{5}\right]$

$\therefore \quad \sigma^2 = \dfrac{25+1+0+4+16}{5} = 9{,}2$ (6)

$\therefore \quad \sigma = \sqrt{9{,}2} = 3{,}03$

13 marks

QUESTION 9

(a) $x^2 + (y+4)^2 = 25$, therefore the coordinates of the centre are (0;– 4)

$m_{\text{radius}} = \dfrac{-1-(-4)}{-4-0} = \dfrac{3}{-4} \qquad \therefore m_{\tan} = \dfrac{4}{3}$

Therefore equation is $y+1 = \dfrac{4}{3}(x+4)$ (6)

(b) (1) C(2 ; –4)

Therefore equation is $(x-2)^2 + (y+4)^2 = 1$ (3)

(2) Area = $\dfrac{1}{2}.6.3.\sin\theta = 9\sin\theta$ (1)

(3) $\theta = 90°$ (1)

(4) centre(8; –1) and radius = 4 units.

Therefore equation is $(x-8)^2 + (y+1)^2 = 16$ (3)

(c) (1)

$TA^2 = 9r^2 - r^2 = 8r^2$ (2)

$\therefore TA = \sqrt{8}r$

(2)

$\tan A\hat{T}M = \dfrac{AM}{AT} = \dfrac{1}{\sqrt{8}}$

$\therefore A\hat{T}M = 19{,}47122063$ (4)

$\therefore m_{AT} = \tan(90° - 19{,}47122063) = 2{,}8$

20 marks

QUESTION 10

$G(7,3;6,6) \to G'$. G must be rotated 5 times to return to itself. After two rotations it transforms to G'. Therefore the transformation that takes G to G' is a rotation through $\frac{360°}{5} \times 2 = 144°$.
The transformation is a rotation of 144° about the origin in an anticlockwise direction.

$$\begin{aligned} x_{G'} &= x_G \cos\theta - y_G \sin\theta \\ &= 7,3.\cos 144° - 6,6.\sin 144° \\ &= -9,8 \end{aligned}$$

$$\begin{aligned} y_{G'} &= y_G \cos\theta + x_G \sin\theta \\ &= 6,6\cos 144° + 7,3.\sin 144° \\ &= -1,0 \end{aligned}$$

8 marks

Total for Section B: 75 marks

Total: 150 marks