RONDEBOSCH BOYS' HIGH SCHOOL

GRADE 11

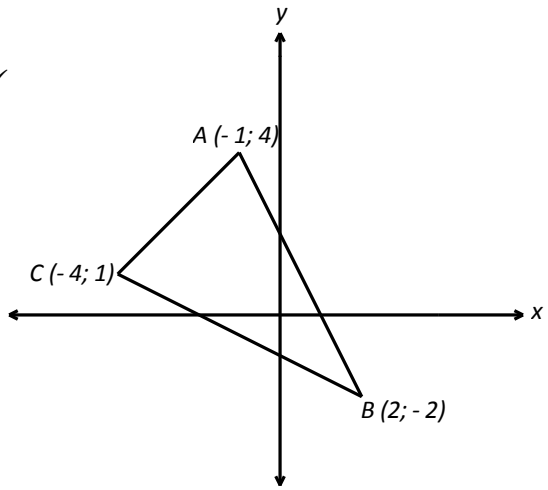
MATHEMATICS (PAPER 2)
10 JUNE 2016

MEMORANDUM

MARKS: 100 **EXAMINER: D GELDENHUYS**

TIME: 2 HOURS **MODERATOR: S VERSTER**

QUESTION 1



1.1 $BC = \sqrt{(-4-2)^2+(1+2)^2}$ ✓

$= 3\sqrt{5}$ ✓ (2) R

1.2 D $\left(\frac{1}{2}\,;1\right)$ ✓✓ (2) R

1.3 $m_{AB} = \frac{-2-4}{2+1}$

$= -2$ ✓

$\therefore m = \frac{1}{2}$ ✓ $(\perp)$

$1 = \frac{1}{2}\left(\frac{1}{2}\right) + c$ ✓

$\therefore c = \frac{3}{4}$

$\therefore y = \frac{1}{2}x + \frac{3}{4}$ ✓ (4) R

1.4 $m_{AC} = \frac{1-4}{-4+1}$

$= 1$ ✓

$\therefore m = 1$ $(\|)$

$-2 = 1(2) + c$ ✓

$\therefore c = -4$

$\therefore y = x - 4$ ✓ (3) R

1.5 $\tan\theta = 1$

$\therefore\ \theta = 45°$ ✓

$\tan\theta = m_{AB}$

$= -2$ ✓

$\therefore\ RA \approx 63{,}43°$ ✓ or $\therefore\ RA \approx 116{,}57°$ (✓)

$\therefore B\hat{A}C = 180° - 45° - 63{,}43°$ $\therefore B\hat{A}C = 116{,}57° - 45°$

$= 71{,}57°$ ✓ $= 71{,}57°$ (✓) (4) C

1.6 E $(5; 1)$ ✓✓ (2) R

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QUESTION 2

2.1 $DP = \sqrt{(-4+6)^2+(3-7)^2}$

$= 2\sqrt{5}$ ✓

$EP = \sqrt{(2+6)^2+(3-7)^2}$ ✓

$= 4\sqrt{5}$ ✓

$\therefore 2\,DP = EP$ (3) R

2.2 $\therefore m = -\frac{2}{3}$ ✓ $(\perp)$

$\therefore -\frac{2}{3} = \frac{-4+10}{x-7}$ ✓ or $-10 = -\frac{2}{3}(7) + c$ (✓✓) or $\frac{3}{2} \times \frac{6}{x-7} = -1$ (✓✓)

$\therefore -2(x-7) = 3(6)$ $\therefore c = -\frac{16}{3}$ $9 = -x + 7$

$\therefore -2x + 14 = 18$ $\therefore y = -\frac{2}{3}x - \frac{16}{3}$ $x = -2$ (✓)

$\therefore -2x = 4$ $\therefore -4 = -\frac{2}{3}x - \frac{16}{3}$

$\therefore x = -2$ ✓ $\therefore x = -2$ (✓) (3) C

2.3 $\sqrt{a^2+b^2} = \sqrt{(a-6)^2+b^2}$

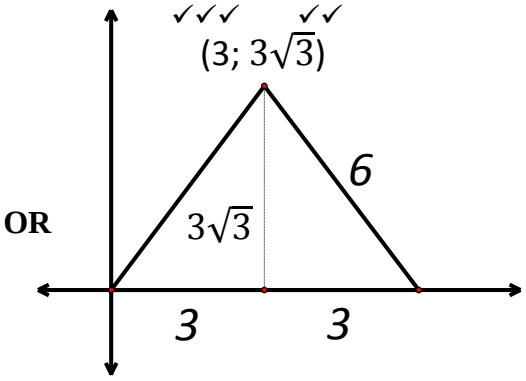
$\therefore a^2 + b^2 = a^2 - 12a + 36 + b^2$ ✓

$\therefore 12a = 36$ ✓

$\therefore a = 3$ ✓

$\therefore 3^2 + b^2 = 36$ ✓

$\therefore b = 3\sqrt{3}$ ✓



OR

OR

$\frac{a}{6} = \cos 60°$ (✓) $\frac{b}{6} = \sin 60°$ (✓)

$\therefore a = 6\left(\frac{1}{2}\right)$ $\therefore b = 6\left(\frac{\sqrt{3}}{2}\right)$

$\therefore a = 3$ (✓✓) $\therefore b = 3\sqrt{3}$ (✓) (5) PS

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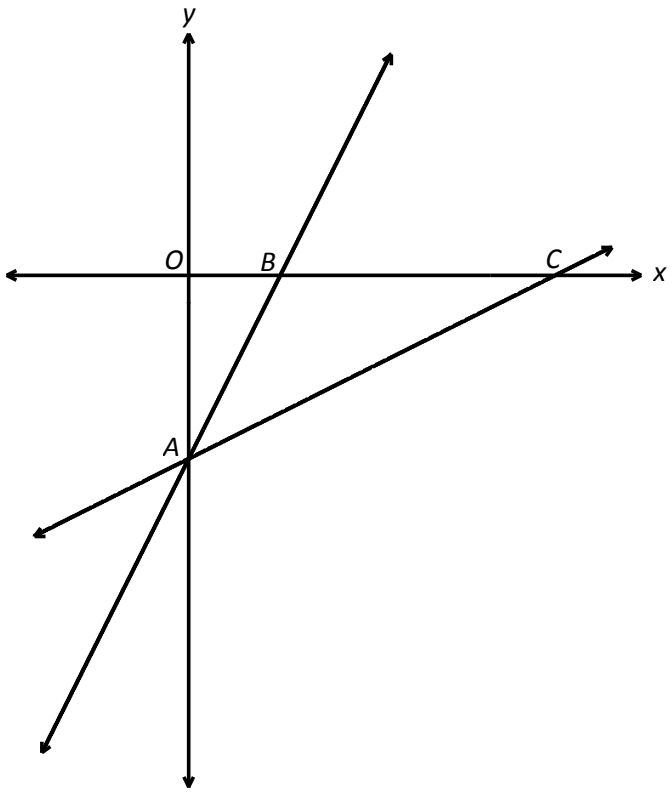
QUESTION 3

$y - 2x + q = 0$ and $2y - x + 2q = 0$ are sketched below.



3.1 A $(0;\ -q)$ ✓ (1) R

3.2 $0 - 2x + q = 0$ $2(0) - x + 2q = 0$

$\therefore -2x = -q$ ✓ $\therefore -x = -2q$ ✓

$\therefore x = \frac{q}{2}$ or $\frac{1}{2}q$ $\therefore x = 2q$

$\therefore$ B $\left(\frac{q}{2}; 0\right)$ ✓ and C $(2q; 0)$ ✓ (4) R

3.3 Area Δ ABC $= \frac{1}{2} \times 2q \times \boldsymbol{q} - \frac{1}{2} \times \frac{1}{2}q \times \boldsymbol{q}$ ✓ ✓$(positive\ \boldsymbol{q}\ of or\ line\ AB)$

$= q^2 - \frac{1}{4}q^2$

$= \frac{3}{4}q^2$ ✓ (3) PS

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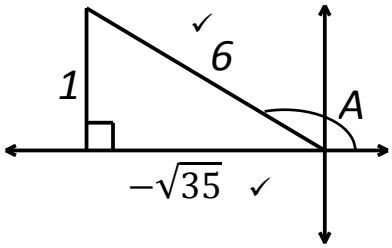
QUESTION 4

4.1 $\sin A = \frac{1}{6}$



✓ *quadrant*

$\cos(180° - A) = -\cos A$ ✓

$= -\left(-\frac{\sqrt{35}}{6}\right)$

$= \frac{\sqrt{35}}{6}$ ✓ (5) R

4.2 $\frac{\cos(180°-x).\tan(360°-x).\cos^2(90°-x)}{\sin(180°-x)} + \cos^2 x$

$= \frac{(-\cos x)(-\tan x)(\sin^2 x)}{\sin x} + \cos^2 x$ (✓ ✓ ✓ ✓)

$= \cos x \times \frac{\sin x}{\cos x} \times \sin x + \cos^2 x$ ✓

$= \sin^2 x + \cos^2 x$ ✓

$= 1$ ✓ (7) R

4.3 $\frac{\tan 420°}{\cos 60°} = \frac{\tan 60°}{\cos 60°}$ ✓

$= \frac{\frac{\sqrt{3}}{1}}{\frac{1}{2}}$ ✓ ✓

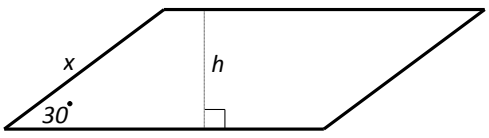
$= 2\sqrt{3}$ ✓ (4) R

4.4 $\sin 30° = \frac{h}{x}$ ✓

$\therefore x \sin 30° = h$

$\therefore h = x \times \frac{1}{2}$

$\therefore h = \frac{x}{2}$ ✓ (2) C



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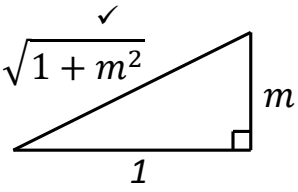
QUESTION 5

5.1.1 $\tan 58° = \frac{m}{1}$



$\therefore \cos 58° = \frac{1}{\sqrt{1+m^2}}$ ✓ (2) R

5.1.2 $\sin(-122°) = -\sin 58°$ ✓

$= -\frac{m}{\sqrt{1+m^2}}$ ✓ (2) R

5.2.1 $LHS = \sin\theta \left[\sin\theta + \frac{\cos\theta}{\sin\theta}\right] - \cos\theta$ (✓ on $\frac{\cos\theta}{\sin\theta}$, ✓ on $\cos\theta$)

$= \sin^2\theta + \cos\theta - \cos\theta$ (✓ on $\cos\theta$)

$= \sin^2\theta$ ✓

$= 1 - \cos^2\theta$

$= RHS$ (4) C

5.2.2 $\tan\theta = 0$

$\therefore \theta = 0° + n.180°$

$\therefore \theta = n.180°; n \in Z$ ✓

or $\theta = 90° + n.180°$ ✓ } *or* $\theta = n.90°$ ✓✓ (2) R

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QUESTION 6

6.1.1 $\cos(2x - 20°) = -0,37 \qquad 0° \leq x \leq 180°$

$RA \approx 68,28°$

Q2: $\therefore 2x - 20° = 180° - 68,28°$ ✓ or Q3: $2x - 20° = 180° + 68,28°$ ✓

$\therefore 2x = 131,72°$ $\therefore 2x = 268,28°$

$\therefore x = 65,86°$ ✓ $\therefore x = 134,14°$ ✓ (4) R

6.1.2 $9^{\tan x} = 27 \qquad x \in [-180°; 360°]$

$\therefore 3^{2\tan x} = 3^3$ ✓

$\therefore 2\tan x = 3$ ✓

$\therefore \tan x = \frac{3}{2}$ ✓

$RA \approx 56,31°$

$\therefore x = 56,31° + n.180°; n \in Z$

$\therefore x = -123,69°$ *or* $56,31°$ *or* $236,31°$ ✓✓ (5) C

6.2.1 $\sin^2 x - 3\cos^2 x = 2\sin x . \cos x$

$\therefore \sin^2 x - 2\sin x . \cos x - 3\cos^2 x = 0$ ✓

$\therefore (\sin x - 3\cos x)(\sin x + \cos x) = 0$ ✓

$\therefore \sin x - 3\cos x = 0$ or $\sin x + \cos x = 0$

$\therefore \tan x = 3$ ✓ $\tan x = -1$ ✓

$RA \approx 71,57°$ $RA = 45°$

$\therefore x = 71,57° + n.180°; n \in Z$ ✓ $\therefore x = 135° + n.180°$ ✓

or $x = 251,57° + n.180°$ or $x = 315° + n.180°$

$(only\ need\ to\ give\ one\ option)$ (6) C

$\mathbf{-1\ if\ they\ left\ out\ n \in Z}$

6.2.2 $x = -45°$ ✓ *or* $71,57°$ ✓ (CA) (2) C

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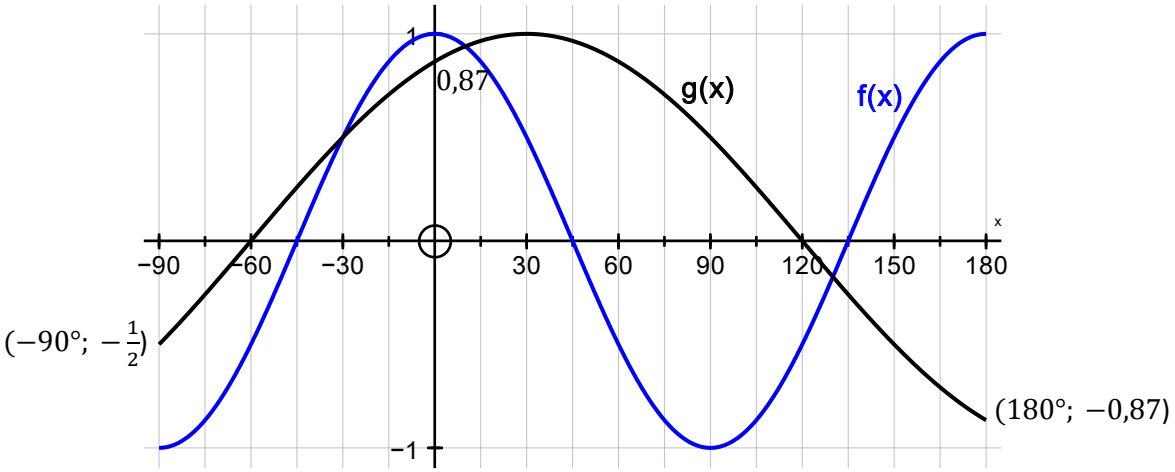
QUESTION 7

7.1 $f(x) = \cos 2x$ and $g(x) = \sin(x + 60°)$ for $x \in [-90°; 180°]$



$f(x)$: ✓$y-int.$ ✓$x-int.$ ✓Max & $Min\ points$ (3) R

7.2 $\cos 2x = \sin(x + 60°)$

$\therefore \cos 2x = \cos\big(90° - (x + 60°)\big)$

$\therefore \cos 2x = \cos(30° - x)$ ✓

Q1: $\therefore 2x = 30° - x + n.360°; n \in Z$ ✓ or Q4: $2x = 360° - 30° + x + n.360°$ ✓

$\therefore 3x = 30° + n.360°$ $x = 330° + n.360°$ ✓

$\therefore x = 10° + n.120°$ ✓

$\therefore x = -30°\ or\ 10°\ or\ 130°$ ✓

OR

$\sin(x + 60°) = \cos 2x$

$\therefore \sin(x + 60°) = \sin(90° - 2x)$ (✓)

$\therefore x + 60° = 90° - 2x + n.360°; n \in Z$ (✓) or $x + 60° = 180° - 90° + 2x + n.360°$ (✓)

$\therefore 3x = 30° + n.360°$ $-x = 30° + n.360°$

$\therefore x = 10° + n.120°$ (✓) $x = -30° - n.360°$ (✓)

$\therefore x = -30°\ or\ 10°\ or\ 130°$ (✓) (6) C

7.3.1 $-30° < x < 10°$ ✓ or $130° < x \leq 180°$ ✓ (2) C

7.3.2 $-60° < x < -45°$ ✓ (1) C

[12]

QUESTION 8

8.1 $\tan\beta + \sin\beta = m$ $\tan\beta - \sin\beta = n$

$\therefore \tan\beta = m - \sin\beta$ $\therefore \tan\beta = n + \sin\beta$

$\therefore m - \sin\beta = n + \sin\beta$ ✓

$\therefore m - n = 2\sin\beta$ ✓

and $\sin\beta = m - \tan\beta$ $\sin\beta = \tan\beta - n$

$\therefore m - \tan\beta = \tan\beta - n$

$\therefore m + n = 2\tan\beta$ ✓

But $m^2 - n^2 = (m+n)(m-n)$ ✓

$= 2\tan\beta \times 2\sin\beta$ ✓

$= 4\sin\beta\,.\tan\beta$

$= RHS$

OR

$m^2 - n^2 = (m+n)(m-n)$ ✓

$= (\tan\beta + \sin\beta + \tan\beta - \sin\beta)\big(\tan\beta + \sin\beta - (\tan\beta - \sin\beta)\big)$ ✓✓

$= (2\tan\beta)(\tan\beta + \sin\beta - \tan\beta + \sin\beta)$ ✓

$= (2\tan\beta)(2\sin\beta)$ ✓

$= 4\sin\beta\,.\tan\beta$

$= RHS$

OR

$m^2 - n^2 = (\tan\beta + \sin\beta)^2 - (\tan\beta - \sin\beta)^2$ ✓✓

$= \tan^2\beta + 2\tan\beta\,.\sin\beta + \sin^2\beta$ ✓ $- \tan^2\beta - 2\tan\beta\,.\sin\beta - \sin^2\beta$ ✓✓

$= 4\sin\beta\,.\tan\beta$

$= RHS$ (5) PS

8.2 $\tan 1° \times \tan 2° \times \tan 3° \times \ldots \times \tan 87° \times \tan 88° \times \tan 89°$

$\tan 1° \times \tan 89° = 1$ …

$\tan 45° = 1$

$\therefore \tan 1° \times \tan 2° \times \tan 3° \times \ldots \times \tan 87° \times \tan 88° \times \tan 89° = 1$ ✓✓ (2) PS

[7]