AGA KHAN UNIVERSITY EXAMINATION BOARD

HIGHER SECONDARY SCHOOL CERTIFICATE

CLASS XI EXAMINATION

APRIL/ MAY 2018

Mathematics Paper II

Time: 2 hours 15 minutes Marks: 65

INSTRUCTIONS

Please read the following instructions carefully.

1. Check your name and school information. Sign if it is accurate.

I agree that this is my name and school. **Candidate's signature**

2. RUBRIC. There are TEN questions. Answer ALL questions. Choices are specified inside the paper.

3. When answering the questions:

   Read each question carefully.
   Use a black pointer to write your answers. DO NOT write your answers in pencil.
   Use a black pencil for diagrams. DO NOT use coloured pencils.
   DO NOT use staples, paper clips, glue, correcting fluid or ink erasers.
   Complete your answer in the allocated space only. DO NOT write outside the answer box.

4. The marks for the questions are shown in brackets ( ).

5. You may use a scientific calculator if you wish.

Q.1. (Total 6 Marks)

Without using calculator, apply basic operations to separate real and imaginary parts of $\frac{(3+2i)^2}{1+i} \div (2+3i)$.

Q.2. (Total 8 Marks)

a. Without expansion, verify that $\begin{vmatrix} a & b & c \\ 1 & 1 & 1 \\ bc & ac & ab \end{vmatrix} = -\begin{vmatrix} a & b & b+c \\ a^2 & b^2 & b^2+c^2 \\ 1 & 1 & 2 \end{vmatrix}$. (4 Marks)

b. The multiplicative inverse of the matrix $\begin{bmatrix} 1 & 1 & 0 \\ 0 & 2 & 1 \\ 2 & 1 & 0 \end{bmatrix}$ is $\begin{bmatrix} -1 & 0 & a \\ 2 & 0 & -1 \\ -4 & 1 & 2 \end{bmatrix}$. Find the value of a.

(4 Marks)

Q.3. (Total 6 Marks)

Find the first term (a_1), common difference (d) and the n^{th} term of an arithmetic sequence which satisfies conditions $4 \times a_6 = a_{26}$ and $a_{15} = 47$.

(ATTEMPT EITHER PART a OR PART b OF Q.4.)

Q.4. (Total 3 Marks)

a. Over a period of five years in a certain city, the number of road accidents increased by 20% per year. If there were 10,240 accidents in 2010 and the road accidents follow geometric sequence, then how many accidents occurred in 2015?

(**Note:** The answer should be the nearest whole number.)

b. Find TWO harmonic means between $\frac{1}{17}$ and $\frac{1}{32}$.

(ATTEMPT EITHER PART a OR PART b OF Q.5.)

Q.5. (Total 6 Marks)

a.

i. How many different words can be formed with the letters of word **BREAD** if

I. all letters are used? (1 Mark)

II. all letters are used and B and R always come together? (1 Mark)

III. only three letters are used? (1 Mark)

ii. A basket contains 6 white balls and 4 black balls. If all the balls are identical, then how many selections of 4 balls can be made such that at least 3 of them are white balls? (3 Marks)

(ATTEMPT EITHER PART a OR PART b OF Q.5.)

b. Two fair dice are rolled simultaneously and score on both dice is added together.

i. Complete the given table to show all possible outcomes. (2 Marks)

Die-2 \ Die-1	**1**	**2**	**3**	**4**	**5**	**6**
1	2					7
2		4			7	
3			6	7		
4			7	8		
5		7			10	
6	7					12

ii. Find the probability of obtaining the score of

I. exactly 10. (1 Mark)

II. at least 10. (1 Mark)

III. at most 10. (1 Mark)

IV. other than 10. (1 Mark)

Q.6. (Total 6 Marks)

Prove by mathematical induction that for all positive integral values of n, $7^n - 1$ is divisible by 6.

(ATTEMPT EITHER PART a OR PART b OF Q.7.)

Q.7. (Total 8 Marks)

a. Find the solution set of the equation $x^4 - 7x^3 + 12x^2 - 7x + 1 = 0$. (8 Marks)

b.

i. Solve the following system of equations. (6 Marks)

$$x^2 + y^2 + 2y = 16$$
$$3x + y = 6$$

ii. Prove that $(\omega^7 + 1)^2 = \omega$. (2 Marks)

(ATTEMPT EITHER PART a OR PART b OF Q.8.)

Q.8. (Total 7 Marks)

a.

i. Find the remaining trigonometric ratios, if $\sin\theta = \frac{5}{13}$ and the terminal ray of θ is not in the first quadrant. (4 Marks)

ii. Prove that $\frac{1-\cot^2\theta}{1+\cot^2\theta} = \sin^2\theta - \cos^2\theta$. (3 Marks)

(ATTEMPT EITHER PART a OR PART b OF Q.8.)

b.

i. Prove that $\cos(\alpha+\beta)\times\cos(\alpha-\beta)=1-(\sin^2\alpha+\sin^2\beta)$. (4 Marks)

ii. With the help of $\cos\alpha$, prove that $\sin\frac{\alpha}{2}=\pm\sqrt{\frac{1-\cos\alpha}{2}}$. (3 Marks)

(ATTEMPT EITHER PART a OR PART b OF Q.9.)

Q.9. (Total 8 Marks)

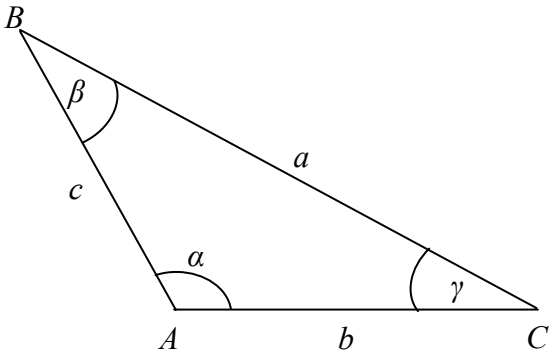
a.

i. With the help of suitable diagram of an oblique triangle *ABC*, prove that $\frac{a}{\sin\alpha} = \frac{c}{\sin\gamma}$.

(5 Marks)

Space for diagram

ii. In the given diagram, find the value of a when $b = 25$ cm, $\beta = 35^o$ and $\gamma = 30^o$ (3 Marks)



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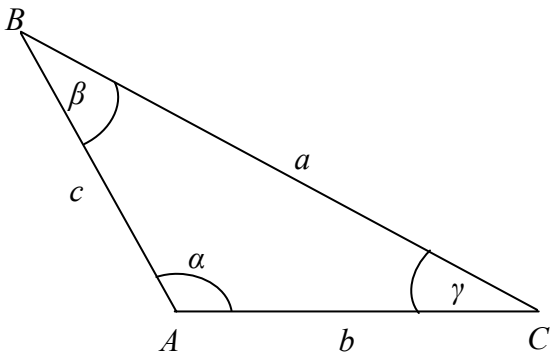
(ATTEMPT EITHER PART a OR PART b OF Q.9.)

b. Prove that $\sin\frac{\beta}{2}=\sqrt{\frac{(s-c)(s-a)}{ac}}$. (8 Marks)

(**Hint:** $\cos\beta=\cos\left(\frac{\beta}{2}+\frac{\beta}{2}\right)$ and $2s=a+b+c$)

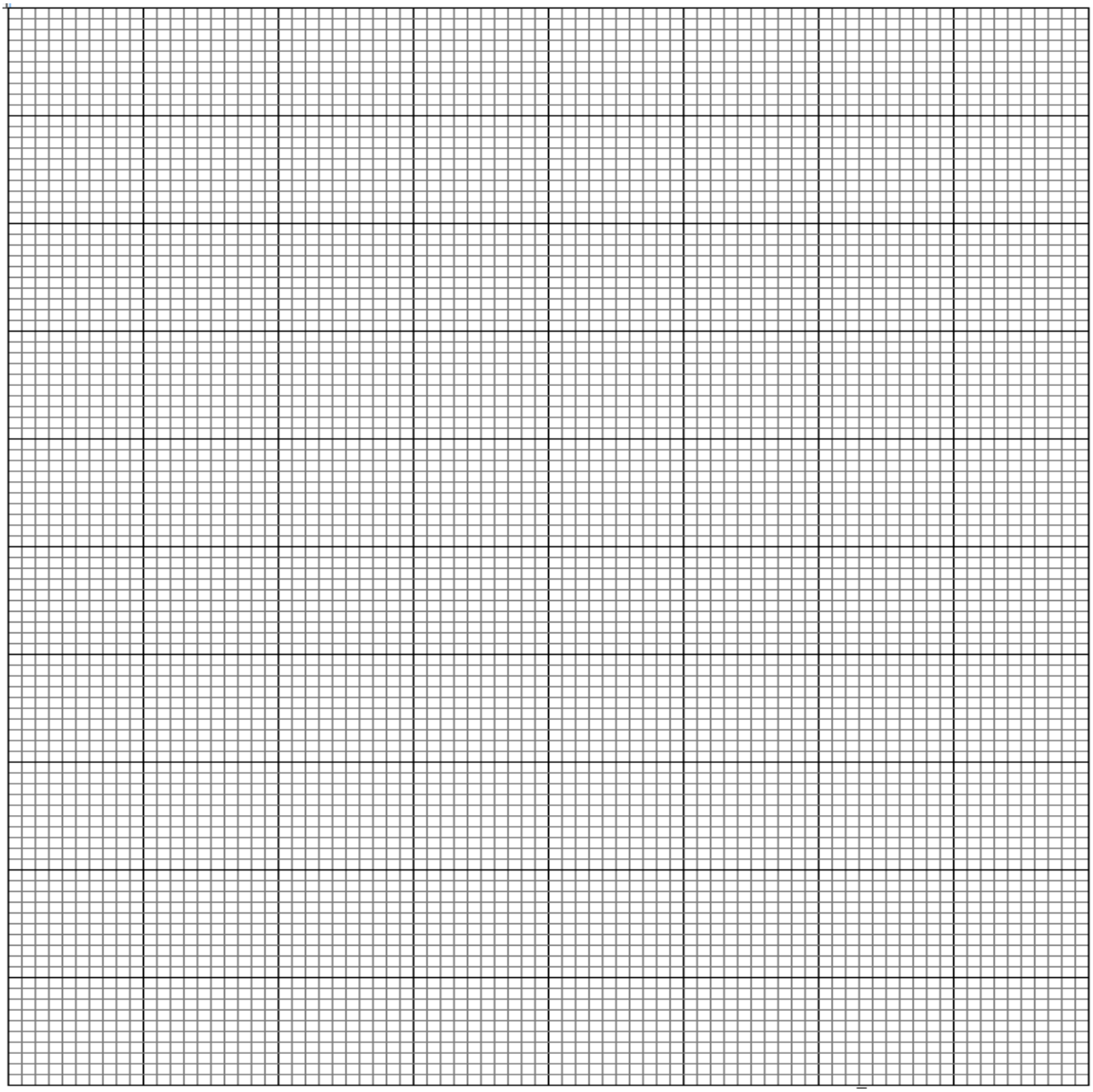


(ATTEMPT EITHER PART a OR PART b OF Q.10.)

Q.10. (Total 7 Marks)

a. Complete the following table to draw the graph of $\text{cosec}\theta$ on the given graph. Also write the range of the $\text{cosec}\theta$. (7 Marks)

θ	0	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
$\text{cosec}\theta$													



(ATTEMPT EITHER PART a OR PART b OF Q.10.)

b.

i. Find the solution set of the trigonometric equation $\sin 2x = \cos x$ when $0 \le x \le 2\pi$.

(4 Marks)

ii. Find the solution set of the trigonometric equation $\theta \tan^2 \theta + 3\theta = 0$, when $0 \le \theta \le 2\pi$.

(3 Marks)

END OF PAPER

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