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INDEX NUMBER

Anglo - Chinese School
(Independent)

THE BEST IS YET TO BE

FINAL EXAMINATION 2020
YEAR THREE EXPRESS
ADDITIONAL MATHEMATIC
PAPER 2

Thursday **8 October 2020** **1 hour 30 minutes**

Candidates answer on the Question Paper.

No additional materials are required.

READ THESE INSTRUCTIONS FIRST

Write your index number in the space at the top of this page.
Write in dark blue or black pen.
You may use an HD pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an approved scientific calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 60.

For Examiner's Use
/ 60

This document consists of **11** printed pages and **1** blank page.

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial expansion

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{r!(n-r)!} = \frac{n(n-1)\ldots(n-r+1)}{r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}ab\sin C$$

Answer **all** the questions.

1 The area of a square is $\frac{3+2\sqrt{2}}{3-2\sqrt{2}}\ cm^2$. Find the perimeter of the square in the form of $a+\sqrt{b}$, where a and b are integers. [4]

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2 The number y, of E. coli bacteria after x hours of an experiment is given by $y = 40\left(1.4^x\right)$. Find

(i) the number of E. coli bacteria at the start of the experiment, [1]

(ii) the time needed to grow the population to 1000, correcting your answer to the nearest hour. [3]

3 Given that $x^3 + 3x^2 - 2x + 16 - b(x-2)^2(x-1) \equiv ax^2(x-1) + c(x+2)$ for all values of x, find the value of each of the constants a, b and c. [4]

4 **(i)** Prove that $\dfrac{\sec^2\theta - 1}{\tan\theta + \tan^3\theta} = \sin\theta\cos\theta$. [4]

(ii) Hence, solve the equation $\dfrac{\sec^2\theta - 1}{\tan\theta + \tan^3\theta} = 2\cos^2\theta$ for $0^o \le \theta \le 360^o$. [4]

5 **(a)** Solve the equation $0.9-\cos\left(\frac{x}{2}-30^{o}\right)=0$ for $0^{o}\leq x\leq 180^{o}$ [4]

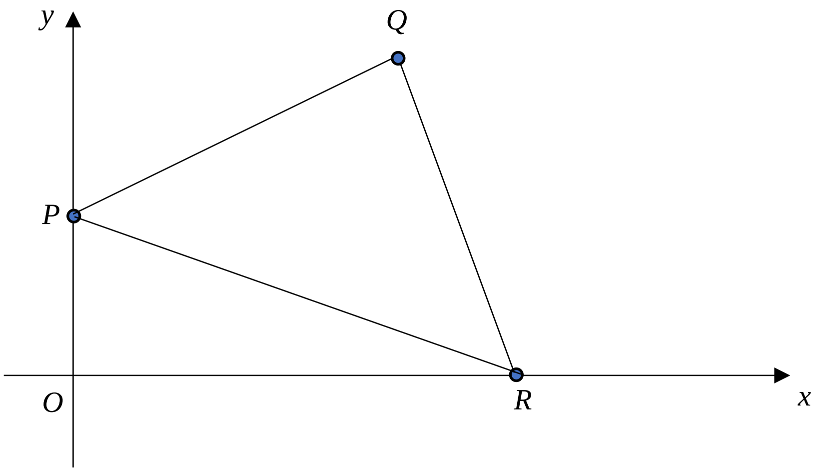
(b) Solve the equation $2\cos^{2}x+\frac{3}{co\sec x}=0$ for $0<x<2\pi$. Leave your answer (s) in terms of π.

[5]

6 **(a)** The equation of a curve is $y=\left(2-3p\right)x^2+\left(4-p\right)x+2$. Find the range of values of p for which $y > 0$. [5]

(b) Find the largest positive integer k for which the line $y=-7-kx$ does not intersect the curve $y=4x^2-3x+2$. [5]

7 In the diagram below, P and R are points on the y-axis and x-axis respectively.



(a) Given that the equation of PR is $y = -\frac{x}{2} + 5$, find the coordinates of P and R. [2]

(b) If $Q(7, q)$ lies on the perpendicular bisector of PR, find the value of q. [3]

(c) Given the point $S\left(3,-\frac{3}{2}\right)$, explain why *PQRS* is a rhombus. [2]

(d) Calculate the area of *PQRS.* [2]

8 **(a)** Solve the following equations:

(i) $5^{2x} = 2^{x-1}$ [4]

(ii) $2\left(16^{y}\right) + 2 = 5\left(4^{y}\right)$ [4]

(b) Show that the equation $7^{x+1} - 8\left(7^{-x}\right) + 1 = 0$ has only 1 real root. [4]

End of Paper 2

Answers:

1) $\left(12+\sqrt{128}\right)cm$

2i) 40 2ii) 10hrs

3) $a=2,\ b=-1,\ c=6$

4ii) 63.4^o or 243.4^o

5a) 8.3^o or 111.7^o 5b) $\frac{7\pi}{6}\ or\ \frac{11\pi}{6}$

6a) $-16<p<0$ 6b) $k=14$

7a) $P(0,5)\ and\ R(10,0)$ 7b) $q=6.5$ 7d) 50 units^2

8ai) -0.274 8aii) $-\frac{1}{2}\ or\ \frac{1}{2}$