INDEX NUMBER

Anglo - Chinese School

(Independent)

FINAL EXAMINATION 2022

YEAR THREE EXPRESS

ADDITIONAL MATHEMATICS

PAPER 1 **4049/02**

Tuesday **4 October 2022** **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

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 Solve the following pair of simultaneous equations [4]

$$2x - 5y = 7$$
$$12x^2 - 5y^2 = 7$$

2 Two variables x and y are related in such a way that when $\frac{1}{y}$ is plotted against x^2, a straight line is obtained. Given that points $A(-10, 7)$ and $B(5,1)$ lie on the line,

(i) express y in terms of x, [4]

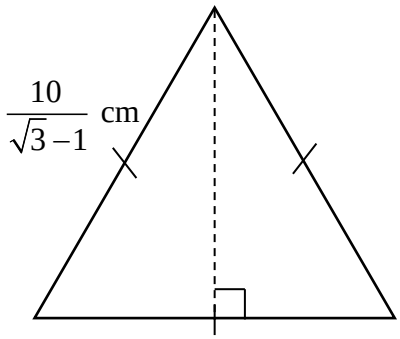
(ii) find the value of k, given that $C(0, k)$ also lies on the line. [1]

3 **(a)** The graph $y = a\cos x + b$, where $a > 0$, has a maximum value of 7 and a minimum value of 3.

Find the value of a and of b. [2]

(b) Using the value of a and of b from part (a), sketch the graph of $y = a\cos x + b$ for $0° \leq x \leq 360°$. Hence find the number of solutions for which $\cos x = -\frac{1}{4}$. [4]

4 An equilateral triangle has sides of $\frac{10}{\sqrt{3}-1}$ cm . Find the height of the triangle, expressing it in the form $(a+b\sqrt{3})$ cm . [6]



5 **(a)** Given that the curve $y = x^2 + 2(m-3)x + 25$ has a minimum value greater than 0, calculate the range of values of m. [4]

(b) Find the range of values of x for which $\dfrac{5}{-x^2+5x-6} > 0$. [3]

6 The population of a certain species of microorganisms, P, after t days can be modelled by $P = P_0 e^{nt}$, where n and P_0 are constants.

(a) After 3 days, the population of the microorganisms is doubled. Show, with clear working, that the value of n is 0.231. [3]

(b) Find the percentage increase in the population of the microorganisms after 7 days. [2]

7 Given that $\tan A = \frac{1}{2}$ and $0 < A < \pi$, find the exact value of

(i) $\sin A$, [2]

(ii) $\cos(-A)$, [1]

(iii) $\sec(\frac{\pi}{2} - A)$. [2]

8 **(a)** Given that $4x^3 - 3x^2 - 25x - 1 \equiv (Ax + 1)(x + B)(x + 2) + C$ for all real values of x, find the constants A, B and C. [5]

(b) Express $\dfrac{3x - 5}{(x + 1)^2(x - 3)}$ in partial fractions. [5]

9 Given that $p = \log_{16} q$, express the following, as simply as possible, in terms of p,

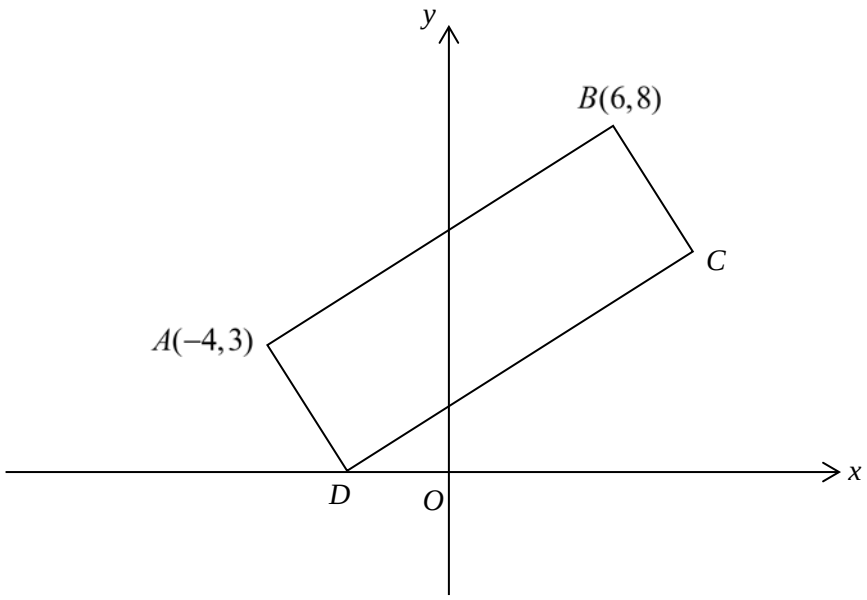
(i) $\log_{16}(\frac{1}{q})$, [1]

(ii) $\log_4 q$, [2]

(iii) $\sqrt{q}$. [2]

10 ***Solutions obtained by accurate drawing will not be accepted.***

The diagram below shows a rectangle *ABCD* and the coordinates of *A* and *B* are $(-4,3)$ and $(6,8)$ respectively. Point *D* lies on the *x*-axis.



(a) Find

(i) the coordinates of *D*, [3]

(ii) the coordinates of C. [2]

(b) Given that the coordinates of E are $(8.5, 3)$, are the points B, C and E collinear? Justify your answer.

[2]

END OF PAPER

2022 A Math Final Exam P1 Ans

1. $x=1,\ y=-1$ or $x=-1.5,\ y=-2$

2. (i) $y=\dfrac{5}{-2x^2+15}$

(ii) $k=3$

3. (a) $a=2,\ b=5$

(b) 2 solutions

4. $\dfrac{15}{2}+\dfrac{5}{2}\sqrt{3}$

5. (a) $-2<m<8$

(b) $2<x<3$

6. (b) 404%

7. (i) $\dfrac{1}{\sqrt{5}}$

(ii) $\dfrac{2}{\sqrt{5}}$

(iii) $\sqrt{5}$

8. (a) $A=4,\ B=-3,\ C=5$

(b) $-\dfrac{1}{4(x+1)}+\dfrac{2}{(x+1)^2}+\dfrac{1}{4(x-3)}$

9. (i) $-p$

(ii) $2p$

(iii) 4^p

10. (ai) $(-2.5,0)$

(aii) $(7.5,5)$