Anglo - Chinese School
(Independent)

THE BEST IS YET TO BE

FINAL EXAMINATION 2016
YEAR THREE EXPRESS
ADDITIONAL MATHEMATICS
Paper I

Friday **7 October 2016** **1 hour 30 minutes**

Additional Materials:
Answer Paper (6 Sheets)

READ THESE INSTRUCTIONS FIRST

Write your index number on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
Write your answers on the separate Answer Paper provided.
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 a scientific calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
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.**

This question paper consists of 4 printed pages.
[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

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

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

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

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

$$\sin 2A = 2 \sin A \cos A$$

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

$$\tan 2A = \frac{2\tan A}{1 - \tan^2 A}$$

Formulae for ΔABC

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

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

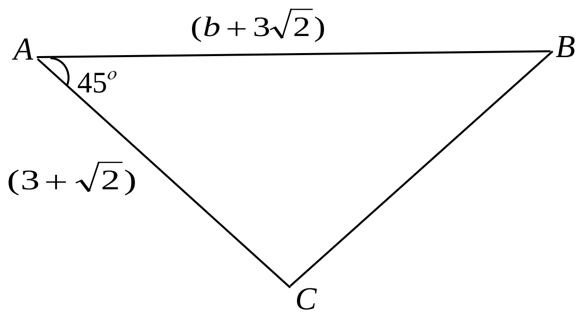
$$\Delta = \frac{1}{2}ab\sin C$$

Answer all questions

1 (i) Find the value(s) of x for which $3x^{-\frac{1}{2}} = \frac{1}{3}x^{\frac{1}{2}}$. [2]

(ii) Sketch the graph of $y = 3x^{-\frac{1}{2}}$ and of $y = \frac{1}{3}x^{\frac{1}{2}}$ on the same axes, indicating the coordinates of the point of intersection. [2]

2 In triangle *ABC* shown below, sides *AB* and *AC* are $(b + 3\sqrt{2})$ cm and $(3 + \sqrt{2})$ cm respectively and $\angle BAC = 45^o$.



Given that the area of triangle *ABC* is $(\frac{11}{2} + 3\sqrt{2})$ cm^2,

(i) show that $b = 2$, [2]

(ii) find the perpendicular distance from *B* to *AC*, leaving your answer in the form $p\sqrt{2} + q$. [3]

3 A biologist conducted a research on a particular type of bacteria. At the start of the experiment, there were 50 bacteria in the growth medium. After 8 hours, there were 960 bacteria.

The growth of bacteria is assumed to follow the equation $P = P_o e^{kt}$, where P is the number of bacteria after t hours, P_o is the initial number of bacteria and k is the growth constant.

(a) Find the value of k . [3]

(b) Determine the number of bacteria present after 1 day of growth. [1]

(c) Determine the number of hours for the number of bacteria to be 15 times the original number. [2]

4 Express $\dfrac{2(x^2 - 3)}{(x+3)(x-1)^2}$ in partial fractions. [6]

5 The expression $x^3 + 3x^2 + hx + k$ is exactly divisible by $(x-2)$ and has a remainder of 30 when divided by $(x+1)$.

(a) Find the value of *h* and of *k*. [5]

(b) Hence, or otherwise,

(i) determine the remainder when the above expression is divided by $(x-3)$, and [1]

(ii) factorise the expression completely. [3]

6 (a) Solve, for $0^o \le x \le 360^o$, the equation $4\cos ec^2 x = 3\cot x + 5$. [5]

(b) Given that $0 < z < 5$, find the maximum value of *z* such that $\tan(2z-1) = 0.6$. [4]

7 (a) (i) Sketch the graph of $y = 2\cos 2x$ for the domain $0 \le x \le 2\pi$, showing clearly the coordinates of the turning point(s). [2]

(ii) To solve the equation $2\pi\cos 2x - \pi = x$, a line must be added to the graph of (i). Find the equation of this line. [2]

(iii) Insert the line on the graph in (i). [1]

(iv) Hence determine the number of points of intersection in the interval $0 \le x \le 2\pi$, for the equation $2\pi\cos 2x - \pi = x$. [1]

(b) Given that $\sin A = \dfrac{3}{4}$ and $\cos A$ is negative, find without the use of calculators,

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

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

(iii) $\sin(\dfrac{\pi}{2} - A)$. [2]

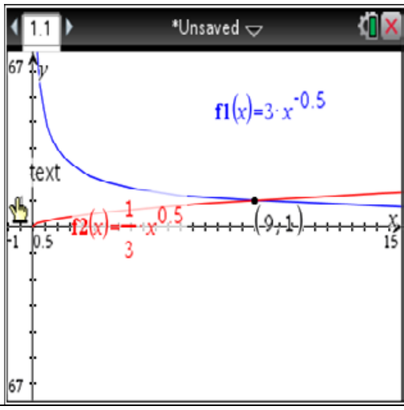
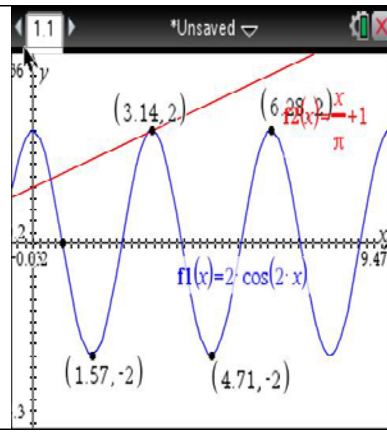
8 (a) Solve the equation $\log_2(x+1) - \log_4(x-3) = 2$. [4]

(b) Solve the equation $e^x(e^x + 3) = 18$. [3]

(c) If $4(\lg x)^2 + (\lg y)^2 = 4(\lg x)(\lg y)$, express *y* in terms of *x*. [3]

End of Paper

Answers to EOY Y3 AM Paper I

1(i) (ii)	x=9  	6(a)	104.0^0, 284.0^0, 45^0,225^0.
2(ii)	$3+\sqrt{2}$	6(b)	3.91
3(a)	0.369	7(a)(i)	
(b)	351000	(ii)	Y=(x/π)+1
(c)	7.33 hours3	(iii)	2 solutions
4	$\frac{3}{4(x+3)}+\frac{5}{4(x-1)}-\frac{1}{(x-1)^2}$	(b)(i)	$\frac{-4}{\sqrt{7}}$
5(a)	h = -16 , k = 12	(ii)	$\frac{-\sqrt{7}}{4}$
(b)(i)	18	(iii)	$\frac{-\sqrt{7}}{4}$
(ii)	(x-2)(x+6)(x-1)	8(a)	X=7
		(b)	1.10
		©	Y=x^2