

Anglo-Chinese School

(Independent)



FINAL EXAMINATION 2018 YEAR THREE EXPRESS ADDITIONAL MATHEMATICS PAPER 2

Wednesday

10 October 2018

1 hour 30 minutes

Additional Materials:

Answer Paper (6 sheets)

Graph Paper (1 sheet)

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

ALGEBRA

Quadratic Equation

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

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

Binomial expansion

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

where n is a positive integer and ${}^nC_r = \frac{n!}{r!(n-r)!} = \frac{n(n-1)\dots(n-r+1)}{r!}$.

TRIGONOMETRY

Identities

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

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

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

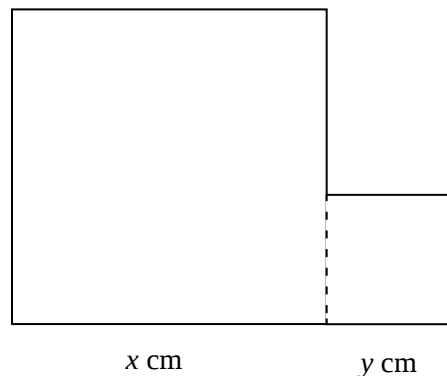
Formulae for $\triangle ABC$

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

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

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

- 1 (i) Determine the set of values of k for which the equation $x^2 + 2 = k\left(x - \frac{1}{2}\right)$ has real and distinct roots. [4]
- (ii) Hence, state what can be deduced about the curve $y = x^2 + 2$ and the line $y = 6x - 3$ [1]
- 2 Sketch the graph of $y^2 = 16x$ and $y = \frac{4}{x^2}$. Determine the coordinates of the point(s) where the two graphs intersect. [5]
- 3 An experiment is conducted to determine how much content students can remember after a lecture. Right after the lecture and every month after that, they were tested to see how much of the material they still remembered. The average score, M , was given by the proposed human memory model $M = k - 6\ln(t+1)$, where t is the number of months after the lecture. It is assumed that the average score is 30 at the beginning of the experiment.
- (i) Find the value of k . [2]
- (ii) An average score below 15 indicates that the students have forgotten most of what they learnt from the lecture. How long does the model predict for this to take place? [3]
- 4 The figure shows two square tables (not drawn to scale) placed side by side. Its combined area is 37300 cm^2 while the perimeter of the figure is 860 cm. Find the length of the sides of each table. [5]



- 5 Solve the equations:
- (a) $\log_3 x + 2 - 3\log_x 3 = 0$ [4]
- (b) $4^{2x} - 4^{\frac{x+1}{2}} = 4^{x+2} - 17$ [4]

6 (a) If $(\sqrt{a} - \sqrt{3})^2 = 5 - 4\sqrt{b}$, find the exact value of a and of b . [4]

(b) A cuboid of volume $(18 + 11\sqrt{2})\text{cm}^3$ stands on a square base of side $(1 + \sqrt{2})\text{cm}$. Find the height of the cuboid, and express the answer in surd form. [4]

7 (a) Given that A is acute such that $\cos A = \frac{1}{\sqrt{5}}$, find each of the following without the use of a calculator:

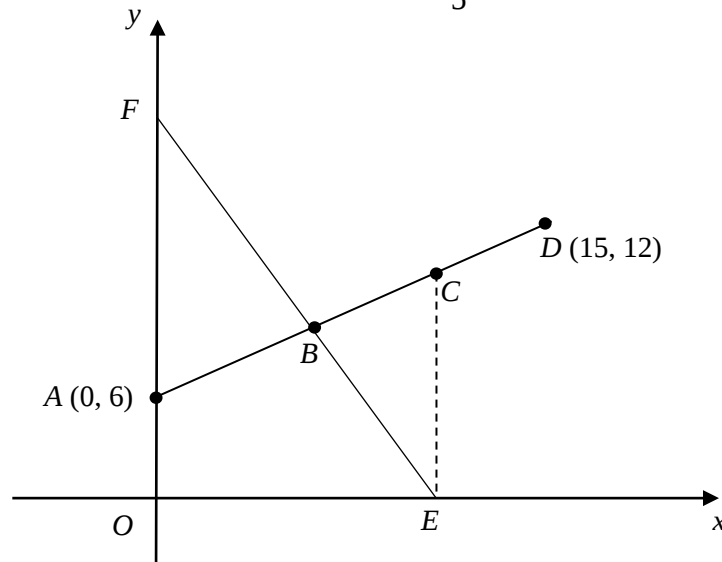
(i) $\sin A$ [2]

(ii) $\frac{2 \cos \frac{\pi}{3}}{\tan(90^\circ - A)}$ [3]

(b) (i) Prove that $\frac{\cos x}{1 - \sin x} - \frac{1}{\cos x} = \tan x$. [3]

(ii) Hence, or otherwise, solve $\frac{\cos x}{1 - \sin x} = \frac{1}{\cos x} - 5$ for $0^\circ < x < 360^\circ$. [3]

8 In the diagram below, point E lies on the x -axis and point C lies on the line AD . The lines AD and EF intersect at point B and the equation of EF is $y = -\frac{8}{5}x + 16$.



(i) Find the coordinates of B . [3]

(ii) Given that C is vertically above E , find the coordinates of C . [2]

(iii) Find the area of $\triangle ABE$ and hence, calculate the shortest distance from B to AE . [4]

(iv) Find the perpendicular bisector of OD and determine if it passes through E . [4]

-----The End -----

Answers:

(1i) $k < -2$ or $k > 4$ (1ii) Roots are real and distinct

(2) (1, 4)

(3i) $k = 30$ (3ii) 12

(4) 180 cm by 70 cm or 164 cm by 102 cm

(5a) $x = \frac{1}{27}$ or 3 (5b) $x = 0$ or $x = 2.04$

(6a) $a = 2$ or $b = \frac{3}{2}$ (6b) $(10 - 3\sqrt{2})\text{cm}$

(7ai) $\frac{2\sqrt{5}}{5}$ (7aii) 2 (7bii) 101.3° or 281.3°

(8i) $B(5, 8)$ (8ii) $C(10, 10)$ 8(iii) 4.29 units 8(iv) $y = -\frac{5}{4}x + \frac{123}{8}$, does

not pass through.