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**Anglo - Chinese School**  
**(Independent)**



**FINAL EXAMINATIONS 2020**  
**YEAR 3 INTEGRATED PROGRAMME**  
**CORE MATHEMATICS**  
**PAPER 1**

**FRIDAY**

**2<sup>nd</sup> OCTOBER 2020**

**1 h 30 min**

Candidates answer on the Question Paper.  
No additional materials are required.

**INSTRUCTIONS TO CANDIDATES**

- Write your index number in the boxes above.
- Do not open this examination paper until instructed to do so.
- You are not permitted access to any calculator for this paper.
- Answer all questions in the spaces provided.
- Unless otherwise stated in the question, all numerical answers must be given exactly or correct to three significant figures.
- The maximum mark for this paper is 80.

**For Examiner's Use**

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This paper consists of 17 printed pages and 1 blank page.

[Turn over

Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

Answer **all** the questions in the spaces provided.

**1** [Maximum mark: 4]

(a) Evaluate  $(\sqrt{2} - \sqrt{10002})(\sqrt{10002} + \sqrt{2})$  [2 marks]

(b) If  $\frac{a-b}{a+b} = 2$ , find the value of  $\frac{a}{b}$ . [2 marks]

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[Maximum mark: 6]

(a) Express  $\frac{2}{m+4} + \frac{3}{m-2}$  as a single fraction.

[2 marks]

**(b)** Make  $y$  the subject of the formula  $x = \frac{y+z}{y-z}$ .

[4 marks]

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

3

[Maximum mark: 7]

(a) Simplify  $\left(\frac{x^2 - 3x}{4x}\right)\left[\frac{5(x+1)}{x-3}\right]$ .

*[3 marks]*

(b) (i) Hence, solve  $0 \leq \left( \frac{x^2 - 3x}{4x} \right) \left[ \frac{5(x+1)}{x-3} \right] < 5$ .

*[3 marks]*

**(ii)** State the largest integer value of  $x$  that satisfy the inequalities.

[1 mark]

[illegible]

4

A cuboid consisting of a rectangular base of breadth  $3 - \sqrt{5}$  cm and length  $\sqrt{5} + 1$  cm has a volume of  $48 - 16\sqrt{5}$  cm<sup>3</sup>. Find the height of the cuboid in the form  $a(\sqrt{5} - 1)$ , where  $a$  is an integer to be determined. [5 marks]

This image shows a full page of white paper with horizontal dotted lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

5

[Maximum mark: 9]

Consider the equation  $y = -x^2 - 6x + 15$ ,

- (a) Write the expression  $-x^2 - 6x + 15$  in the form  $-(x+h)^2 + k$ , where  $h$  and  $k$  are constants to be determined. [2 marks]
- (b) State the coordinates of the turning point of  $y = -x^2 - 6x + 15$ . [1 mark]
- (c) Solve the equation  $-x^2 - 6x + 15$ , **simplifying** your answers and leaving them in **surd form**. [3 marks]
- (d) Sketch the graph of  $y = -x^2 - 6x + 15$ , stating the coordinates of the points of intersection with the axes and turning point clearly. [3 marks]

.....[Working may be continued next page]

[Continuation of working space for Question 5].....

[illegible]

**6** *[Maximum mark: 12]*

Solve the following equations, leaving your answers in **exact form**.

(a)  $7^{x+3} = 1^x$  [2 marks]

**(b)**  $e^{x+2} = 2^{x-1}$  *[4 marks]*

(c)  $3^{x^2} - 18(3^{-x^2}) = 7$  [6 marks]

.....[Working may be continued next page]

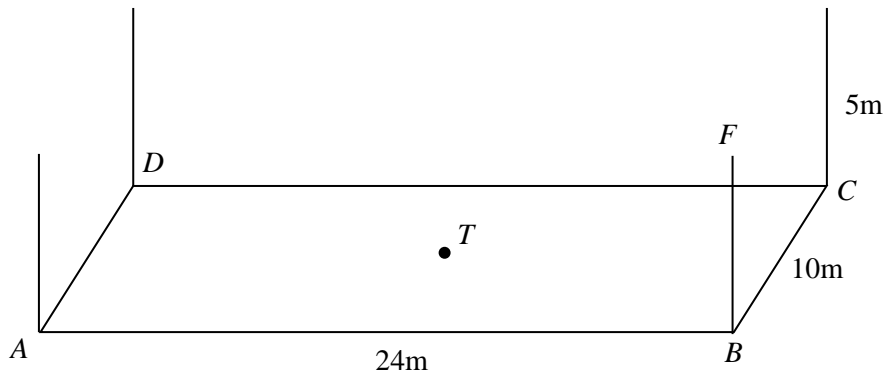


[Continuation of working space for Question 6].....

This image shows a full page of a handwriting practice worksheet. It consists of approximately 20 horizontal rows. Each row is defined by two parallel dotted lines, creating a series of uniform gaps for writing. The entire page is otherwise blank, with no margins, text, or other markings.

7 [Maximum mark: 7]

The diagram below shows a small field where  $A$ ,  $B$ ,  $C$  and  $D$  are points on level ground. Four vertical poles are erected at each corner. The height of each pole is 5m,  $T$  is the center of the field and  $BF$  is the pole at  $B$ . It is known that  $AB = 24\text{m}$  and  $BC = 10\text{m}$ .



(a) Find the length

(i)  $TB$  [2 marks]

(ii)  $TF$  [2 marks]

(b) Hence, find

(i)  $\tan \angle FTB$  [1 mark]

(ii)  $\cos \angle FTD$  [2 marks]

Leave your answers in surd form where applicable.

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.....[Working may be continued next page]

[Continuation of working space for Question 7].....

This image shows a full page of white paper designed for handwriting practice. It features approximately 20 evenly spaced horizontal dotted lines running across the width of the page. There are no margins, text, or other markings present.

**8** [Maximum mark: 9]

In the diagram below, the points  $A(-2, 2)$  and  $B(6, 8)$  are two vertices of a quadrilateral  $ABCD$ .  $AD$  is parallel to the vertical axis and is equal in length to  $AB$ .

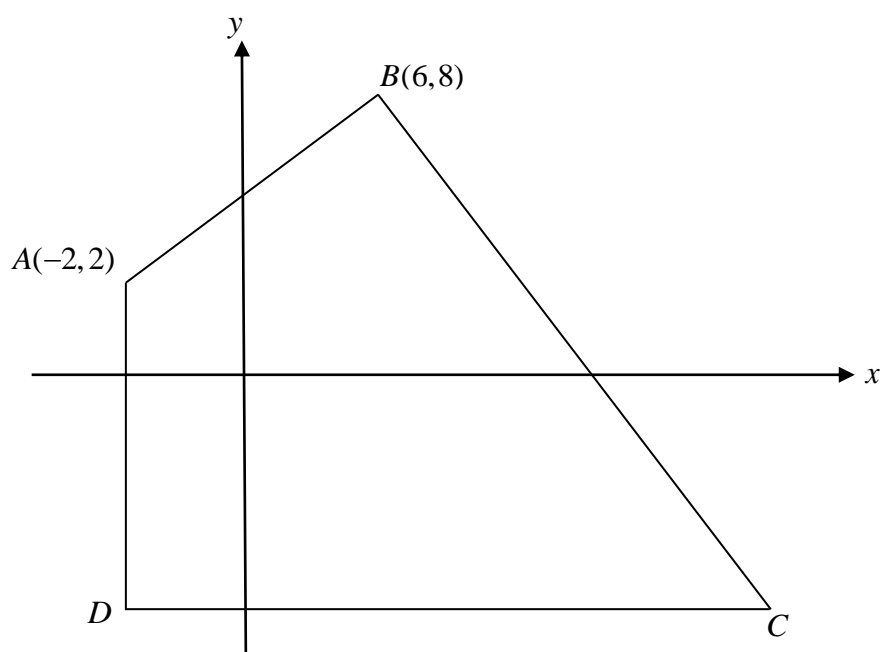
(a) Find the coordinates of point  $D$ . [2 marks]

(b) Show that the equation of the perpendicular bisector of  $BD$  is  $y = -\frac{1}{2}x + 1$ . [4 marks]

It is further given that  $DC$  is parallel to the  $x$  axis and point  $C$  lies on the perpendicular bisector of  $BD$ .

(c) Find the coordinates of  $C$  [2 marks]

(d) Find the area of  $\triangle ABC$ . [1 mark]



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.....[Working may be continued next page]

[Continuation of working space for Question 8].....

This image shows a full page of a worksheet designed for handwriting practice. It consists of approximately 20 horizontal rows. Each row is defined by two parallel dotted lines, creating a series of uniform gaps for writing. The entire page is otherwise blank, with no text or other markings.

9

[Maximum mark: 8]

- (a) Find the range of values of  $k$  such that  $y = x^2 - kx + 3 - k$  intersects the  $x$ -axis at two points. [3 marks]
- (b) The roots to the equation  $x^2 - 4x + 5 = 0$  are  $p$  and  $q$ . Find the quadratic equation in terms of  $k$ , whose roots are  $kp$  and  $kq$ . [5 marks]

.....[Working may be continued next page]

[Continuation of working space for Question 9].....

This image shows a full page of white paper designed for handwriting practice. It features approximately 20 evenly spaced horizontal dotted lines running from left to right across the entire width of the page. There are no margins, text, or other markings present.

**10** *[Maximum mark: 13]*

- (a) Find the value of  $p$  in the equation  $6\log_3(p-5) = 12$ . [3 marks]
- (b) Solve the equation  $\log_9 x + \log_x 81 = 3$ . [5 marks]
- (c) Explain, with clear mathematical reasonings, if there are any solutions to the equation  $\log_4(x-3)^2 + 2\log_2 \sqrt{x+1} = \log_2(3-x)$ . [5 marks]

.....[Working may be continued next page]



[Continuation of working space for Question 10].....

This image shows a full page of a document template designed for handwriting practice or general note-taking. It consists of approximately 28 evenly spaced, horizontal dotted lines extending across the width of the page. The background is plain white, providing a clear contrast for the grey dots. There are no margins, headers, footers, or other markings present on the page.

**End of Paper 1**

## Answer Key

1a) -10000

1b) -3

2a)  $\frac{5m+8}{(m+4)(m-2)}$

2b)  $y = \frac{z(x+1)}{x-1}$

3a)  $\frac{5}{4}(x+1)$

3bi)  $-1 \leq x < 3$

3bii) 2

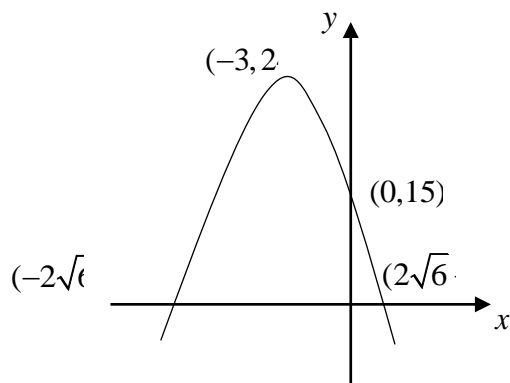
4)  $h = 4(\sqrt{5} - 1)$

5a)  $-(x+3)^2 + 24$

5b)  $(-3, 24)$

5c)  $x = \pm 2\sqrt{6} - 3$

5d)



6a)  $x = -3$

6b)  $x = \frac{-2 - \ln 2}{1 - \ln 2}$

6c)  $x = \pm\sqrt{2}$

7ai) 13cm

7aii)  $\sqrt{194}$  cm

7bi)  $\frac{5}{13}$

7bii)  $-\frac{13}{\sqrt{194}}$

8a)  $D = (-2, -8)$

8b) Showing Question

8c)  $C = (18, -8)$

8d) 100

9a)  $k < -6, k > 2$

9b)  $x^2 - 4kx + 5k^2 = 0$

10a)  $p = 14$ .

10b)  $x = 81, x = 9$

10c)  $x = 0$