Name ______________________________ ( )	Class 4 _______

ANGLICAN HIGH SCHOOL
PRELIMINARY EXAMINATION 2017
SECONDARY FOUR

S4

ADDITIONAL MATHEMATICS **4047/01**
Paper 1 **Monday 7 August 2017**
2 hours

Additional Materials: 7 Writing Papers

READ THESE INSTRUCTIONS FIRST

Write your name and index number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.
If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, attach the entire set of question papers on top of your answer scripts.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is **80**.

For Examiner's Use

Question	1	2	3	4	5	6	7	8	9	10	11	12
Marks												

Table of Penalties		**Qn. No.**		
Presentation	–1			
Units	–1			
Significant Figures	–1		**Parent's/ Guardian's Name/ Signature/ Date**	80

This question paper consists of 5 printed pages.

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

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$
$$a^2 = b^2 + c^2 - 2bc\cos A$$
$$\Delta = \frac{1}{2}ab\sin C$$

1 The line $x + y = h$, where h is a constant, is tangent to the curve $y = 3x^2 + 5x$ at the point R. Find the value of h and the coordinates of R. [5]

2 Without using a calculator, find the values of the integers m and n for which the solution of the equation $x\sqrt{12} = x\sqrt{\dfrac{2}{27}} + \sqrt{108}$ is $\dfrac{m + n\sqrt{2}}{161}$. [5]

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

4 **(a)** The graph of $y = |3x + q|$ passes through the point $(-2, 5)$, find the possible values of q. [2]

(b) **(i)** Solve the inequality $|3x - 5| > 4$. [2]

(ii) Sketch the graph of $y = |3x - 5| - 4$ for $0 \le x < 2$. [2]

5 **(i)** Sketch the graph of $y^2 = \dfrac{x}{32}$ where $x \ge 0$. [2]

(ii) Find the x-coordinates of the points of intersection when the curve, $y = x^3$ meets the curve $y^2 = \dfrac{x}{32}$. [3]

6 **(a)** Given that $A = \tan^{-1}(-5)$, where A is the principal value, find the exact value of

(i) $\cot A$ [1]

(ii) $\sec A$ [1]

(iii) $\sin(-A)$ [1]

(b) Sketch the graph of $y = 4\tan\left(\dfrac{x}{3}\right)$ where $-\pi \le x \le \pi$. [3]

7 **(a)** Prove that $\sec x \operatorname{cosec} x = \cot x + \tan x$. [3]

(b) Solve the equation $\cos^2 y - \sin^2 y = 4\sin y\cos y$ for $-180° \le y \le 180°$. [5]

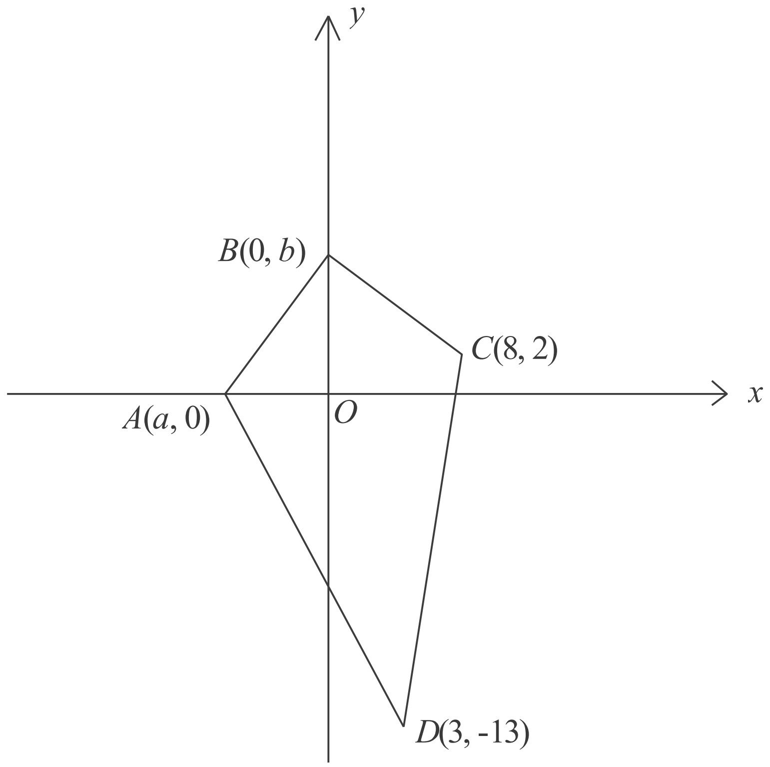
8 The diagram shows a kite $ABCD$ in which the coordinates of C and D are (8, 2) and $(3,-13)$ respectively. Given that the point $A(a, 0)$ and $B(0, b)$ lie on the x-axis and y-axis respectively, find the

(i) gradient of CD, [1]

(ii) coordinates of A and of B, [4]

(iii) midpoint of AC and [1]

(iv) area of the kite. [2]



9 **(a)** Find the equation of the tangent to the curve $y=(2x-1)^3$, for $x>\frac{1}{4}$, which is perpendicular to the line $3y+2x=9$. [7]

(b) A curve is such that $\frac{dy}{dx}=6\cos 2x+1$ and passes through the point $\left(\frac{\pi}{4},\frac{\pi}{4}+1\right)$. Find the equation of the curve. [3]

10 **(a)** **(i)** Find $\frac{d}{dx}\left(e^{x^2}\right)$. [1]

(ii) Hence, evaluate $\int_0^1 xe^{x^2}\,dx$. [2]

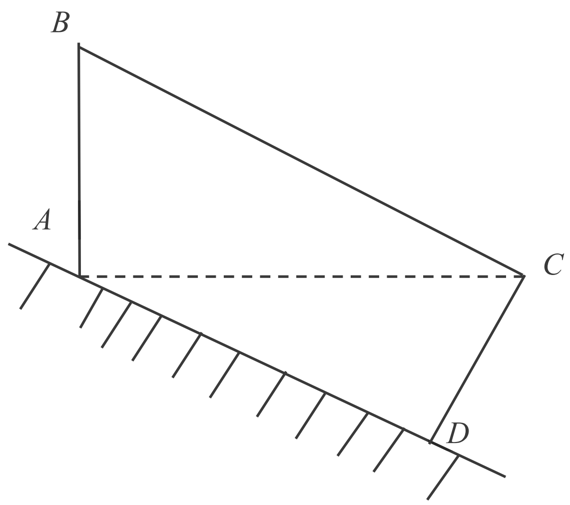
(b) Given that $f(x)=\frac{\ln x}{x-1}$ for $x>1$.

(i) Show that $f'(x)=\frac{x(1-\ln x)-1}{x(x-1)^2}$. [2]

(ii) Hence, find the equation of the normal to the curve $y=f(x)$ at the point where $x=2$. [3]

11 Find the positive number, x, when added to twice its reciprocal gives a minimum sum. [5]

12 The diagram shows the plan of a field. On one side of the field is a wall AD. The farmer wants to fence up the field represented by the solid lines, AB, BC and CD.



Angles BAC and CDA are right angles, $\angle ACB=\angle DAC=\theta$ radians, and $BC=50$ m.

(i) Show that the total length of fencing, P m, is given by $P=25\sin 2\theta+50\sin\theta+50$. [2]

(ii) Determine the stationary value of P. [5]

(iii) Give a reason why this value of P is a maximum value. [2]

END OF PAPER