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Name	Register Number	Class
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GREENRIDGE SECONDARY SCHOOL

End-of-Year Examination 2016 Secondary 3 Express

ADDITIONAL MATHEMATICS Paper 1

4047/1
October 2016
2 hours

Additional Materials: Answer Paper

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READ THESE INSTRUCTIONS FIRST

Write your name, register number and class on all the work you hand in.
Write in dark blue or black pen.
You may use a 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.

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 80.

Setter: Mrs Goh-Kok Mei Leng

For Examiner's Use

80

This paper consists of 5 printed pages, including this cover page.

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

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

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

Binomial Theorem

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

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!} = \frac{n(n-1)\cdots(n-r+1)}{r!}$

2. TRIGONOMETRY

Identities

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

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

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

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

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

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

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

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

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

$$\sin A + \sin B = 2 \sin \frac{1}{2}(A + B) \cos \frac{1}{2}(A - B)$$

$$\sin A - \sin B = 2 \cos \frac{1}{2}(A + B) \sin \frac{1}{2}(A - B)$$

$$\cos A + \cos B = 2 \cos \frac{1}{2}(A + B) \cos \frac{1}{2}(A - B)$$

$$\cos A - \cos B = -2 \sin \frac{1}{2}(A + B) \sin \frac{1}{2}(A - B)$$

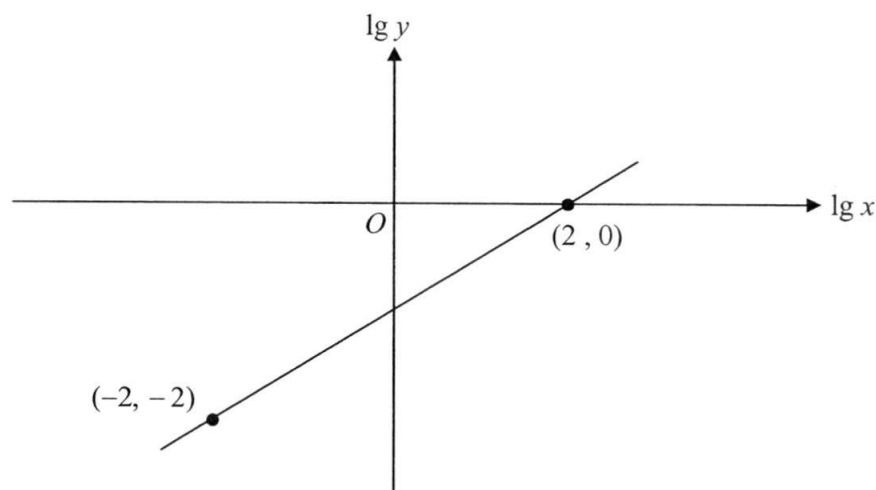
Formulae for $\triangle ABC$

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

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

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

- 1 The line $2y - x = 3$ meets the curve $x^2 - xy - y^2 = 1$ at the points P and Q . Show that the distance PQ can be expressed in the form $a\sqrt{b}$, where a and b are integers. [5]
- 2 Simplify
- (i) $(2\sqrt{3} - \sqrt{10})(3\sqrt{6} + 2\sqrt{5})$, [2]
- (ii) $\sqrt[3]{16} + \sqrt[3]{250} - \sqrt[3]{\frac{125}{4}}$. [3]
- 3 Find the range of values of k for which the expression $k(x^2 + 2x + 3) - 4x - 2$ is always positive for all real values of x . [4]
- 4 The diagram shows part of the straight line graph drawn to represent the equation $y = ax^b$. Given that the straight line passes through $(2, 0)$ and $(-2, -2)$, find the value of a and of b . [4]



- 5 $(x - 2)$ is a factor of the polynomial $x^3 - 4x^2 + ax + b$, where a and b are constants. It leaves a remainder of -60 when the polynomial is divided by $x + 3$.
- (i) Find the value of a and of b . [4]
- (ii) Factorise the polynomial completely and hence solve the equation $(x + 1)^3 - 4(x + 1)^2 + (x + 1) + 6 = 0$. [5]
- 6 (a) Express $\frac{9x + 6}{(2x - 3)(x^2 + 1)}$ in partial fractions. [4]

- (b) Divide $x^2 - x + 1$ by $x^2 - 5x - 6$. Hence, express $\frac{x^2 - x + 1}{x^2 - 5x - 6}$ in partial fractions. [5]
- 7 The equation $2x^2 - 3x + 4 = 0$ has roots α and β . Write down the value of $\alpha + \beta$ and $\alpha\beta$.
Find the equation whose roots are $\alpha + \frac{1}{\alpha}$ and $\beta + \frac{1}{\beta}$. [7]
- 8 (a) Find, in ascending powers of x , the first 4 terms in the expansion of $\left(2x - \frac{1}{2}\right)^9$. Hence
obtain the coefficient of x^7 in the expansion $(1-x)\left(2x - \frac{1}{2}\right)^9$. [4]
- (b) The term independent of x in the binomial expansion of $\left(x^3 + \frac{a}{x^2}\right)^{10}$ is 210. Find the
values of a . [4]
- 9 (a) Express $(11 + \sqrt{3}) - \left(\frac{13}{4 + \sqrt{3}}\right)^2$ in the form $a + b\sqrt{3}$, where a and b are integers to be
determined. [4]
- (b) Given that $\frac{9^{n+2} - 3^{2n+2}}{2^5} = 2^a 3^b$, where a and b are integers, find the value of a and
express b in terms of n . [3]
- 10 Solve the following equations.
(i) $\log_5(x-1) + \log_5(x-2) = 2\log_5 \sqrt{6}$ [3]
(ii) $\log_2 x = 4 - 3\log_x 2$ [4]
- 11 (i) Using the substitution $u = 2^x$, express the equation $8^x + 48 = 7(4^x)$ as a cubic equation
in u . [2]
(ii) Show that $u = 4$ is the only integer solution of this equation. [3]
(iii) Hence find the integral value of x for $8^x + 48 = 7(4^x)$. [1]

- 12 The line $3y - 2x = 6$ meets the x -axis at A and the y -axis at B . Find
- (i) the coordinates of A and B , [2]
 - (ii) the area of triangle OAB , where O is the origin, [1]
 - (iii) the line which is parallel to AB and which passes through the point $C(4, -4)$, [2]
 - (iv) the coordinates of the point D if $ABCD$ is a parallelogram, [2]
 - (v) the area of $ABCD$. [2]

End of Paper

Greenridge Secondary School
Preliminary Examination 2016
Secondary 4 Express Additional Mathematics Paper 1

Qn	Parts	Answer
1		$P(13,8)$ and $Q(-1,1)$ Dist = $7\sqrt{5}$ units
2	(i)	$8\sqrt{2} - 2\sqrt{15}$
	(ii)	$\frac{9}{2}\sqrt[3]{2}$
3		$k < -2$ (NA), $k > 1$
4		$a = \frac{1}{10}$, $b = \frac{1}{2}$
5	(i)	$a = 1$, $b = 6$
	(ii)	$f(x) = (x-2)(x-3)(x+1)$ $x = 1, 2, -2$
6	(a)	$\frac{6}{2x-3} - \frac{3x}{x^2+1}$
	(b)	$1 + \frac{31}{7(x-6)} - \frac{3}{7(x+1)}$
7		$x^2 - \frac{9}{4}x + \frac{13}{8} = 0$
8	(a)	1824
	(b)	1 or -1
9	(a)	$-8 + 9\sqrt{3}$
	(b)	$a = -2$, $b = 2n + 2$
10	(i)	$x = 4$ or -1 (NA)
	(ii)	8 or 2
11	(i)	$u^3 - 7u^2 + 48 = 0$
	(iii)	$x = 2$
13	(i)	$A(-3,0)$ and $B(0,-2)$
	(ii)	3 unit^2

	(iii)	$y = \frac{2}{3}x - \frac{20}{3}$
	(iv)	$D(1, -6)$
	(v)	26 units ²