Class	Register No	Name

Bukit Merah Secondary School
Mid-Year Examination 2016
Secondary 3 Express

E

ADDITIONAL MATHEMATICS 4047

10 May 2016

Additional Materials: Writing Paper (8 sheets)
Cover Page

2 hours

READ THESE INSTRUCTIONS FIRST

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

Answer **all** the questions.
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 the marks for this paper is **80**.

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Mathematical Formulae

Quadratic Equation

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

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

Binomial Theorem

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

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

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1. $P(x)$ is a cubic polynomial. The graph of $y = P(x)$ intersects the x-axis at -4, -1 and $\frac{1}{2}$ and passes through the point (0, 16). Find an expression for $P(x)$. [3]

2. Solve the simultaneous equations

$$0.5^{x}(4^{3y}) = 16$$

$$\log_4 2x + \log_4 (x+3y) = 1$$

[5]

3. The polynomial $f(x)$ is such that $f(x) = 3x^3 + ax^2 + bx + c$, where a, b and c are constants, is divisible by $x-1$ but leaves a remainder of 3 when divided by $x+2$.

(i) Show that $a - b = 10$. [3]

Given also that the remainder is 15 when $f(x)$ is divided by $x+1$.

(ii) Find the value of c. [2]

4. Express the equation $2(9^x) - 75(3^{x-1}) + 63 = 0$ as a quadratic equation in 3^x.
Hence solve the equation for x. [5]

5. Express $\dfrac{7-3x}{(1-x)(1+x-2x^2)}$ as a sum of 3 partial fractions. [7]

6. (a) The length of the two shorter sides of a right-angled triangle are $\left(2\sqrt{2}+\sqrt{3}\right)$ cm and $\left(4\sqrt{3}-\sqrt{8}\right)$ cm respectively. Find, without using a calculator, the exact value of the square of the longest side of the triangle in the form $\left(c+d\sqrt{6}\right)\text{cm}^2$, where c and d are integers. [3]

(b) The solution of the equation $x\sqrt{2} = \sqrt{135} - x\sqrt{5}$ is $a\sqrt{3} - \sqrt{b}$.
Without using a calculator, find the values of the integers a and b. [4]

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7. (a) Given that $\log_x 8 = \frac{3}{4}$, evaluate $\log_4\left(\frac{1}{x}\right)$. [3]

(b) Given that $\log_x y + \log_y x - \frac{10}{\log_x y} = 0$, express y in terms of x. [4]

8. (a) One root of the equation $2x^2 + px + 3q = 0$ is three times the other root. Express p in terms of q. [4]

(b) Given that α and β are the roots of the equation $3x^2 - 2x + 3 = 0$, form an equation whose roots are $4\alpha\beta$ and $\alpha^3 + \beta^3$. [5]

9. Solve the equations

(a) $\sqrt{3\sqrt{2x-3}} = 2$ [3]

(b) $\sqrt{5^x} \div \left(\frac{1}{5}\right)^{2x+1} = 25^{x+3}$ [3]

(c) $\log_3(10 - 9x) - 4\log_9 x = 2$ [4]

10. Solve the equation $8x^3 - 6x^2 - 5x + 3 = 0$. **Hence** solve [5]

(i) $3x^3 - 5x^2 = 6x - 8$ [3]

(ii) $8\left(2^{3y}\right) - 3\left(2^{2y+1}\right) - 5\left(2^y + 1\right) + 8 = 0$ [3]

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11. (a) Given that the coefficient of x in the binomial expansion of $\left(x+\frac{k}{x^3}\right)^9$ is 9, find the negative value of the constant k. [4]

(b) Write down, and simplify, the first three terms in the expansion of $\left(2-\frac{x}{5}\right)^8$ in ascending powers of x.

Given that the first three non-zero terms in the expansion of $(3+ax)\left(2-\frac{x}{5}\right)^8$ are $b-512x+cx^2$. Find the values of a, b and c. [7]

* * * End-of-Paper * * *

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BUKIT MERAH SECONDARY SCHOOL
2016 MID-YEAR EXAMINATION

ADDITIONAL MATHEMATICS (4047) – Answer Keys

1.	$P(x) = -4(x+4)(x+1)(2x-1)$
2.	$x = \frac{2}{3}$, $y = \frac{7}{9}$
3.	(ii) $c = 8$
4.	$2(3^x)^2 - 25(3^x) + 63 = 0$, $x = 1.14$ *or* 2
5.	$\frac{7-3x}{(1-x)^2(1+2x)} = \frac{17}{9(1-x)} + \frac{4}{3(1-x)^2} + \frac{34}{9(1+2x)}$
6.	(a) $(67-12\sqrt{6})cm^2$ (b) $a = 5$ *and* $b = 30$
7.	(a) -2 (b) $y = x^3$ *or* $y = \frac{1}{x^3}$
8.	(a) $p = \pm 4\sqrt{2q}$ (b) Quad equation is $x^2 - \frac{62}{27}x - \frac{184}{27} = 0$ *or* $27x^2 - 62x - 184 = 0$
9.	(a) $2\frac{7}{18}$ (b) $x = 10$ (c) $x = \frac{2}{3}$
10.	$x = 1$, $x = -\frac{3}{4}$ *or* $x = \frac{1}{2}$ (i) $x = 1$, $-\frac{4}{3}$ *or* 2 (ii) $y = 0$, *or* $y = -1$
11.	(a) $k = -\frac{1}{2}$ (b) $256 - \frac{1024}{5}x + \frac{1792}{25}x^2 + \ldots$, $a = \frac{2}{5}$, $b = 768$ *and* $c = 133\frac{3}{25}$

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