FUKIEN SECONDARY SCHOOL S4 First Term Uniform Test (2020-2021) Mathematics Compulsory Part (1 hour 15 minutes)

Date: 20th October 2020 Time: 8:30 a.m. - 9:45 a.m.

Name:	
Class:	No.:

Instructions to students:

- 1. This paper consists of FOUR parts, Section A, Section B, Multiple-choice Questions and Bonus Question. Section A carries 40 marks, Section B carries 22 marks, Multiple-choice Questions carry 10 marks and Bonus Question carries 4 marks.
- 2. The maximum score of this paper is 72.
- 3. Write your answers in the spaces provided in this Question / Answer Book.
- 4. Unless otherwise specified, show your workings clearly.
- 5. Unless otherwise specified, numerical answers should either be exact or correct to 3 significant figures.
- 6. The diagrams in this paper are not necessarily drawn to scale.

S4 Mathematics Section A (40 marks)

1.	Make c the subject of the formula $\frac{3-c}{2} = \frac{5b-4a}{2}$.	
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		(3 marks)
2.	Simplify $\frac{(a^4b^{-3})^2}{(a^{-1}b^3)^2}$ and express your answer with positive indices.	
	$(a^{-})^{\circ}$	(2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 -
		(3 marks)
3.	Factorize	
	(a) $3a^2 + 8ab - 3b^2$,	
	(b) $3a^2 + 8ab - 3b^2 - 12b - 4a$.	
		(3 marks)

S4 Mathematics

4.	Sol	ve each of the following equations.			
	(a)	(4x+3)(3x-1) = 0	(b)	4x - 12 = (x + 1)(x - 3)	
	(c)	(3x-2)(2x+1) = 5	(d)	$(2x+1)^2 + 4(2x+1) + 3 = 0$	
	(e)	$(5x+2)^2 + (3x-1)^2 = 40$	(f)	$6x = x^2 + 10$	
					(15 marks)
					(10 mains)

	Convert the recurring decimal 3.14 into a fraction.	
		(3 marks)
	Simplify $\frac{1}{and}$ and express the answer in the form $a+bi$	
0.	Simplify $\sqrt{2} + 3i$ and empress are answer in the form $a + br.$	
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- 7. (a) Solve the equation $20x^2 + 39x 63 = 0$.
 - (b) Ken deposits \$30 000 in a bank at the beginning of the first year, and \$58 500 at the beginning of the second year. The interest is compounded yearly at *r*% p.a. . If the total amount Ken received at the end of the second year is \$94 500, find *r*.

	(6 marks)
8. It is given that $f(x) = (x + k)(x - 1) - 2x$ and $f(k) = k^2 - 3$. Find the value(s) of k.	
	(4 marks)

Section B (9 - 22 marks)

In this section, answer EITHER part (X) OR part (Y) in each question. Do not answer both parts. If both parts in a question are attempted, only part (X) will be marked.

9. (X) Consider the quadratic equation

$$x^{2}-5kx+(5k-1)=0$$
 ... (*),

where k is a rational number.

- (a) Express the discriminant of (*) in terms of *k*.
- (b) Katie claims that the roots of (*) are both rational. Do you agree? Explain your answer.

(5 marks)

Find the discriminant for the equation $3x^2 - 14x + 19 = 0$ and determine its nature of roots. (Y) (2 marks)

10. (X) Given the quadratic equation

 $(k+3)x^{2} + 2kx + (k-9) = 0$ (*)

where *k* is a real constant.

- (a) Find the range of possible values of k if (*) has two distinct real roots.
- (b) Let *k* be the smallest integer in the range obtained in (a), and α , β be the roots of the corresponding equation.
 - (i) Find $\alpha\beta^3 + \alpha^3\beta$.
 - (ii) Hence, form a quadratic equation in x whose roots are $\alpha\beta^3$ and $\alpha^3\beta$.

(9 marks)

(Y) If α and β are the roots of the quadratic equation $2x^2 + 3x - 7 = 0$, find the values of the following expressions.

- (a) $3\alpha + 3\beta$
- (b) $\frac{1}{\alpha} + \frac{1}{\beta}$ (c) $\left(2\alpha + \frac{1}{\beta}\right)\left(2\beta + \frac{1}{\alpha}\right)$

(4 marks)

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11. (X) Figure 1 shows the graph of $y = x^2 - 8x + 20$, where $x \ge 0$. A(a, 0) and E(a + 3, 0) are two points on the *x*-axis. B(0, b) is a point on the *y*-axis. *D* and *F* are two points on the graph of $y = x^2 - 8x + 20$ so that *D* and *F* are vertically above *A* and *E* B(0, F)

respectively.

- (a) Express b in terms of a.
- (b) If the area of trapezium *AEFD* is $\frac{39}{2}$ sq. units, find all possible values of *a*.
- $y = x^{2} 8x + 20$ B (0, b) B (0, b) B (0, b) B (0, b) F (a + 3, 0) F (a + 3, 0)



(Y) Figure 2 shows the graph of $y = \frac{x^2}{2} - 3x - \frac{7}{2}$. It cuts the *x*-axis at the points *P* and *Q*. Find the coordinates of *P* and *Q*.



(3 marks)

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Multiple-choice Questions (10 marks)

12	13	14	15	16

- 12. If 4α and 4β are the roots of the quadratic equation $x^2 6x 6 = 0$, form a quadratic equation in x whose roots are α and β .
 - A. $4x^2 6x 3 = 0$
 - B. $8x^2 12x 3 = 0$
 - C. $16x^2 12x 3 = 0$
 - D. $16x^2 + 12x 3 = 0$
- 13. Solve the equation 2ax(2 ax) + ax = 2, where $a \neq 0$.
 - A. x = 0B. $x = \frac{1}{2a}$ C. $x = \frac{1}{2a}$ or $\frac{2}{a}$ D. x = 2a or a

14. If
$$\begin{cases} a^2 + 3a + k = 0 \\ b^2 + 3b + k = 0 \end{cases}$$
, $a \neq b$ and $a^2 + b^2 = 11$, then $k =$
A. -1. B. -3. C. -5. D. -7.

- 15. For the complex number $\frac{4i-7}{3}$, which of the following is correct?
 - A. Real part = 4, imaginary part = -7
 - B. Real part = -7, imaginary part = 4
 - C. Real part $=\frac{4}{3}$, imaginary part $=-\frac{7}{3}$
 - D. Real part $= -\frac{7}{3}$, imaginary part $= \frac{4}{3}$

16. If
$$f(x) = \frac{x}{x+1}$$
 where $x \neq -1$, then $f(x+1) \times f(x+2) =$
A. $\frac{x+2}{x+3}$. B. $\frac{x+1}{x+2}$.
C. $\frac{x+1}{x+3}$. D. $\frac{x}{x+3}$.

Bonus Question (4 marks)

17. It is given that $(2 + i)^2 - b(2 + i) = c$, where b and c are real numbers.

- (a) Find b and c.
- (b) Someone claims that $\frac{5}{2-i}$ is a root of the equation $x^2 bx c = 0$. Do you agree? Explain

your answer.

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END OF PAPER