FUKIEN SECONDARY SCHOOL

S3 First Term Uniform Test (2021-2022)

Mathematics

(1 hour)

Date: 9th November 2021 Name:_____

Time: 9:45 a.m. - 10:45 a.m. Class: _____ No.: _____

Instructions to students:

1. This paper consists of THREE parts, Section A, Section B and Bonus Question. Section A carries 45 marks, Section B carries 15 marks and Bonus Question carries 6 marks.

2. The maximum score of this paper is 60.

3. Attempt ALL questions in Section A and Section B.
   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.

Section A (45 marks)

1. Make b the subject of the formula $\frac{a+5}{4}=\frac{b+2}{3}$.

(3 marks)

2. (a) Solve the inequality $2(3x+1)<-8(4-5x)$ and represent the solutions graphically.
   (b) Write down the smallest integer that satisfies the inequality in (a).

(4 marks)

3. Simplify the following expressions and express your answers with positive indices.

(a) $(m^2 \times 9m^3)^2$

(b) $\dfrac{9y^{11}}{(-3y^2)^4}$

(4 marks)

4. Factorize

(a) $9r^3 - 18r^2s$,

(b) $9r^3 - 18r^2s - rs^2 + 2s^3$.

(4 marks)

5. (a) Express $1 \times 16 + 0 \times 8 + 1 \times 4 + 1 \times 2 + 0$ as a binary number.

   (b) Express $8 \times 16^5 + 15 \times 16^4 + 12 \times 16^2 + 9$ as a hexadecimal number.

(4 marks)

6. Convert the following numbers into the bases mentioned in brackets.

   (a) 123 [2]

   (b) 1230 [16]

(4 marks)

7. In Figure 1, *AB* is the altitude of *BC* in $\triangle ABC$. *BD* = 8, *BC* = 17 and $\triangle ABC \sim \triangle BDC$.

   (a) Prove that *BD* is an altitude of $\triangle ABC$.

   (b) Find the lengths of *CD* and *AC*.

(5 marks)

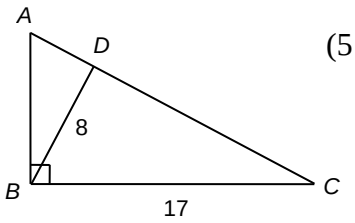

Figure 1

8. Without using a calculator, find the values of the following expressions, and express your answers in scientific notation.

   (a) $7.8\times10^{4}-6.5\times10^{5}+2.3\times10^{6}$

   (b) $\dfrac{5.63\times10^{8}-2\times10^{6}}{3\times10^{-3}}$

(5 marks)

9. Solve the following inequalities.

(a) $\frac{7x+1}{2} \leq \frac{5x-1}{4}$

(b) $\frac{1}{3}\left(5-\frac{2x-3}{6}\right) \geq x+3$

(6 marks)

10. In Figure 2, *AB* // *DC*, *BD* and *CA* are angle bisectors in $\triangle ABC$ and $\triangle BCD$ respectively. Prove that

    (a) $\triangle BCD$ is an isosceles triangle,

    (b) *CE* is the perpendicular bisector of *BD* in $\triangle BCD$. (6 marks)

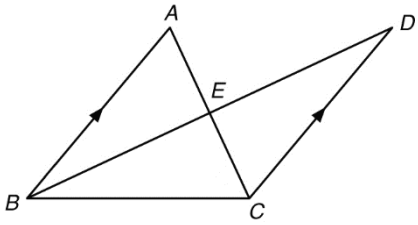

Figure 2

Section B (15 marks)

11. Simplify the following expressions and express your answers with positive indices.

(a) $\dfrac{(8mn)^0(m^2n)^4}{(4m^2n^{-7})^{-1}}$

(b) $\left[\left(\dfrac{1}{abc}\right)^{2021} \times (ab)^{2022} \times (-c)^{2023}\right]^{-1}$

(c) $\dfrac{5^{n+2} - 15 \times 5^{n-1}}{11 \times 5^n}$ (n is an integer)

(9 marks)

12. In Figure 3, I is the incentre of $\triangle ABC$ and $AI = BI = CI$. Prove that

(a) $a = b = c = d = e = f$,

(b) $\triangle ABC$ is an equilateral triangle.

(6 marks)

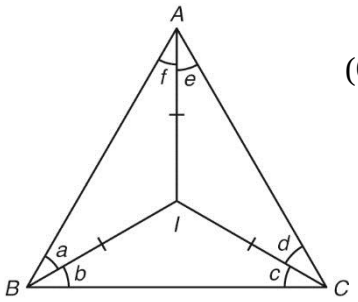

Figure 3

Bonus Question (6 marks)

13. It is given that $a \geq 7$ and $b \leq 3$.

    (a) Find the minimum values of the following expressions.

        (i) $4a^2 - 4ab + b^2$

        (ii) $3a^2 - 5ab + 2b^2$

    (b) Using the results of (a), is the value of the expression $7a^2 - 9ab + 3b^2$ not less than 181? Explain your answer.

(6 marks)

END OF PAPER