

FUKIEN SECONDARY SCHOOL
S3 First Term Examination (2020-2021)
Mathematics
(2 hours)

Date: 4th January 2021

Name: _____

Time: 10:00 a.m. - 12:00 nn

Class: _____ No.: _____

Instructions to students:

1. This paper consists of THREE parts, Conventional Questions, Multiple-choice Questions and Bonus Question. There are Section A(1), Section A(2) and Section B in Conventional Questions. Section A(1) carries 30 marks, Section A(2) carries 32 marks, Section B carries 18 marks, Multiple-choice Questions carry 20 marks and Bonus Question carries 5 marks.
2. The maximum score of this paper is 100.
3. Attempt ALL questions in Conventional Questions and Multiple-choice Questions. Write your answers in the spaces provided in this Question / Answer Book.
4. Unless otherwise specified, all workings must be clearly shown.
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 (1) (30 marks)

1. Make b the subject of the formula $\frac{5a+6b-9}{b}=8$.

(3 marks)

2. (a) Find the range of values of x which satisfies $\frac{11x-19}{5} > x-11$.

- (b) Write down the smallest integer satisfying the inequality in (a).

(3 marks)

3. Factorize

(a) $x^3 + x^2y - 7x^2$,

(b) $x^3 + x^2y - 7x^2 - x - y + 7$.

(3 marks)

4. Figure 1 shows a regular tetrahedron $ABCD$, where DQ is the height of $ABCD$, $AB \perp DM$ and $AB \perp CM$.

- (a) (i) Name the projection of DM on plane ABC .
 (ii) Name the angle between DM and plane ABC .
 (b) Name the angle between planes DAB and ABC .

(3 marks)

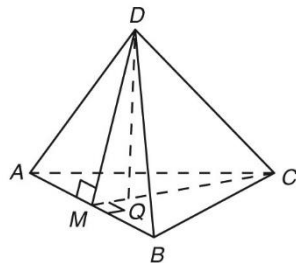


Figure 1

5. (a) Convert 108 into a binary number.
 (b) Convert $31E_{16}$ into a denary number.

(4 marks)

6. Figure 2 shows a regular pyramid $VABCD$ with a square base $ABCD$.

(a) Find VO .

(b) Hence, find the volume of the pyramid.

(4 marks)

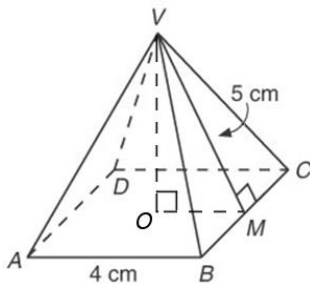


Figure 2

7. Simplify the following expressions and express your answer with positive indices.

(a) $\frac{(m^8 n^7)^2}{m^7 n^{-5}}$,

(b) $\left(\frac{-3a^3 b^0}{a^{-1} b^{-3}}\right)^{-3}$.

(5 marks)

8. In Figure 3, D and E are points on AC and BC respectively such that DE is the perpendicular bisector of BC in $\triangle ABC$. It is given that $AB \perp AC$. If $\angle DBE = 4\angle ABD$, find $\angle ACB$.

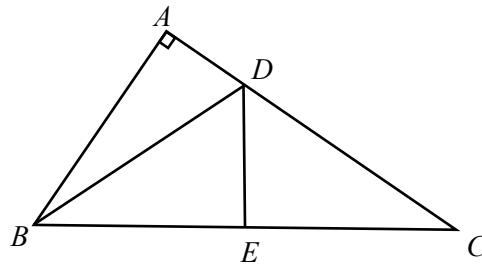


Figure 3

(5 marks)

9. Let $E = \frac{2^{3n+1} \times 8^{2n-1}}{4^{3n+2}}$.

- (b) Given that $E=1$, find n .

(5 marks)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

11. Figure 4 shows a quadrilateral $ABCD$. $\angle DAC = \angle DBC$, $AD \parallel BC$ and AC intersects BD at E .
- (a) Prove that $\triangle AED$ and $\triangle BCE$ are isosceles triangles.
- (b) If AE is the median of $\triangle ABD$, prove that $\angle BAD = 90^\circ$.

(5 marks)

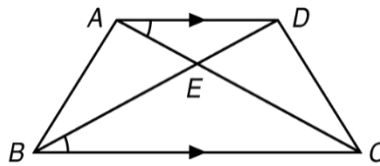


Figure 4

[illegible]

12. Tina is going to bake at least 570 cookies for a wedding party using ovens A and B . The number of cookies baked by oven A per hour is 10 more than twice the number of cookies baked by oven B per hour.
- (a) If 40 cookies can be baked by oven B in an hour and oven B can only operate for 3 hours, at least how many hours has oven A operated for?
- (b) If both ovens A and B can only operate for 4 hours, at least how many cookies should be baked by oven B in an hour?

(5 marks)

[illegible]

13. Sandy has a paper sector AOB as shown in Figure 5. The radius of the sector is 17 cm. Reflex $\angle AOB = 216^\circ$. By joining OA and OB together, the sector is folded to form a right circular cone.

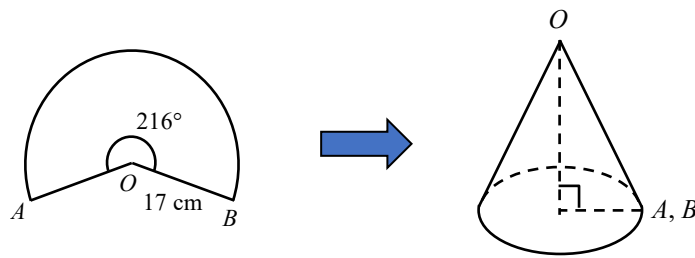


Figure 5

- Find the base radius of the cone.
- Find the volume of the cone, correct to the nearest integer.

(6 marks)

[illegible]

Handwriting practice lines consisting of 20 sets of three horizontal lines (top solid, middle dashed, bottom solid).

Handwriting practice lines consisting of 20 sets of three horizontal lines (top, middle, and bottom lines) for letter formation.

Multiple-choice Questions (20 marks)

Write down the best answer for each question into the boxes.

17	18	19	20	21	22	23	24	25	26

17. $2^{10} + 2^8 + 2^6 + 5 =$

- A. 1010100001₂.
- B. 1010100011₂.
- C. 10101000101₂.
- D. 10101000011₂.

18. Consider the following integers:

4, 4, 5, 5, 5, 5, 5, 7, 7, 8, 10, 10, 11, 12, k

Let a , b and c be the mean, the median and the mode of the above integers respectively.

If $5 \leq k \leq 7$, which of the following must be true?

- I. $a > b$
 - II. $a > c$
 - III. $b > c$
- A. II only
 - B. III only
 - C. I and III only
 - D. II and III only

19. Consider the following net as shown in Figure 8.

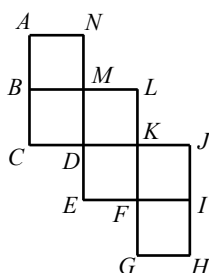


Figure 8

If the net is folded into a cube, which of the following vertices will coincide with B ?

- A. D
- B. E
- C. K
- D. H

20. Figure 9 shows the 2-D representations of a solid from various views.

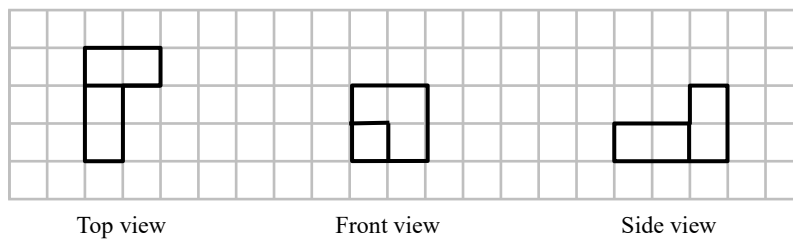
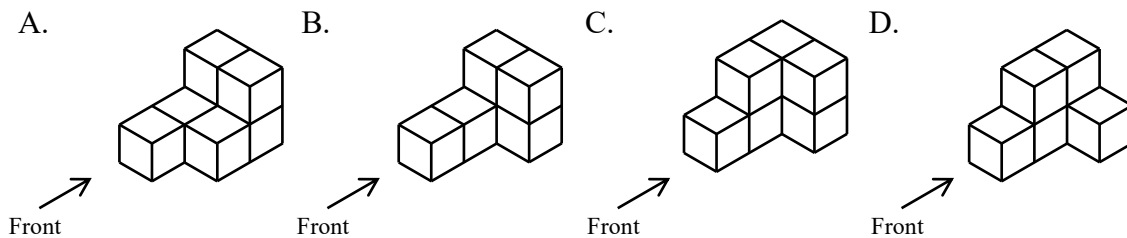


Figure 9

Which of the following could be the solid?



21. In Figure 10, PQ is an axis of rotational symmetry of the given solid. What is the order of rotational symmetry for PQ ?

- A. 6
- B. 8
- C. 10
- D. 12

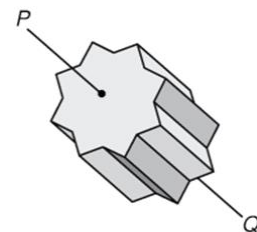


Figure 10

22. If $m > n$ and $k < 0$, which of the following must be true?

- I. $m^3 > n^3$
 - II. $\frac{m}{k^3} < \frac{n}{k^3}$
 - III. $m + nk < n + mk$
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

23. In Figure 11, AD and BE are two altitudes of $\triangle ABC$. Which of the following must be true?

- I. If $AD = CD$, then $BE = CE$.
- II. $\triangle ADC \sim \triangle BEC$
- III. O is the incentre of $\triangle ABC$.

- A. II only
- B. I and II only
- C. II and III only
- D. I, II and III

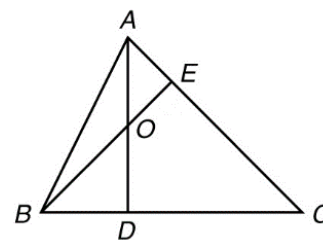


Figure 11

24. $0.000\ 050\ 987 \times 10^2 =$

- A. 5.09×10^{-3} (cor. to 3 sig. fig.).
- B. 5.10×10^{-3} (cor. to 3 sig. fig.).
- C. 5.10×10^7 (cor. to 3 sig. fig.).
- D. 5.1×10^7 (cor. to 1 d.p.).

25. The following table shows the marks of Amy and Billy in different papers of an English examination.

Paper	Comprehension	Composition	Oral
Amy	65	70	60
Billy	67	60	62
Weight	50%	30%	20%

Which of the following is/are true?

- I. Amy has a higher mean mark than Billy has.
- II. Amy has a higher weighted mean mark than Billy has.
- III. Amy's weighted mean mark is higher than her mean mark.

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

26. The ratio of the base radius and the height of a right cylinder is 3 : 2. The radius of a hemisphere is twice the base radius of the cylinder. Find the ratio of the total surface area of the cylinder to that of the hemisphere.

- A. 5 : 18
- B. 5 : 12
- C. 1 : 9
- D. 1 : 6

Bonus Question (5 marks)

27. (a) Expand $(x-1)(1+x+x^2+\dots+x^n)$, where n is a positive integer greater than 3 and $x \neq 1$.
- (b) Hence, find the value of $1+2+2^2+\dots+2^{64}$.
(Give your answer in scientific notation and correct to 3 significant figures.)

[illegible]