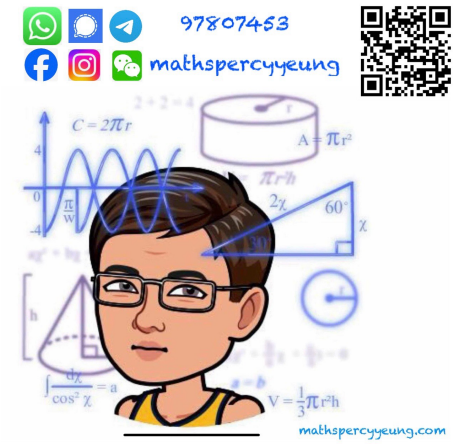
2022-2023 S4
2nd TERM UT
MATH CP

2022 – 2023
S4 Second Term Uniform Test

MATHEMATICS Compulsory Part

Question–Answer Book

16th March, 2023
8:15 am – 9:30 am (1 hour 15 minutes)
This paper must be answered in English



INSTRUCTIONS

1. Write your name, class and class number in the spaces provided on this cover.

2. Answer ALL questions in Section A. You should use an HB pencil to mark all the answers on the Answer Sheet, so that wrong marks can be completely erased with a clean rubber. You must mark the answers clearly; otherwise you will lose marks if the answers cannot be captured. You should mark only ONE answer for each question. If you mark more than one answer, you will receive NO MARKS for that question.

3. Attempt ALL questions in Sections B and C. Write your answers in the spaces provided in this Question – Answer Book.

4. Unless otherwise specified, all working must be clearly shown and numerical answers should be either exact or correct to 3 significant figures.

5. The diagrams in this paper are not necessarily drawn to scale.

Sections	Marks
A Total	**/26**
B (14 – 16)	
B (17 – 20)	
B Total	**/28**
C Total	**/16**
TOTAL	**/70**

Section A (26 marks)

Choose the best answer for each question.

1. If $a>0$ and $b>0$, then $\dfrac{1}{\sqrt[3]{a^{-1}b^3}}=$

   A. $\dfrac{a^{\frac{3}{2}}}{b^{\frac{9}{2}}}$.

   B. $a^{\frac{1}{3}}b$.

   C. $\dfrac{b^{\frac{3}{2}}}{a^{\frac{1}{2}}}$.

   D. $\dfrac{a^{\frac{1}{3}}}{b}$.

2. Simplify $\dfrac{3}{12x+6y}+\dfrac{1}{4y-8x}$.

   A. $\dfrac{2x-3y}{2(2x^2-y^2)}$

   B. $\dfrac{3y-2x}{2(2x+y)(2x-y)}$

   C. $\dfrac{2x-3y}{4(2x+y)(2x-y)}$

   D. $\dfrac{6x-y}{4(2x+y)(2x-y)}$

3. If $4^{x+1}=3(2^{2x})+64$, then $x=$

   A. 3.

   B. 4.

   C. 6.

   D. 8.

4. If $\log x<0$, then the range of values of x is

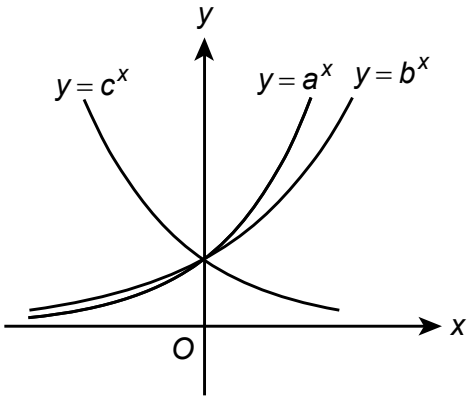
   A. $x<1$.

   B. $-1<x<0$.

   C. $0<x<1$.

   D. $x>1$.

5. The figure shows the graphs of $y=a^x$, $y=b^x$ and $y=c^x$, where a, b and c are distinct positive constants and not equal to 1. Which of the following must be true?



   I. $a>b$

   II. $ab<4$

   III. $ac>bc$

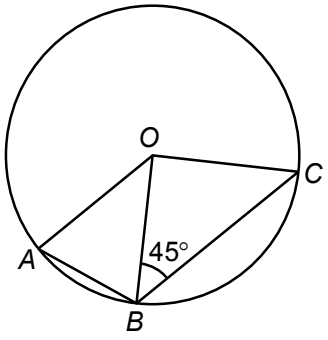
   A. I and II only

   B. I and III only

   C. II and III only

   D. I, II and III

6. In the figure, O is the centre of the circle. $\overset{\frown}{AB}:\overset{\frown}{BC}=1:2$ and $\angle OBC=45°$.



   Which of the following must be true?

   I. $OA//CB$

   II. $\angle OAC=22.5°$

   III. major $\overset{\frown}{AC}=5\overset{\frown}{AB}$

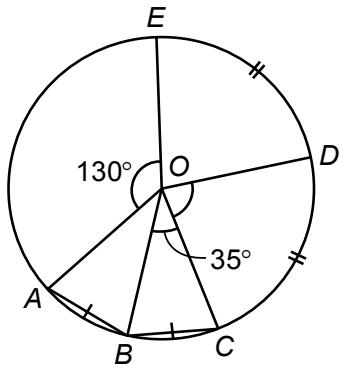
   A. I and II only

   B. I and III only

   C. II and III only

   D. I, II and III

7. In the figure, O is the centre of the circle. AB and BC are equal chords, and $\overset{\frown}{CD} = \overset{\frown}{DE}$. If $\angle BOC = 35°$ and $\angle AOE = 130°$, then $\angle COD =$



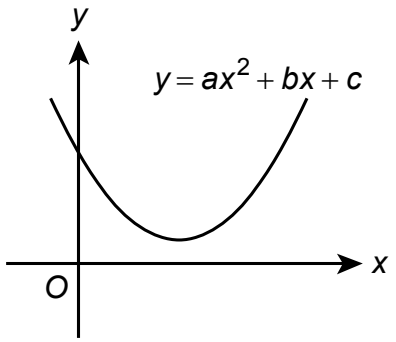
A. $70°$.
B. $80°$.
C. $95°$.
D. $160°$.

8. Solve the equation
$$\log(x+2) + \log(x-3) = \log x^2.$$
A. $x = -6$
B. $x = 2$
C. $x = 4$
D. No solutions

9. Find the remainder when $f(x) = (x-1)^{4n} - (x+1)^{2n}$ is divided by x, where n is a positive integer.
A. -2
B. 0
C. 2
D. 2^{2n}

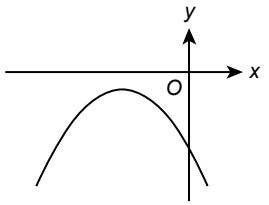
10. If $\log 3 = a$ and $\log 5 = b$, express $\log 4.5$ in terms of a and b.
A. $2a + b - 1$
B. $2a - b + 1$
C. $a - 2b + 1$
D. $a + 2b - 1$

11. The figure shows the graph of $y = ax^2 + bx + c$.

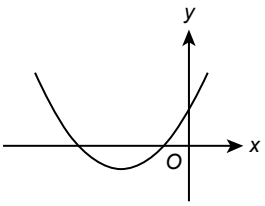


Which of the following may represent the graph of $y = cx^2 + ax + b$?

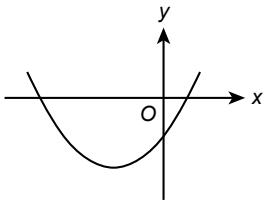
A.



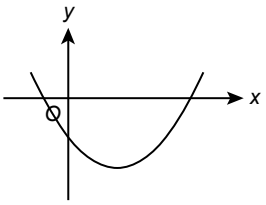
B.



C.



D.



12. Which of the following is the largest?
A. 435^{867}
B. 272^{876}
C. 345^{768}
D. 453^{786}

13. Three straight lines L_1: $36x-48y+11=0$, L_2: $9x-12y+2=0$ and L_3: $4x+3y-5=0$ are given. Which of the following is / are true?

I. $L_2 \perp L_3$

II. L_1 and L_2 have no intersections.

III. L_1 and L_3 have infinitely many intersections.

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

Section B(1) (13 marks)

14. Simplify $\left(\frac{a^{-4}}{c^{-2}}\right)\left(\frac{a^3}{2c^2}\right)^5$ and express the answer with positive indices. (3 marks)

15. Make b the subject of the formula $\frac{1}{a}-\frac{1}{b}=\frac{1}{c}$. (3 marks)

16. (a) Factorize $3a^2 + ab - 2b^2$.

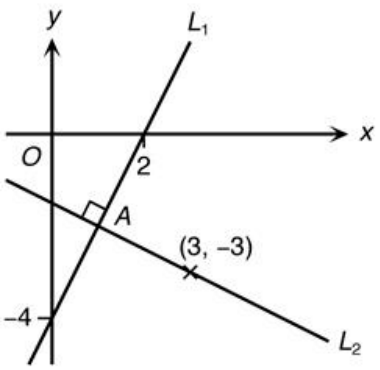
(b) Hence, factorize $3a^2 + ab - 2b^2 + 2b - 3a$. (3 marks)

17. In the figure, the straight line $L_1 : 2x - y - 4 = 0$ and L_2 are perpendicular to each other and intersect at point A. The y-intercept of L_1 is -4 and L_2 passes through $(3, -3)$.

(a) Find the equation of L_2.

(b) Find the coordinates of A.

(4 marks)



Section B(2) (15 marks)

18. The value $\$V$ of an antique vase after t years can be estimated by $V(t) = 500\ 000 \times a^{0.1t}$, where a is a positive constant. It is given that the value of the antique vase will be \$4 500 000 after 20 years.

    (a) Find the current value of the antique vase.

    (b) Find the value of a.

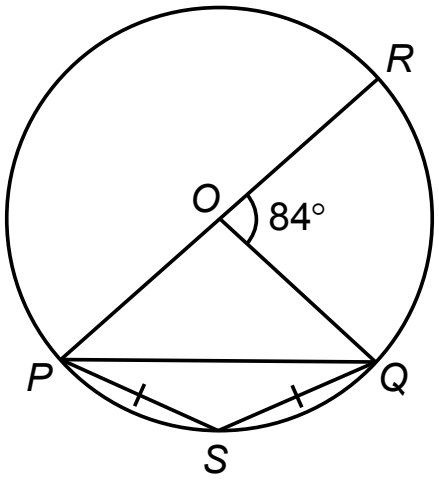
    (c) Estimate the increase in the value of the antique vase in the 8^{th} year. (5 marks)

19. Let a and b be constants. When $f(x) = 6x^3 + ax^2 + 31x - 17$ is divided by $2x + 7$, the quotient is $3x^2 + bx - 2$ and $f\left(\frac{-7}{2}\right) = -3$.

(a) Find the values of a and b. (3 marks)

(b) Solve the equation $f(x) + 3 = 0$. (2 marks)

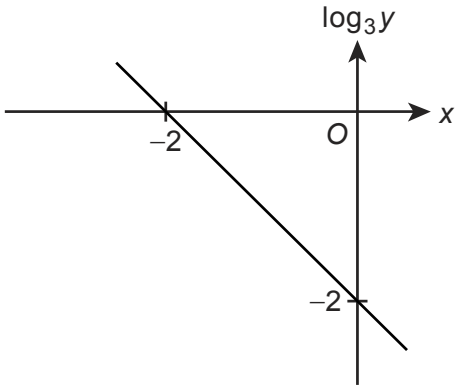
20. In the figure, O is the centre of the circle $PSQR$. POR is a straight line. $PS = SQ$ and $\angle ROQ = 84°$. Find $\angle QPS$. (5 marks)



Section C (16 marks)

21. Simplify $\dfrac{3\log\sqrt{x}-\log x^5}{\log x^4}$ where $x>0$ and $x\neq 1$. (3 marks)

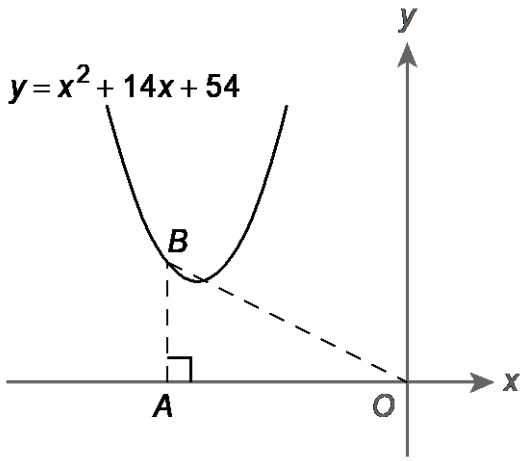
22. The figure shows a linear relation between x and $\log_3 y$. Express the relation between x and y in the form $y=ka^x$, where k and a are constants. (3 marks)



23. (a) Let d be a constant. Find the value of d such that $x+8$ is the factor of $x^3+dx^2+54x+48$.

(2 marks)

(b) The figure shows the graph of $y=x^2+14x+54$. B is a variable point on the graph. A is the foot of perpendicular from B to the x-axis.



(i) Let $(a, 0)$ be the coordinates of A. Express the area of ΔOAB in terms of a.

(ii) How many different positions of A are there such that the area of ΔOAB is 24? Explain your answer.

(iii) Assume a is an integer. Find the perimeter of ΔOAB.

(8 marks)

END OF PAPER