**18-19 F.5
2nd TERM EXAM
MATH CP
PAPER 1**

2018 – 2019
Form 5 2nd Term Examination

## MATHEMATICS Compulsory Part

PAPER 1

Question-Answer Book

6th June, 2019
8:15 a.m. – 10:30 a.m. (2 hours 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. This paper consists of THREE sections, A(1), A(2) and B.

3. Attempt ALL questions in this paper. Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.

4. Unless otherwise specified, all working must be clearly shown.

5. Unless otherwise specified, numerical answers should be either exact or correct to 3 significant figures.

6. The diagrams in this paper are not necessarily drawn to scale.
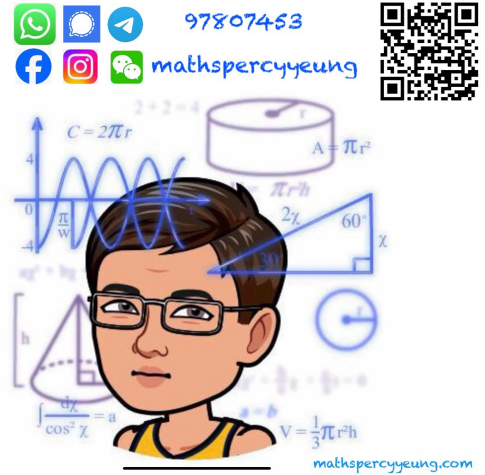
Section	Marks
A (1 – 8)	
A (9 – 13)	
A Total	**/ 70**
B Total	**/ 35**
TOTAL	**/ 105**

Section A(1) (35 marks)

1. Simplify $\dfrac{3x^2 m}{\left(xm^{-1}\right)^3}$ and express your answer in positive indices. (3 marks)

2. (a) Factorize
   (i) $x^2 + 12xy - 45y^2$,
   (ii) $mx - 3my$.
   (b) Hence, simplify $x^2 + 12xy - 45y^2 + mx - 3my$. (4 marks)

3. Make m the subject of the formula $2(p+m) = \dfrac{3mq}{5}$. (3 marks)

4. Simplify $\dfrac{a}{a-b} - \dfrac{2b}{5b-5a}$. (3 marks)

5. A shopkeeper bought 80 dozens of oranges for $1200.
   (a) If he wants to make a profit of 40%, what is the selling price of each orange?
   (b) After 800 oranges are sold, he found that the rest of them are rotten. Find the overall profit percentage or loss percentage. (5 marks)

6. (a) Solve the inequality $-2(x+1) > \dfrac{2x-45}{3}$.
   (b) Find the number of integers satisfying both inequalities $-2(x+1) \geq \dfrac{2x-45}{3}$ and $4 \leq 25 + 3x$. (4 marks)

7. The pie chart below shows the test marks of a class of 36 students. It is given that half of the class gets below 70 marks in the test.

Test marks of a class of 36 students

(a) How many students get marks below 50?

(b) Given that the number students get marks between 70 and 79 is 10. Find x.

(c) Later, 4 new students have joined the class and they have taken the same test. Their marks are 55, 44, 98 and 91. If a student is randomly selected from the class, find the probability that the selected student get marks below 60.

(7 marks)

8. Refer to Figure 1, Paul starts to walk from *A* to *B* at a bearing of N33°E. Then he runs for another 80 m to *C* at a bearing of S57°E . The total time spent is 1 minute.

Figure 1

(a) Find the distance between *A* and *C*.

(b) Find the compass bearing of *C* from *A*.

(c) Given that his average running speed is 4 m/s, find his average walking speed.

(6 marks)

Section A(2) (35 marks)

9. In Figure 2, O is the centre of the circle $ABCD$. $\angle COB = 140°$, $\overset{\frown}{AD} : \overset{\frown}{BC} = 1 : 2$, $AD \parallel BC$, AC and BD intersect at M. Find x, y and z. (7 marks)

Figure 2

10. A publisher plans to publish a magazine. If the preparation time is T weeks and N copies are issued, then the average cost of each copy of the magazine is $\$C$. It is given that C is a sum of two parts, one part varies as the square root of T and the other part varies inversely as N. When $T = 4$ and $N = 100$, $C = 14$; when $T = 9$ and $N = 200$, $C = 11$.

(a) When the preparation time of a magazine is 25 weeks and the number of copies issued is 400, find the average cost of each copy of the magazine. (4 marks)

(b) The selling price of each copy of the magazine mentioned in (a) is $\$15$. If the publisher sells 280 copies only, does the publisher suffer a loss? Explain your answer. (2 marks)

11. The side of a metal cube is measured as 8 cm, correct to the nearest cm.

    (a) (i) Write down the maximum absolute error of the measurement.

          (ii) Find the range of the possible volume of the metal cube.   (3 marks)

    (b) The metal cube is melted and recast into a number of identical spheres of radius 2 cm, correct to the nearest cm. Find the maximum number of spheres that could be made.

                                                                       (3 marks)

12. Let $f(x) = 2x^3 + hx^2 + 17x + k$, where h is a constant. It is given that $f(x)$ is divisible by $2x^2 - 5x + 2$.

    (a) Find the values of h and k. Hence, solve $f(x) = 0$.   (5 marks)

    (b) Let $g(x) = f(x) - 27x - a$, where a is a constant. It is given that $f(x)$ and $g(x)$ have a common factor. Find the possible values of a.   (3 marks)

13. In Figure 3(a), a closed right conical vessel contains liquid to a depth of 12 cm.

Figure 3(a)   Figure 3(b)

(a) Find the volume of the liquid inside the vessel in terms of π. (3 marks)

(b) In Figure 3(b), the vessel is turned upside down.

    (i) Find the new depth of liquid in the inverted vessel.

    (ii) If half of the water is poured out, find the percentage decrease of the wet surface area of the vessel. (5 marks)

Section B (35 marks)

14. Scale A and Scale B are defined to represent the magnitude of a typhoon as shown below:

Scale	Formula
A	$M = \log_2(E + 30)$
B	$N = \log_5 E$

It is given that M and N are the magnitudes of a typhoon on Scale A and Scale B respectively while E is the relative energy released by the typhoon. If the magnitude of a typhoon is 6.5 on Scale A, find the magnitude of the typhoon on Scale B.　(3 marks)

15. A factory packs oysters in bottles for export. The standard deviation of the weights of oysters in the bottles is 0.2 kg. It is known that the weights of oysters in the bottles are normally distributed and the percentage of bottles that contains less than 2.1 kg of oysters is 2.5%.

(a) Find the percentage of bottles that contains 2.1 kg to 2.7 kg of oysters. (3 marks)

(b) If 2 bottles are chosen at random, find the probability that they both contain 2.1 kg to 2.7 kg of oysters. (2 marks)

(c) In a certain batch of bottles of oysters, it is found that 10 bottles contain more than 2.9 kg of oysters. Estimate the number of bottles in the batch. (2 marks)

16. 2 teachers and 2 parents are selected from 5 teachers and 12 parents to be the guests of a school activity. Four guests sit in a row.

(a) How many ways are there for the guests to be seated? (2 marks)

(b) In how many ways can the 2 teachers be arranged on the left of the 2 parents? (2 marks)

17. Let $f(x) = -\dfrac{1}{4}x^2 - 6x - 45$.

(a) Using the method of completing the square, find the equation of the axis of symmetry of the graph of $y = f(x)$. (2 marks)

(b) The graph of $y = g(x)$ is obtained by translating the graph of $y = f(x)$ horizontally. If the axis of symmetry of the graph of $y = g(x)$ lies on the y-axis, find $g(x)$. (2 marks)

(c) Under a transformation, $f(x)$ is changed to $-x^2 - 12x - 45$. Describe the geometric meaning of the transformation. (2 marks)

18. A straight line L passes through the origin and $B(12,5)$. L is a tangent to the circle which touches the x-axis at A. L touches the circle at B. Let the centre of the circle be C.

    (a) Find the coordinates of A and C.   (3 marks)

    (b) Find the equation of the circle.   (1 mark)

    (c) For all circles touching both L and the x-axis,

        (i)   describe the loci formed by their centres,

        (ii) find the equation of the loci in (c)(i).   (2 marks)

    (d) Are O, A, C and B concyclic? Explain your answer.   (1 mark)

18 continued

19. In Figure 4, *PQRS* is a quadrilateral. Its diagonals *PR* and *QS* meet at *T* and $\angle QTR = \theta$.

Figure 4

(a) Show that the area of *PQRS* is $\dfrac{1}{2}(PR)(QS)\sin\theta$. (3 marks)

(b) It is given that $\triangle RTS$ is an equilateral triangle, *PT* = 40 cm and *QT* = 30 cm.
    (i) Find *PQ*.
    (ii) If $PR = 5TR$, find the area of *PQRS* in surd form. (5 marks)

END OF PAPER