20-21 F.4
1st TERM EXAM
MATH CP
PAPER 1

2020 – 2021
Form 4 First Term Examination

MATHEMATICS Compulsory Part

PAPER 1

Question–Answer Book

6th January, 2021
8:15 am – 9:15 am (1 hour)
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.
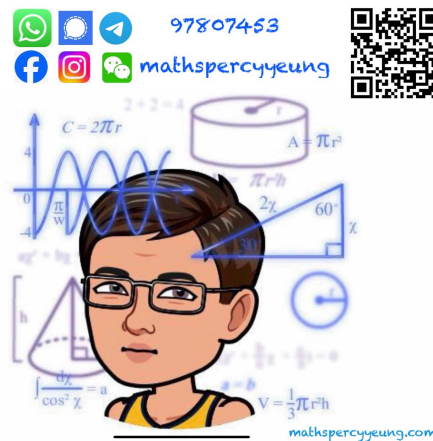
Sections	Marks
A (1 – 3)	
A (4 – 8)	
A Total	**/38**
B Total	**/12**
TOTAL	**/50**

Section A(1) (10 marks)

1. Make b the subject of the formula $\dfrac{a+b}{b} = \dfrac{2a}{c}$. (3 marks)

2. Simplify $\dfrac{(2c^{-2})^2}{-8c^3}$ and express your answer with positive indices. (3 marks)

3. The price of 7 pears and 3 apples is \$47 while the price of 5 pears and 6 apples is \$49. Find the price of a pear. (4 marks)

Section A(2) (28 marks)

4. Let α and β be the roots of $x^2 + kx + 1 = 0$, where k is a constant.

   (a) Find, in terms of k.

   (i) $(\alpha + 2) + (\beta + 2)$

   (ii) $(\alpha + 2)(\beta + 2)$ (3 marks)

   (b) Suppose $\alpha + 2$ and $\beta + 2$ are the roots of $3x^2 + px - 9 = 0$, where p is a constant. Find the values of p and k. (2 marks)

5. Given that the quadratic equation $2x^2 - 6x + p = 0$ has two distinct real roots.

   (a) Find the range of values of p. (3 marks)

   (b) Solve the quadratic equation if p takes the greatest negative integral value, express your answer in surd form. (3 marks)

6.   Let $f(x) = 4x(x+1)^2 + ax + b$, where a and b are constants. It is given that $x-3$ is a factor of $f(x)$. When $f(x)$ is divided by $x+2$, the remainder is $2b+165$.

(a) Find a and b. (3 marks)

(b) Someone claims that the equation $f(x) = 0$ has at least one irrational root. Do you agree? Explain you answer. (4 marks)

7. It is given that $f(x) = 2x - \dfrac{k}{x}$ and $f(k) = 11$.

(a) Find the value of k. (2 marks)

(b) Find $h(x)$ given that $h(x) = f(\dfrac{x}{2})$. (2 marks)

8. Figure 1 shows the graph of $y = a(x-2)^2 + 8$ which cuts the y-axis at $C(0, 6)$ and cuts the x-axis at P and Q.

Figure 1

(a) Write down the coordinates of the vertex.

(b) Find the value of a.

(c) Find the ratio of the area of $\triangle PCO$ to that of $\triangle QCO$.

(6 marks)

Section B (12 marks)

9. Let $g(x) = -2x^2 + 8x + 2k$ where k is a real constant.

   (a) Using the method of completing the square, express, in terms of k, the coordinates of the vertex V of the graph of $y = g(x)$. (2 marks)

   (b) Given that the maximum value of $y = g(x)$ is 3 and the graph of $y = g(x)$ cuts the y-axis at P.

      (i) Find the value of k.

      (ii) Find the area of $\triangle OPV$ where O is the origin.

      (4 marks)

10. Let $f(x) = 2x^3 + kx^2 + 5x + 6$, where k is a constant. It is given that when $f(x)$ is divided by $ax^2 - 4x - 1$, the quotient is $x - 2$ and the remainder is $bx + c$, where a, b and c are constants.

(a) Find a, b and c. (3 marks)

(b) It is given that $g(x) = f(x) - x^2 + 2x$. Factorize $g(x)$. (3 marks)

End of Paper