# TEMASEK JUNIOR COLLEGE

## 2022 IP1 END-OF-YEAR EXAMINATION



CANDIDATE NAME		
CG	SUBJECT TUTOR'S NAME	

### FUNDAMENTAL MATHEMATICS

5 October 2022 2 hours

#### READ THESE INSTRUCTIONS FIRST

Write your name, CG and tutor's name on all the work you hand in. Write in dark blue or black pen.

You may use a soft pencil for any diagrams or graphs.

Do not use paper clips, highlighters, glue or correction fluid.

Answer all questions.

Write your answers in the spaces provided in the question paper.

You may request for additional writing materials if there is insufficient space. These should be attached to the back of the booklet.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question. The calculator value for  $\pi$  should be used unless the question requires the answer in terms of  $\pi$ .

The use of an approved scientific and/or graphing calculator is expected where appropriate.

You are reminded of the need for clear presentation in your answers. Marks will be deducted for poor or unclear presentation. The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use			
Q1	/ 6		
Q2	/7		
Q3	/7		
Q4	/7		
Q5	/7		
Q6	/ 6		
Q7	/ 6		
Q8	/ 4		
Q9	/ 6		
Q10	/ 6		
Q11	/ 6		
Q12	/ 6		
Q13	/ 6		
Presentation Deduction	-1 /-2		
Total	/ 80		

This document consists of **17** printed pages and **1** blank page.

## Answer all questions in the spaces provided. Show all working clearly.

1 (a) Identify all the irrational numbers in the list of numbers below.

$$\sqrt{24}, -1.6^2, \frac{22}{7}, \frac{\pi}{3}, \sqrt[3]{343}, 0$$
 [2]

(b) Without the use of a calculator, evaluate

$$5 - 2\left[\frac{\sqrt[3]{125}}{2} + 3 \div 6\right] + \sqrt{-4^2 + 65} .$$
 [4]

[Answers for Question 1]

- 2 (a) It is given that  $\sqrt[3]{5} = 1.71$ , correct to 3 significant figures. Find, without the use of a calculator, the length of an edge of a cube which has a volume of 5000 cm<sup>3</sup>. [3]
  - (b) The numbers 36 and 56, written as the products of their prime factors, are  $36 = 2^2 \times 3^2$  and  $56 = 2^3 \times 7$ .
    - (i) Find the highest common factor of 36 and 56. [1]
    - (ii) Find the smallest positive integer k such that  $\frac{56}{k}$  is a perfect square. [1]
    - (iii) Ash, Misty and Brock are each given a rope of length n cm. Ash cuts his rope into smaller pieces of equal length of 36 cm. Misty cuts her rope into smaller pieces of equal length of 56 cm. Brock cuts his rope into smaller pieces of equal length of 54 cm. If there is no rope leftover, find the smallest possible value of n. [2]

[Answers for Question 2]

3 (a) Express 
$$\frac{3p-2(q-1)}{3} - \frac{4p-5q+1}{2}$$
 as a single fraction in its simplest form. [3]

(b) Expand and simplify 2ay+4(xy-ab)+2x(y-6b) completely, leaving your answer in its factorised form. [4]

[Answers for Question 3]

4 (a) Solve the equation 
$$\frac{2m-3}{3} = -\frac{1-2m}{5} + \frac{1}{2}$$
. [4]

(**b**) Given that 
$$\frac{3x-4y}{7x+2y} = -\frac{2}{3}$$
, find the value of  $\frac{x}{y}$ . [3]

# [Answers for Question 4]

5 There are four numbers.

The first number is half of the second number.

The third number is 6 less than the first number.

The fourth number is  $\frac{2}{7}$  times the third number.

(i) Given that the first number is *x*, write down expressions, in terms of *x*, to represent the second, third and fourth numbers. [3]

The average of the four numbers is 27.

- (ii) Form an equation, in terms of x, and solve it. [3]
- (iii) Hence find the sum of the first and third numbers. [1]

#### [Answers for Question 5]

- 6 (a) Every year, the value of a car depreciates by 11% of the previous year's value. Given that the value of a car is \$158 000 now, find the value of the car 2 years ago, giving your answer to the nearest dollar. [2]
  - (b) The breadth of a rectangle is x cm and the length of the same rectangle is 5 times that of its breadth. If the length is decreased by 40% and the breadth is increased by 35%, determine the percentage decrease of its perimeter. [4]

#### [Answers for Question 6]

- 7 A triathlete takes  $1\frac{3}{4}$  hours to complete a sprint triathlon which consists of swimming, cycling and running. He takes x minutes to run, 25 minutes less than running to swim and 1.25x minutes to cycle.
  - (i) Form an equation, in terms of *x*, and solve it to find the time taken for him to complete running, leaving your answer in minutes. [2]

The total distance completed during the triathlon is 25 750 m. Given that the triathlete swims at an average speed of 50 metres per minute, and the ratio of the distances covered is 3:80: y for swimming, cycling, and running respectively,

(ii)	find the value of <i>y</i> ,	
(iii)	calculate the average cycling speed in m/min.	[2]

#### [Answers for Question 7]

8 Tom claims that 3 of the exterior angles of an irregular nonagon (9-sided polygon) are  $(x+30)^\circ$ ,  $(2x-6)^\circ$  and  $(5x+14)^\circ$ , and the remaining exterior angles are 55° each. Is his claim accurate? Justify your answer. [4]

## [Answers for Question 8]

9 In the diagram below (not drawn to scale), *AGEF* is a rhombus,  $\triangle AGB$  is an isosceles triangle, and *FED* is a straight line. It is given that  $\angle GAF = 44^\circ$ ,  $\angle AGE = x^\circ$ ,  $\angle AGB = 88^\circ$ ,  $\angle GED = y^\circ$ ,  $\angle EDB = z^\circ$  and  $\angle DBC = 90^\circ$ .



Find the value of

(i)	Х,	[1]
( <b>ii</b> )	у,	[1]
( <b>iii</b> )	Ζ.	[4]

[Answers to Question 9]

10 The graph below shows the cost, C, of renting a car from a car rental company Company A, for a number of days, d.



Using the graph, find

(i) the cost of renting a car for 5 days,

[1]

[2]

(ii) the maximum number of days a person can rent a car for if he had \$140, [1]

There is a fixed charge of p and an additional charge of q for each day of car rental from Company A.

(iii) Find the value of p and of q.

The cost of renting a car from another car rental company, Company B, is given by the formula C = 51d + 20.

(iv) Lewis claims that it is always cheaper to rent a car from Company A than from Company B. By drawing an additional graph same set of axes, or otherwise, explain to what extent you agree or disagree with Lewis. [2]

[Answers for Question 10]



**11** A straight line  $L_1$  is given in the grid below. The point A(-1, -2) lies on  $L_1$ .

(i) Find the equation of  $L_1$ .

[2]

The equations of two other straight lines,  $L_2$  and  $L_3$ , are y = -x - 3 and x = 1.5 respectively. The lines  $L_1$  and  $L_2$  intersect at A(-1, -2).

- (ii) On the same set of axes above, sketch the graphs of  $L_2$  and  $L_3$ , labelling all axial intercepts. [3]
- (iii) State the shape that is bounded by the lines  $L_1$ ,  $L_2$ ,  $L_3$  and the y-axis. [1]

#### [Answers for Question 11]

12 The figure below (not drawn to scale) shows a solid prism. The cross-section of the prism consists of an isosceles trapezium, *ABCD*, of height 4 cm, removed from a semicircle of diameter 30 cm. It is given that AB = CD = 5 cm, AD = 14 cm and BC = 8 cm. The length of the prism is 25 cm.





Find, giving all answers correct to 1 decimal place,

( <b>b</b> )	the volume of the prism,	[1]

(c) the total surface area of the prism. [3]

[Answers for Question 12]

Let  $T_n$  be the  $n^{\text{th}}$  term of the number sequence 1, 4, 7, 10, 13, ... 13

> Find an expression for  $T_n$ . (i) [1]

Let  $Q_n$  and  $U_n$  be the  $n^{\text{th}}$  term of two other number sequences.

Let  $Q_n$  and  $U_n$  be use n are given to be  $\frac{1}{2}$ , 1,  $\frac{7}{6}$ ,  $\frac{5}{4}$ ,  $\frac{13}{10}$ , ... 3n-2

(ii) By considering 
$$Q_n = \frac{I_n}{U_n}$$
, or otherwise, show that  $Q_n = \frac{3n-2}{2n}$ . [2]

Student X observes that  $Q_n$  is an increasing sequence, and claims there are two numbers,  $Q_k$  and  $Q_{2k}$ , where k is a positive integer, such that the difference between the two numbers is  $\frac{1}{44}$ 

(iii) Form an equation in terms of *k*, and solve it to find *k*. [3]

#### [Answers for Question 13]

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Answe	er Key					
1	<b>(a)</b>	$\sqrt{24}, \ \frac{\pi}{3}$	(b)	6		
2	<b>(a)</b>	17.1 cm				
	(b)(i)	4	( <b>ii</b> )	14	(iii)	1512
3	<b>(a)</b>	$\frac{11q-6p+1}{6}$	(b)	2(y-2b)(3x+a)		
4	<b>(a)</b>	$m = \frac{39}{8}$	(b)	$\frac{x}{y} = \frac{8}{23}$		
5	(i)	$2x, x-6 \text{ and } \frac{2}{7}(x-6)$				
	( <b>ii</b> )	<i>x</i> = 27				
	(iii)	48				
6	(a)	\$199470	<b>(b)</b>	27.5%		
7	(i)	x = 40	( <b>ii</b> )	y = 20	(iii)	400 m/min
8	His cla	aim is not accurate sind	ce there	is a negative exterior a	angle, w	hen exterior angles
	are pos	sitive				
9	(i)	x = 136	( <b>ii</b> )	<i>y</i> = 136	(iii)	z = 44
10	(i)	\$275	( <b>ii</b> )	2 days	(iii)	p = 50,  q = 45
	(iv)	Lewis is correct only if renting for 6 or more days from Company A				
11	(i)	y = 3x + 1	(iii)	Trapezium		
12	(ii)	7735.7 cm <sup>3</sup>	( <b>iii</b> )	$2647.0 \text{ cm}^2$		
13	(i)	$T_n = 3n - 2$	( <b>iii</b> )	<i>k</i> = 22		