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GCSE Preliminary Examination Mock Paper 2022
SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC

CANDIDATE NAME

CENTRE

ELEMENTARY MATHEMATICS 4048/02

Mock Paper 2 August 2022

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Graph Paper (1 sheet).

READ THESE INSTRUCTIONS FIRST

Write your name and centre in the spaces at the top of this page.
Write in dark blue or black pen.
You may use a HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 siginificant figures, or decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an approved scientific calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is **100**.

Grade Tables: For Examiner's Use

Total Score	**Deductions**			**Grade**
	Rounding	Units	Presentation	

Setter: **Kaiwen :)**

This question paper consists of 27 printed pages including the cover page

Grade Tables: For Examiner's Use

Question	Points	Score
1	10	
2	9	
3	7	
4	8	
5	11	
6	6	

Question	Points	Score
7	7	
8	11	
9	10	
10	11	
11	10	
Total:	100	

Examiner's Comments

List of Mathematical Formulae

Compound interest

$$\text{Total amount} = P\left(1 + \frac{r}{100}\right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi rl$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2}ab\sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

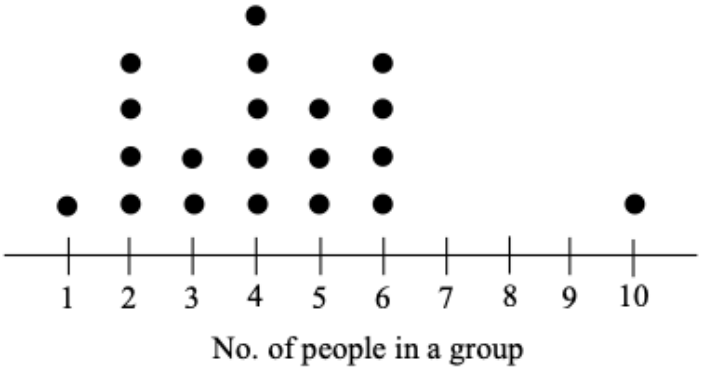
Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

Answer all questions: 100 marks

1. (a) The following dot diagram shows the number of people in each group who booked a tour package. There are 20 groups



(i) Find the median number of people in a group

Answer _____ [1]

(ii) Find the mean number of people in the group

Answer _____ [1]

(iii) Explain whether the median or mean is a more appropriate average to use to analyse the information in this distribution

Answer

[1]

(iv) Find the standard deviation of the number of people in the group

Answer _____ [1]

(v) The standard deviation of the number of people in the group who booked another tour package was 3.52. Use this information to comment on one difference between the two distribution

Answer

[1]

(b) There are 5 balls numbered 1 to 5 placed in a box. A game involves a player drawing two balls, one after another without replacement, from the box. A player wins a prize if the product of the two balls drawn is an odd number

(i) Draw a possibility diagram to show the possible outcomes
Answer

[2]

(ii) Find, as a fraction in its simplest form, the probability that

(a) a player wins a prize

Answer _____ [1]

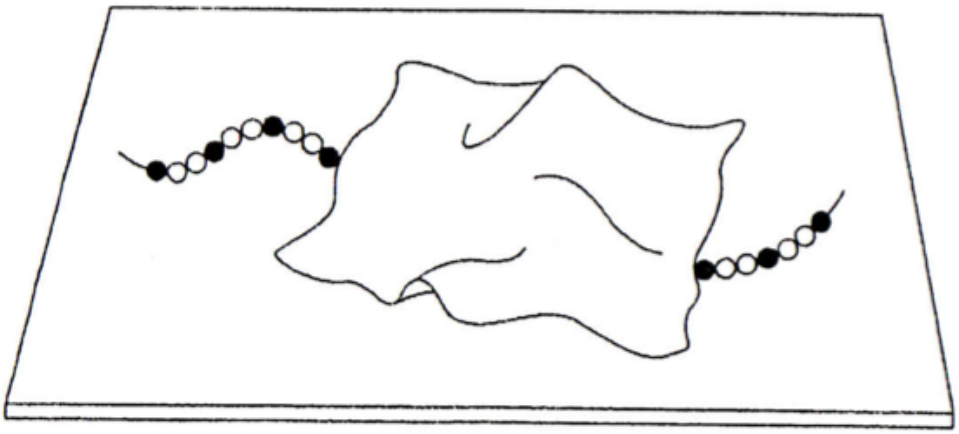
(b) only one out of two players wins a prize

Answer _____ [1]

(c) at least one out of two players wins a prize

Answer _____ [1]

2. (a) A string of beads on a table is partially covered by a piece of cloth as shown



There are 2 white beads between every 2 black beads. Altogether, there are 14 black beads. John guessed that there are **28 white beads**. Do you agree? Justify your answer with calculations
Answer

[2]

(b) Find the integers such that

$$2x + 1 < 9 < 3x + 1$$

Answer _____ [2]

(c) Factorise the following completely

$$a^2 + 9b^2 - 6ab - 2a + 6b$$

Answer _____ [2]

(d) It is given that

$$3b = 4a \qquad 2c = 5a$$

(i) Find $a : b : c$

Answer _____ [1]

(ii) If $a + b + c = 10$, find the value of b

Answer _____ [2]

3. A soccer club offers annual memberships for both adults and juniors. The adult annual membership fee is $150. Junior members need to pay 80% of the adult annual membership fee

   (a) Calculate the discount each junior member receives

Answer _____ [1]

If an adult member does not pay the membership fee by the due date, the club will charge a penalty of 5% per month until the fee is paid. Simon paid the $150 membership fee exactly 2 months after the due date

(b) Calculate the penalty that Simon will be charged

Answer _____ [1]

The soccer club received a statement of the transactions in its saving account for the month of January 2017

Date	Details	Deposit	Withdrawal	Balance
01 Jan 2017	Brought forward			\$63950.00
09 Jan 2017	Math Fees	\$750		\$64700.00
15 Jan 2017	Withdrawal		x	\$42700.00
23 Jan 2017	Membership Fees	\$3800.00		\$46500.00
31 Jan 2017	Interest	\$124.54		\$46624.54

(c) (i) Calculate the withdrawal amount \$$x$ on 15 Jan 2017

Answer _____ [1]

(ii) Interest on the account is calculated on the minimum balance for the month and added to the account on the last day of the month. What is the annual interest rate of this account, corrected to one decimal place

Answer _____ [2]

(d) The soccer club plans to invest \$120000 in an account which pays compound interest at the rate of 2% per annum, compounded monthly. Find the total amount that can be withdrawn at the end of 4 years

Answer _____ [2]

4. In January 2013, the price of rice in Singapore was $\$x$ per kilograms. A food catering company spent \$450 on rice each month

   (a) Write down an expression, in terms of x, for the amount of rice in kilograms that this food catering company ordered in January 2013

Answer _____ [1]

In January 2016, the price of each kilograms of rice had increased by 15 cents. The company continued to spend \$450 on rice each month

   (b) Write down an expression, in terms of x, for the amount of rice in kilograms ordered in January 2016

Answer _____ [1]

   (c) The difference in the amount of rice ordered between January 2013 and January 2016 is 30 kg. Write down an equation in x to represent this information, and show that it reduces to

$$20x^2 + 3x - 45 = 0$$

Answer

[2]

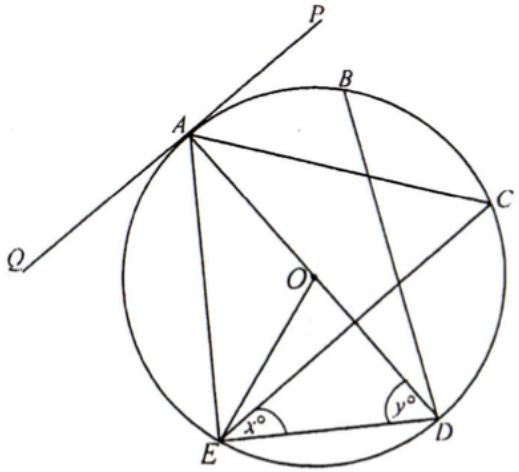
(d) Solve the equation in **part (c)**, giving your solutions correct to 2 decimal places

Answer _____ [2]

(e) **Hence**, calculate the average amount of rice ordered in January 2016. Give your answer correct to the nearest kilogram

Answer _____ [2]

5. (a) A, B, C, D and E lie on a circle with centre O. The line PQ is tangent to the circle at A. AD is the diameter of the circle, $\angle CED = x^\circ$ and $\angle ADE = y^\circ$



Find, in terms of x and y,

(i) $\angle CAD$

Answer _____ [1]

(ii) $\angle COD$

Answer _____ [1]

(iii) $\angle EAO$

Answer _____ [1]

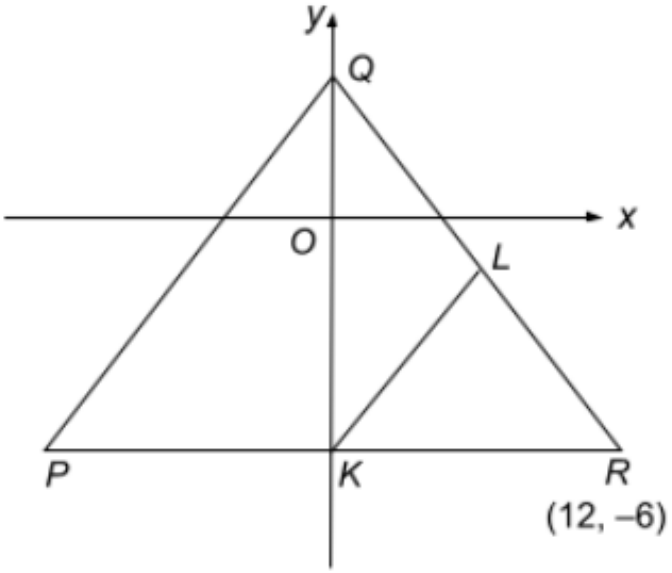
(iv) $\angle EDC$

Answer _____ [1]

(v) $\angle EAQ$

Answer _____ [1]

(b) In the diagram, R is the point $(12, -6)$ and PR is a straight line parallel to the x-axis. Points Q and K lie on the y-axis and L is the midpoint of the straight line QR.



Given that $OK = 2OQ$, find

(i) the coordinates of K and Q

Answer _____ [2]

(ii) the value of a given that the coordinates of L is $(6, a)$

Answer _____ [2]

(iii) the area of $\triangle KQL$

Answer _____ [2]

6. The first four terms in a sequence of numbers are given below

$$T_1 = 1 \times 3 \times 5 = 15$$

$$T_2 = 2 \times 4 \times 6 = 48$$

$$T_3 = 3 \times 5 \times 7 = 105$$

$$T_4 = 4 \times 6 \times 8 = 192$$

(a) Write down the 5th term, T_5, of the sequence in a similar form

Answer _____ [1]

(b) Find an expression, in terms of n, for the nth term, T_n of the sequence

Answer _____ [1]

(c) Evaluate T_{23}

Answer _____ [1]

(d) T_k and T_{k+2} are two terms in the sequence. Find and simplify an expression, in terms of k, for

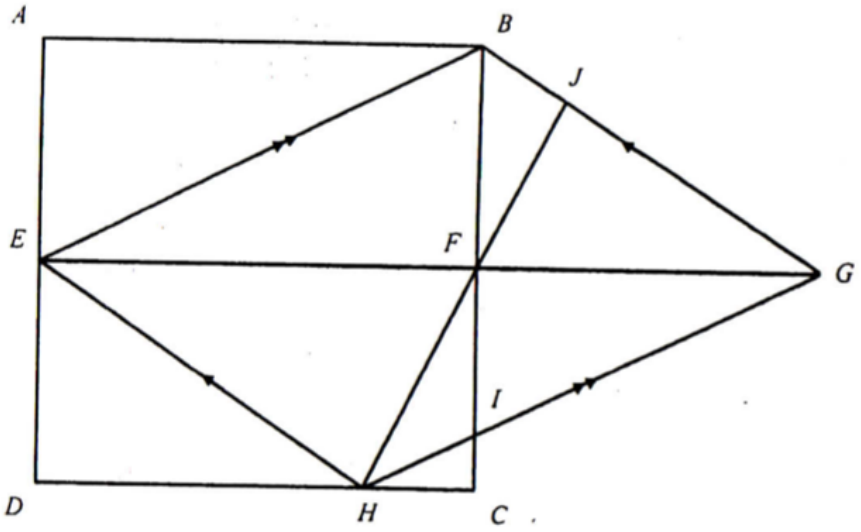
$$T_{k+2} - T_k$$

Answer _____ [2]

(e) Explain why the value of $T_{k+2} - T_k$ must be even for all values of k
Answer

[1]

7. In the diagram $ABCD$ is a square and $EBGH$ is a parallelogram



The lines BC, EG and HJ intersect at the point F. E and F are midpoints of AD and BC respectively and $4DH = 3DC$

(a) Show that

(i) $\triangle EDH$ and $\triangle BFG$ are congruent

Answer

[2]

(ii) $\triangle CHF$ and $\triangle AEB$ are similar

Answer

[2]

(b) Find the numerical value of

(i)
$$\frac{DH}{EG}$$

Answer _____ [1]

(ii)
$$\frac{\text{Area of } \triangle BGF}{\text{Area of } \triangle BEF}$$

Answer _____ [1]

(iii)
$$\frac{\text{Area of } EBGH}{\text{Area of } ABCD}$$

Answer _____ [1]

8. The variables x and y are connected by the equation

$$y = 2x + \frac{50}{x} - 30, \quad x \neq 0$$

Some corresponding values of x and y are given in the following table, corrected to 2 decimal places

x	1	1.5	3	5	7	9	11	13	15	16
y	22.00	p	−7.33	−10.00	−8.86	−6.44	q	−0.15	3.33	5.13

(a) Find the value of p and of q

Answer _____ [1]

(b) Using a scale of 1 cm to 1 unit on the horizontal x-axis and 2 cm to 5 units on the vertical y-axis, draw the graph **(on the sheet of graph paper provided)** of $y = 2x + \frac{50}{x} - 30$ for $1 \leq x \leq 16$

[3]

(c) By drawing a tangent, find the gradient of the curve at the point $x = 10$

Answer _____ [2]

(d) (i) On the same axes, draw the line

$$y = 3 - 2x$$

[1]

(ii) From the graph, state the x-coordinate of the points where this line intersects the curve

Answer _____ [2]

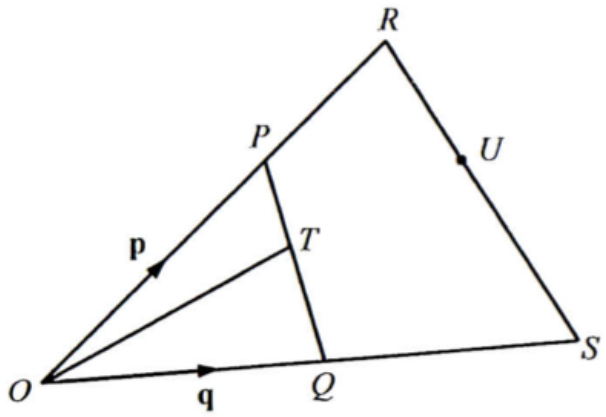
(iii) The values of x are the solutions of the equation

$$Ax^2 - 33x + B = 0$$

Find the value of A and of B

Answer _____ [2]

9. In the diagram below, OPQ is a triangle such that $\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$. $Q$is the mid-point of OS and R lies on OP produced such that $3PR = 2OP$. The point T on PQ such that $PT : TQ = 3 : 5$



(a) Express in terms of **p** and/or **q**

(i) $\overrightarrow{OS}$

Answer _____ [1]

(ii) $\overrightarrow{OR}$

Answer _____ [1]

(iii) $\overrightarrow{OT}$

Answer _____ [1]

(b) Given that $\overrightarrow{QU} = \frac{10}{9}\mathbf{p} - \frac{1}{3}\mathbf{q}$, show that O, T and U are collinear points

Answer

[2]

(c) Find

(i) $\dfrac{RU}{US}$

Answer _____ [1]

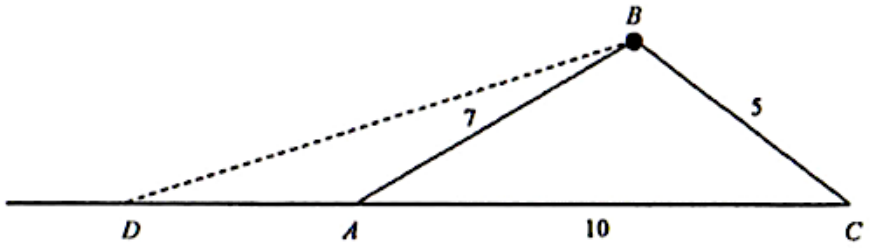
(ii) $\dfrac{\text{Area of } \triangle OTQ}{\text{Area of } \triangle OUS}$

Answer _____ [2]

(iii) area of $\triangle OUS$ if the area of $\triangle OTP$ is 54 cm^2

Answer _____ [2]

10. Given that A, B, C and D are on a horizontal ground. $AB = 7$ m, $BC = 5$ m and $AC = 10$ m



(a) Show that $\angle BAC = 27.7°$, correct to 1 decimal place]
Answer

[2]

(b) Calculate the area of $\triangle ABC$

Answer _____ [2]

(c) Calculate the shortest distance from B to AC

Answer _____ [2]

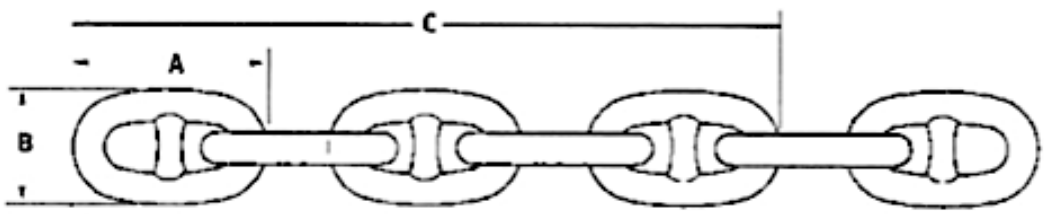
(d) Given that $BD = 12$ m, find the $\angle BDC$

Answer _____ [2]

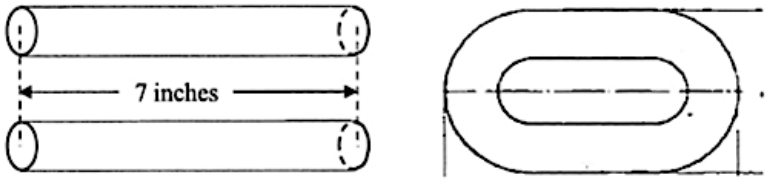
(e) A camera is placed at the top of the vertical metal pole at B. A cameraman estimates that the difference of the angles of elevation of the camera from A and from D is at most 10°. The metal pole is 4.5 m tall. Is his estimate accurate? Justify your answer with calculations clearly

Answer _____ [3]

11. A chain, like the one shown below, is commonly used to drop anchors into the sea



A single unit chain can be modelled by the figure below in which two cylindrical metal pieces are bent and joined together at the edges



Some data on the Stud Link Anchor Chain Dimensions are shown in **Annex A** to help you answer the following questions

(a) Calculate the surface area of the single unit chain in the form of $k\pi$ inches^2, where k is an integer, if the diameter of each cylinder is 1 inch. It is assumed that the surface area of the figure does not change

Answer _____ [1]

(b) Calculate the volume of the single unit chain, in mm^3, if the diameter of each cylinder is 1 inch

Answer _____ [2]

(c) Some anchor chains are sold in sets of 15 fathom shots. The weight per 15 fathom shots in the table is given in kilograms. A fishing boat goes out to sea with the intention of anchoring at a depth of 600 metres. The maximum allowable load for the chain is 45 tonnes. Note that 1 tonne is equivalent to 1000 kg. If a 1.5 inches chain size is selected, determine, showing your calculation, whether the chain size choice is recommended. If otherwise, recommend which chain size should be used

Answer _____ [7]

END OF PAPER

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Annex A - Data for Question 11

Stud Link Anchor Chain Dimensions											
Diameter	Dimensions (inches)			Weight	Grade 2		Grade 3		Oil Rig Quality		Link per shot
Chain Size	A	B	C	-	X	Y	X	Y	X	Y	-
5/8	3 3/4	2 1/4	13 3/4	365	23,745	33,220	33,220	47,465			432
3/4	4 1/2	2 5/8	16 1/2	480	34,000	47,600	47,600	68,000			357
13/16	4 7/8	2 7/8	17 7/8	570	39,800	55,700	55,700	79,500			329
7/8	5 1/4	3 1/8	19 1/4	660	46,000	64,400	64,400	91,800			305
15/16	5 5/8	3 5/16	20 5/8	760	52,600	73,700	73,700	105,000			285
1	6	3 9/16	22	860	59,700	83,600	83,600	119,500	84,000	129,000	267
1 1/16	6 3/8	3 3/4	23 3/8	970	67,200	94,100	94,100	135,000			251
1 1/8	6 3/4	4	24 3/4	1,080	75,000	105,000	105,000	150,000	106,000	161,000	237
1 13/16	7 1/8	4 1/4	26 1/8	1,220	83,400	116,500	116,500	167,000			225
1 1/4	7 1/2	4 1/2	27 1/2	1,350	92,200	129,000	129,000	184,000	130,000	198,000	213
1 5/16	7 7/8	4 3/4	28 7/8	1,490	1,500	142,000	142,000	203,000			203
1 3/8	8 1/4	4 15/16	30 1/4	1,630	111,000	155,000	155,000	222,000	157,000	235,000	195
1 7/16	8 5/8	5 3/16	31 5/8	1,780	120,500	169,000	169,000	241,000			187
1 1/2	9	5 3/8	33	1,940	131,000	183,500	183,500	262,000	185,000	280,000	179
1 9/16	9 3/8	5 5/8	34 3/8	2,090	142,000	198,500	198,500	284,000			171
1 5/8	9 3/4	5 7/8	35 3/4	2,240	153,000	214,000	214,000	306,000	216,000	325,000	165
1 11/16	10 1/8	6 1/16	37 1/8	2,410	166,500	229,000	229,000	327,000			159
1 3/4	10 1/2	6 5/16	38 1/2	2,590	176,000	247,000	247,000	352,000	249,000	380,000	153
1 13/16	10 7/8	6 1/2	39 7/8	2,790	188,500	264,000	264,000	377,000			147
1 7/8	11 1/4	6 3/4	41 1/4	2,980	201,000	281,000	281,000	402,000	285,000	432,000	143
1 15/16	11 5/8	7	42 5/8	3,180	214,000	299,000	299,000	427,000			139
2	12	7 3/16	44	3,360	227,000	318,000	318,000	454,000	322,000	488,000	133

Note that

- X denotes the Proof Test, Y denotes the Break Test.
- ”Weight” and ”Link per shot” columns are calculated per 15 Fathom Shots.
- 1 Fathom is equivalent to 1.8 metres and 1 inch is equivalent to 25.4 milimetres

Question Source

Question	Credit	Remarks
1	S4 P2/GDSS 2017 PRELIM Qn 9	Modified
2	S4 P2/YISS 2017 PRELIM Qn 1 & 2	Modified
3	S4 P2/TKSS 2017 PRELIM Qn 1	-
4	S4 P2/RSS 2017 PRELIM Qn 9	-
5(a)	S4 P2/PRSS 2017 PRELIM Qn 2(b)	Modified
5(b)	S4 P2/BGSSS 2017 PRELIM Qn 7(b)	-
6	S4 P2/NSS 2017 PRELIM Qn 3	-
7	S4 P2/NBSS 2017 PRELIM Qn 2	-
8	S4 P2/JYSS 2017 PRELIM Qn 8	-
9	S4 P2/MSHS 2017 PRELIM Qn 9	-
10	S4 P2/BMSS 2017 PRELIM Qn 8	-
11	S4 P2/BBSS 2021 MYE Qn 10	Modified