Cambridge International AS & A Level

CANDIDATE NAME	

CENTRE NUMBER			CANDIDATE NUMBER	

THINKING SKILLS **9694/13**

Paper 1 Problem Solving **May/June 2024**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS
- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- Show your working.
  Where a final answer is incorrect or missing, you may still be awarded marks for correct steps towards a solution.
  In some questions, if you do not show your working, full marks will not be awarded.

INFORMATION
- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [ ].

[Turn over

1   Kevin makes birdhouses in batches. It takes him 90 minutes to make the first one in the batch. For the next 9 birdhouses, each one takes 2 minutes less than the previous one to make. Once Kevin has made 10 birdhouses, any others take the same time to make as the 10th one.

Kevin has an order for 20 birdhouses.

How long will it take Kevin to make these 20 birdhouses?   [2]

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2 Canapés are being served at a formal event. The caterers have made three types of canapé: salmon, caviar and avocado. It has been decided that each tray should contain exactly three individual canapés, either all the same or one of each type. Close to the end of the event, there are 8 salmon canapés, 7 caviar canapés and 5 avocado canapés remaining.

(a) The caterers know that they can make six trays of canapés at this point in the evening.

List all the possible ways to make six trays. [2]

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(b) The caterers know that making one extra canapé will enable them to make an extra tray.

Which type of canapé should they make? Explain your answer. [1]

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3 In the game of *Bongdong*, there are two ways to score: a *bong* scores 7 points and a *dong* scores 3 points.

The Dolphins have won their previous four games with scores of 13, 29, 26 and 19 points.

(a) How many bongs did they score in the four games? [2]

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In their fifth game today, the Dolphins lost in a game in which the combined scores of the two teams was 25.

(b) What are the different numbers of points that the Dolphins could have scored in this match? [2]

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4 The admission fees for a local museum are shown in the table.

Ticket type	Mon–Fri	Sat
Child (Under 16)	$2.50	$3.50
Adult	$4.00	$6.00
Family (2 adults and 2 children)	$12.00	$16.00
Group (Up to 5 people)	$17.50	$25.00

A group of 6 adults and 5 children visited the museum on Wednesday.

(a) What was the cheapest total cost for the tickets? [2]

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When buying tickets, it is possible to make a donation on top of the admission fee. The local government gives the museum an additional 20% of the amount donated.

A group of 2 adults and 3 children visited the museum on Saturday. They bought the cheapest possible tickets for their admission and made a donation. They paid a total of $25.

(b) How much was given to the museum by the local government as a result of this visit? [2]

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5 A delivery company provides boxes of types A, B, C and D for its customers. The dimensions of each type of box, the maximum weight each can hold and the costs of delivery are shown in the following table.

Type of box	Maximum weight	Dimensions	Cost of delivery
Type A	1 kg	40 cm × 30 cm × 20 cm	$10
Type B	2 kg	50 cm × 40 cm × 40 cm	$15
Type C	3 kg	60 cm × 40 cm × 20 cm	$25
Type D	5 kg	80 cm × 80 cm × 80 cm	$35

A customer may pack any number of parcels in a box so long as the lid fits on properly. Any space remaining in the box is filled with packing material of negligible weight.

Marryk has 72 identical parcels, each of which is a cube with edges of length 20 cm. He packs these parcels tightly into Type C boxes, so that there is no space between them.

(a) (i) What is the total cost for delivering these boxes? [2]

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(ii) What can you deduce about the weight of each of these 72 parcels? [1]

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Steve has two parcels, each measuring 40 cm × 30 cm × 20 cm and weighing 1 kg. He will pack both of them into one type of box so that the cost of delivery is as small as possible.

(b) What is this least cost? [1]

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6 A company has 8 employees. The names of the employees and the days on which they work each week are shown in the table.

Name	Monday	Tuesday	Wednesday	Thursday	Friday
Ann	✓	✓		✓	
Ben		✓	✓	✓	✓
Caz	✓		✓		✓
Den					✓
Eva		✓	✓		
Flo				✓	✓
Glo	✓	✓	✓	✓	✓
Har		✓	✓		✓

The manager is arranging some training for his employees. The training will take place next week on two non-consecutive days. Each employee must attend the training for one day and there will be four employees on each of the two days. An employee must attend the training on a day when they would normally be at work.

(a) (i) Give a reason why one of the days for the training must be Friday. [1]

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(ii) On which other day will the training take place? Explain your answer. [2]

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Because of the tasks they do at work, Ben and Glo cannot attend training on the same day, and Glo and Har cannot attend training on the same day.

(b) Which employees will attend the first training day? [1]

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7 A tie maker plans to offer a 'mediaeval heraldic' range of ties, featuring repeating patterns of coloured stripes of even width. He will use just the five standard original colours (with mediaeval abbreviations):

Red(G), Blue(Z), Black(S), Yellow(O) and White(A).

Yellow (for gold) and White (for silver) are called metals, and must never be next to each other. Any other combination is permitted.

He wants to give names to each colour combination, e.g. 'Jesus' (after Jesus College, Cambridge) for Red and Black, or Black and Red.

(a) How many names will he need for all such permitted ties with two colours? [2]

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He thinks that he needs more options, and considers ties with a repeating pattern of three colours. He notes that the repeating 'Estonian' pattern …AZSAZSAZS… is the same as repeating ZSA, but not SZA.

(b) How many names will he need for all such permitted ties with three colours? [2]

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8 The five regions of Pellandia compete in an inter-region football league every season. Each team plays each of the others twice.

A team gains 4 points for a win and both teams gain 2 points for a drawn match. In addition, the first team to score in any match gains 1 point, whatever the final result.

This is last season's final table.

	Played	Won	Drawn	Lost	Points
East	8	5	2	1	28
South	8	3	2	3	21
West	8	3	1	4	18
Central	8	2	3	3	16
North	8	2	2	4	15

In how many of last season's inter-region matches were no goals scored? Explain your answer.
[2]

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9 Four contestants take part in each edition of the TV quiz show *Build Up*.

In the first part of the show, each of the four contestants is asked 10 questions. For every correct answer the contestant wins $200, but every incorrect answer and every 'pass' adds $50 to the cash totals of each of the other three contestants.

At the end of this part, the two contestants with the lowest cash totals are eliminated, but they do take home their cash totals. A tie-break may be required to decide who is eliminated, but tie-break questions have no cash value.

(a) What would the cash total of each contestant be at the end of the first part if none of the contestants answered any of their ten questions correctly? [1]

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The cash totals of the contestants at the end of the first part of yesterday's show were:

Sarah	$2400
Jason	$2150
Danny	$1400
Linda	$1150

(b) How many questions were answered correctly in the first part of yesterday's show? [2]

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In the second part of the show, the two remaining contestants carry forward their cash totals and continue to increase them by competing against each other. There are 30 questions in this part, each of which is answered by the first to press their buzzer. A correct answer is now worth $500, but an incorrect answer adds $250 to the opponent's cash total. However, $250 is deducted from both cash totals whenever neither contestant presses their buzzer.

At the end of the show the contestant with the lower final cash total wins that total and the 'champion' wins double his or her final cash total. If they both finish with the same final cash total, neither has their total doubled.

In the second part of yesterday's show, five of the questions were not attempted. Sarah answered fourteen questions, but four were incorrect, and Jason answered eleven questions, but two were incorrect.

(c) How much money was won in total by the four contestants in yesterday's show? [3]

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10 Toby is a tree surgeon who prunes trees. The amount he charges for different sizes of trees and the lengths of time he takes to prune these trees are shown in the following table.

Size of tree	Charge per tree	Time taken per tree
Small	$60	50 minutes
Medium	$110	90 minutes
Large	$160	120 minutes

Toby works from 09:00 to 17:00 each day, with a lunch break from 13:00 to 13:30. He does not have to finish pruning a tree before he breaks for lunch; but he will only start work on a tree if he can complete it the same day.

(a) (i) What is the greatest number of trees that Toby can prune in a single day? [1]

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(ii) What is the greatest amount of money that Toby can earn in a single day? [1]

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A customer requires Toby to prune 10 small trees and 12 medium trees. Toby will start work on these trees at 09:00 next Monday and complete the work as soon as possible.

(b) On which day and at what time will he complete the work? [2]

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Toby upgrades his equipment and finds that he can reduce the time taken to prune each tree by 10 minutes. He does not change his charges.

(c) What is now the greatest amount of money that Toby can earn in a single day? [1]

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In a park there are 27 small trees and 8 large trees. Toby will prune these trees using his upgraded equipment. He will start work at 09:00 on a Monday. He knows that he can finish the work on Friday of the same week.

(d) What is the earliest possible time on Friday at which Toby could complete this work? [4]

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11 I was born on 27 March 1981. When written in the form DD/MM/YY (where DD is the day of the month, MM is the numerical form of the month and YY the last two digits of the year) this is date 27/03/81. All six digits are different and DD × MM = YY.

I have four cousins. They were all born on different dates during the 1970s and the date of birth of each one of them is also a date for which the digits of DD/MM/YY are all different and DD × MM = YY.

What are the dates of birth of my four cousins? [3]

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12 The Bolandia Music Society has 600 members. Last week, every member voted either for or against each of two proposals. The results were that 422 members voted **for** Proposal 1 and 163 members voted **against** proposal 2.

(a) What is the smallest possible number of members who could have voted for both proposals?

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In fact, 351 people voted for both proposals.

(b) How many members voted against both proposals? [2]

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[Turn over for Question 13]

13 In our garden recently, my son decided to count the number of birds he could see and my daughter decided to count the number of bees she could see.

When my son announced his total, my daughter, who knows that a bee has six legs and four wings, said 'together we have seen a total of 142 legs and 110 wings'.

How many birds and how many bees had the children counted? [2]

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Birds ....

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