



# Cambridge International AS & A Level

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## THINKING SKILLS

9694/12

Paper 1 Problem Solving

May/June 2021

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 most questions, full marks will be awarded for a correct answer without any working. In some questions, however, you will not be awarded full marks if working needed to support an answer is not shown.

## INFORMATION

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

This document has **20** pages. Any blank pages are indicated.

1 In Bolandia, children will start school on 1 September 2025, provided that they meet **both** of these conditions on that day:

1. They are aged 5.
2. They have received their vaccination **at least** 25 days previously.

Some children's details are given in the table below.

<i>Name</i>	<i>Date of Birth</i>	<i>Vaccination Date</i>
Abraham	07 June 2020	01 August 2025
Joshua	04 February 2021	23 August 2025
David	21 May 2020	10 August 2025
Luke	08 August 2020	05 August 2025
Peter	25 July 2020	04 August 2025
Michael	17 September 2021	15 July 2025
Christian	18 October 2020	17 August 2025

(a) Which of these children will start school on 1 September 2025? [2]

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According to a new rule, a vaccination is considered to be valid only if the child is at least 5 years and 6 days old on the vaccination day.

(b) Which child, as a result of this new rule, is no longer able to start school on 1 September 2025? [1]

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- 2 Kelly owns a shop. Every week she has a special offer on some of the products that she sells and she advertises these offers by comparing her prices with one of the other local shops. Each week the comparison is based on the ingredients for a particular meal.

This week the comparison will be based on spaghetti Bolognese. The ingredients and their prices at the other local shop are shown in the table below.

<i>Item</i>	<i>Local shop charges</i>
Bag of fresh pasta	\$1.75
Beef mince	\$5.50
Bolognese sauce	\$2.25

One of each item is needed to make the meal. Kelly wishes to advertise that it is 10% cheaper to buy the ingredients from her shop. She has decided that she will sell bags of pasta at \$1.70 and jars of Bolognese sauce for \$2.00 each.

At what price should she sell beef mince?

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3 Magnus's 4-digit PIN code has the following properties:

- The 2-digit number formed from the last two digits is twice as large as the 2-digit number formed from the first two digits.
- The second and third digits are the same as each other.
- The sum of all four of the digits is 21.

What is Magnus's PIN code?

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4 The promenade at the seaside resort of Scartonby is 7.2 km long.

A single bus travels the entire length of the promenade between West Head and East Point throughout the day. It departs from West Head every 30 minutes from 09:00 onwards and from East Point every 30 minutes from 09:15 onwards. Each journey from one end to the other takes 12 minutes.

Yesterday, Dionne walked the whole length of Scartonby promenade. She set off from West Head at 10:19 and walked at a constant speed of 4 km/h throughout.

(a) During Dionne’s walk from West Head to East Point:

(i) Was the bus travelling towards West Head or towards East Point when it first passed her? Justify your answer. [1]

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(ii) How many times did the bus pass her? [2]

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At East Point, Dionne visited the aquarium. She left the aquarium at 15:20 and took the next available bus back to West Head.

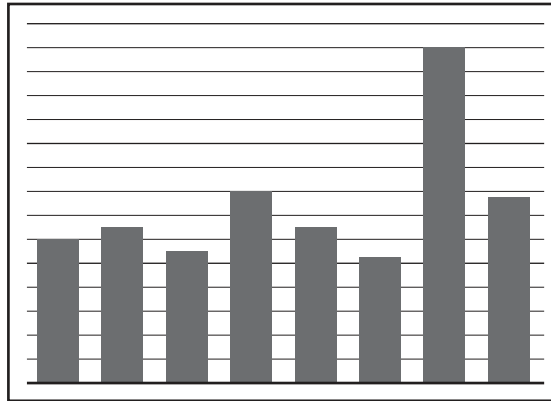
(b) At what time did Dionne arrive back at West Head? [1]

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- 5 Eight of my friends each gave me a gift of some money for my birthday. The amounts are shown in the table below.

Jim	\$120	Mike	\$155	Rob	\$160	Vicky	\$130
Chris	\$110	Brian	\$280	Geoff	\$105	Oscar	\$140

My son made a chart to show the amount given by each friend.



One of the amounts was incorrect on the chart.

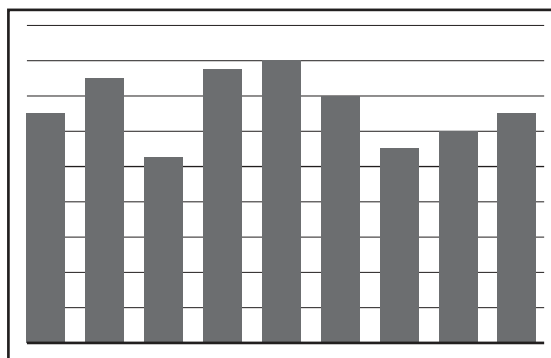
- (a) Which friend's amount was incorrect on the chart? [1]

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Brian telephoned me the next day to explain that his gift consisted of two gifts: one from himself and one from another friend, Phil, and that Phil's gift was larger than his.

My son made a new chart to show the amount given by each friend. This time he made no mistake.



- (b) How much was Phil's gift? [2]

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- 6 The table shows the most popular names for children born on a remote island. Only names used at least 10 times in the year are included.

<b>Year 1994</b>				<b>Year 1995</b>			
<b>Boys</b>	<i>Out of 183</i>	<b>Girls</b>	<i>Out of 183</i>	<b>Boys</b>	<i>Out of 194</i>	<b>Girls</b>	<i>Out of 194</i>
Oliver	35	Mary	47	James	33	Susan	50
Noah	34	Susan	40	Rory	32	Jane	32
Alex	28	Alice	21	Alex	23	Ann	19
James	16	Jenny	14	Kevin	17	Freda	18
Alan	15	Laura	13	Oliver	13	Laura	17
Rory	11	Millie	11	Mark	12	Alice	13
Adam	10	–		–		Mary	13

The name Kevin was fashionable briefly during the spring one year, but was not given to anyone before or since.

- (a) What is the most likely name for the twin sister of someone called Kevin? [1]

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- (b) What is the minimum number of other boys' names that could have been used in 1995 but do not appear in the 1995 table of the most popular? [2]

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7 Eight teams compete in the Morland Football League.

At the end of each season prize money is awarded to the teams finishing in the top four positions, as follows:

1st	\$8000
2nd	\$5000
3rd	\$2500
4th	\$1000

In addition, throughout the season, teams receive \$600 for every match they win, whatever the score, and \$200 whenever they score 2 goals or more in a match that they do not win.

Last season Tilney won 12 consecutive matches before being beaten 3 – 1 by Brigden and 4 – 2 by Wingfield in their last two matches.

This is last season’s final league table.

	<i>Played</i>	<i>Won</i>	<i>Drawn</i>	<i>Lost</i>	<i>Goals scored</i>	<i>Points</i>
Tilney	14	12	0	2	43	36
Holford	14	7	3	4	31	24
Rushworth	14	7	1	6	25	22
Wingfield	14	6	2	6	20	20
Dashwood	14	6	1	7	23	19
Brigden	14	5	2	7	21	17
Fairfax	14	4	2	8	17	14
Serle	14	2	3	9	15	9

(a) How much prize money did Tilney receive in total last season? [2]

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(b) What is the maximum total amount of prize money that Wingfield might have received last season? [3]

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- 8 A hall in a community centre has four walls, each 10 m wide and 6 m high. Adrian intends to paint the walls using tins of red paint and white paint. He will make shades of pink paint by mixing red and white paint in different amounts.

The first wall will have 11 vertical stripes of equal width.

The first stripe will be red;

the second stripe will be pink made by mixing red and white paint in the ratio 9 : 1;

the third stripe will be pink made by mixing red and white paint in the ratio 8 : 2;

and so on until the final stripe, which will be white.

1 litre of paint covers  $12\text{m}^2$  of wall. Adrian will buy all the paint that he needs in 1-litre tins.

- (a) How many tins of red paint would Adrian need to buy to paint this wall? [2]

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The second wall will have 4 vertical stripes of equal width: one red stripe; one dark pink stripe, made by mixing red and white paint in the ratio 4 : 1; one light pink stripe, made by mixing red and white paint in equal amounts; and one white stripe.

- (b) How many tins of red paint and white paint would Adrian need to buy to paint this wall? [3]

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The remaining two walls of the hall will be painted white. Adrian will buy all the tins of paint he needs to paint all four walls of the hall in one purchase.

(c) How many tins of red paint and how many tins of white paint will Adrian buy? [2]

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- 9 Graham is going to a fair today. When he arrives he will need to buy tokens to use for the different activities that are on offer.

Gold tokens cost \$6 and are worth 6 credits.  
Silver tokens cost \$3 and are worth 3 credits.  
Bronze tokens cost \$1 and are worth 1 credit.

The activities require different numbers of credits. It is possible to use tokens with a higher value than needed for an activity, but no change will be given.

Graham plans to do 6 activities in total. Three of the activities require 2 credits, two of the activities require 4 credits and one of the activities requires 8 credits. Graham wants to pay the least amount possible to allow him to do the activities. He also wants to buy the smallest number of tokens possible for this amount of money.

- (a) How many of each type of token should Graham buy? [1]

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When he arrives at the fair, Graham discovers that it is possible to buy packs of tokens for a reduced price.

A \$20 pack contains 3 gold, 2 silver and 1 bronze token.  
A \$10 pack contains 3 silver and 3 bronze tokens.

- (b) (i) Should Graham buy any \$20 packs of the tokens? Justify your answer. [2]

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(ii) Should Graham buy any \$10 packs of the tokens? Justify your answer. [2]

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10 All of the bowls in my kitchen cupboard are either yellow or white or cream. They are also all either large or medium or small.

4 of the bowls are medium and 1 is large. 2 of the bowls are yellow. The large bowl is not white and none of the yellow bowls is medium. There is 1 small, white bowl and there are 3 white, medium bowls.

(a) If there are 2 cream bowls, how many bowls are there altogether? [2]

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(b) If there are 5 cream bowls, how many **small** bowls are there altogether? [1]

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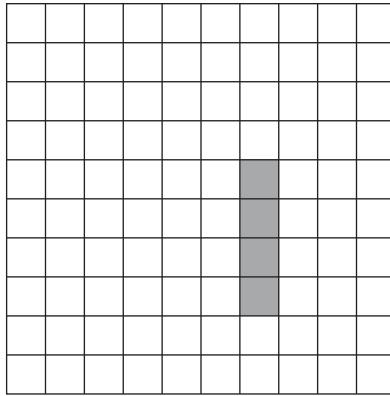
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- 13 Winston is playing a simple game of Battleships, involving a single 'battleship' of 4 squares in a line placed on a 10 by 10 square 'sea'. For example:



The Opponent selects a position at random for the battleship, but does not show Winston where it is. Winston takes a shot, i.e. names a square and is told whether it is a hit or a miss. He continues to try squares until all four parts of the battleship have been hit and it is then considered to be sunk. The aim is to sink it with as few shots as possible.

Winston always chooses a 'good' square, i.e. one that is not less likely than any other to be a hit, based on what he knows at the time.

- (a) (i) How many possible positions for placing the battleship are there? [1]

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- (ii) How many 'good' squares are there at the start? [1]

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Winston is very lucky and gets a hit on his first shot.

- (b) (i) How many possible positions could the battleship be in? [1]

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- (ii) How many 'good' squares are there now, and where are they in relation to the hit? [2]

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Winston misses on his second shot.

(c) What is the chance that his third shot is a hit? [3]

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