
THINKING SKILLS

9694/13

Paper 1 Problem Solving

October/November 2017

1 hour 45 minutes

Additional Materials: Multiple Choice Answer Sheet
 Soft clean eraser
 Soft pencil (type B or HB is recommended)

* 6 8 2 9 6 2 8 5 5 3 *

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.

There are **30** questions on this paper. Answer **all** the questions.

For each question there are four possible answers **A, B, C** and **D**. Choose the **one** you consider correct and record your choice in pencil on the separate answer sheet.

Read very carefully the instructions on the answer sheet. Ignore responses numbered 31–40 on the answer sheet.

DO **NOT** WRITE IN ANY BARCODES.

INFORMATION FOR CANDIDATES

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

This document consists of **19** printed pages and **1** blank page.

- 1 Six teams are taking part in a five-a-side football tournament.

Each match has a playing time of 15 minutes, but if the scores are level at full time, play continues until the next goal is scored. Points are awarded as detailed below.

Winning team : 1 point + the difference between the number of goals scored by the teams

Losing team : 1 point if the team scores 2 goals or more, otherwise 0 points

These are the results of all the matches played so far.

Krakens	4	Triffids	3
Wyverns	5	Yetis	0
Bunyips	4	Dragons	2
Wyverns	5	Triffids	3
Dragons	4	Krakens	1
Yetis	2	Bunyips	0
Dragons	5	Wyverns	2
Krakens	6	Bunyips	4
Triffids	3	Yetis	2

All the teams have now played three matches, and the Wyverns are top of the league table at present.

How many points do the Wyverns have?

- A 9
 - B 10
 - C 11
 - D 12
- 2 Pedro and his wife Amalia are at the railway station. There is an escalator and also a fixed staircase up to the floor where the platforms are. Both have the same size of steps. If someone is standing still on the escalator they rise at the same speed as someone climbing the fixed steps at 2 steps per second. The fixed staircase has 60 steps.

Pedro walks up the fixed staircase at 3 steps per second, whilst Amalia walks up the escalator, taking 2 steps per second.

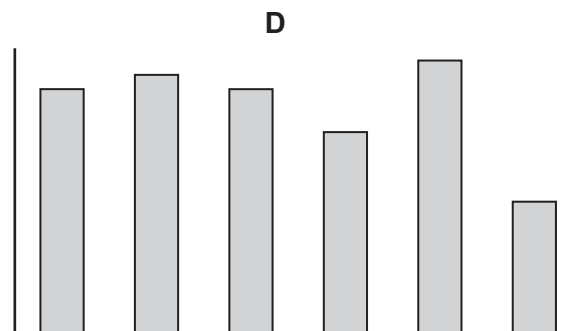
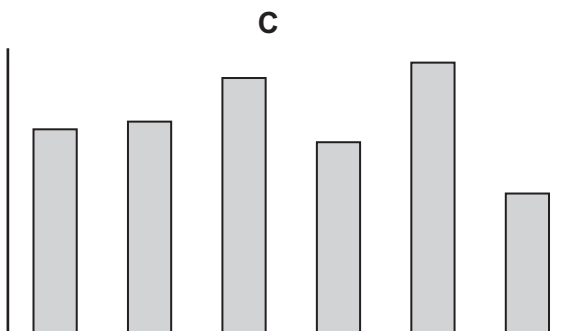
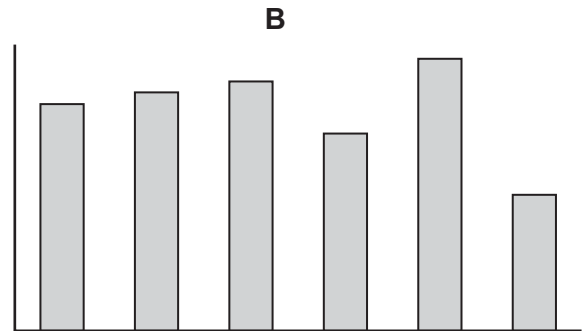
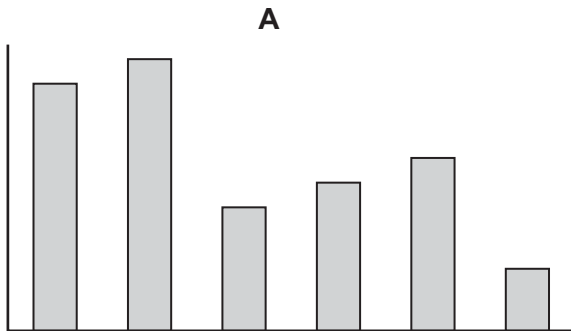
Who reaches the top first, and by how much?

- A Amalia is first by 5 seconds
- B Amalia is first by 10 seconds
- C Pedro is first by 5 seconds
- D Pedro is first by 10 seconds

- 3 In a factory, all the workers are paid \$2 for each item they produce that passes the quality test. Fred kept a record of how many items he produced each day and how many of those failed the test.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Produced	100	105	110	87	120	60
Failed	20	22	10	12	14	5

Which of the following graphs, if suitably labelled, would represent the amount of money Fred earned each day?



4 Forty football teams compete annually for the Hexapod Cup.

The teams are divided into eight groups of five, with the winner of each group proceeding to the knockout stage of the competition. Within each group, the teams all play each other twice – at home and away.

Curculio have won Group E this year. Their results are as follows:

<i>Opponents</i>	<i>Venue</i>	<i>Result</i>	<i>Score (home team first)</i>	<i>Cumulative points total</i>
Tettix	Home	Won	3 – 2	3
Cantharis	Away	Won	1 – 3	6
Sauba	Away	Drawn	1 – 1	7
Hesperian	Home	Lost	2 – 5	7
Tettix	Away	Won	0 – 2	10
Cantharis	Home	Drawn	3 – 3	11
Sauba	Home	Won	4 – 2	14
Hesperian	Away	Won	2 – 3	17

Against which team did Curculio score most goals in total over the two matches?

- A** Cantharis
- B** Hesperian
- C** Sauba
- D** Tettix

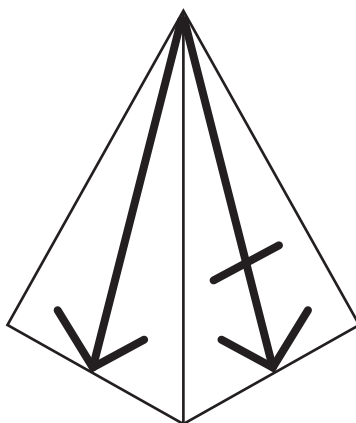
- 5 Groups of organic chemicals have a general mathematical formula which applies to all members of the group. So, suppose that molecules such as C_nH_n exist. If n was equal to 1 then the molecule would have one carbon atom and one hydrogen atom, that is C_1H_1 . The next member of the group would have two of each type of atom, C_2H_2 , the third would have three of each type, C_3H_3 , and so on as the organic molecule increases in length.

The first four members of a group of organic chemicals known as the *alkanes* are as follows:

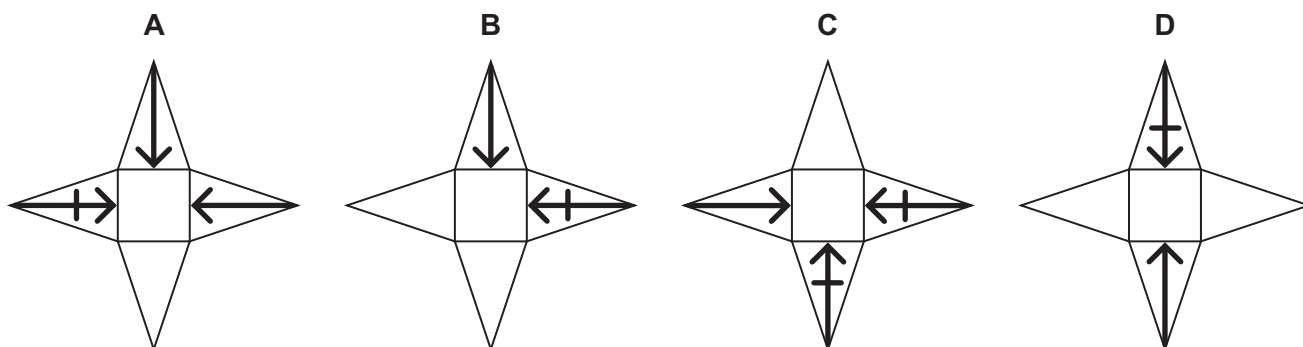
<i>Molecular formula</i>	<i>Name</i>
CH_4	methane
C_2H_6	ethane
C_3H_8	propane
C_4H_{10}	butane

Which of the following represents the general formula of the *alkanes*?

- A C_nH_{2n-1}
 B C_nH_{2n}
 C C_nH_{2n+1}
 D C_nH_{2n+2}
- 6 The pyramid below is constructed by folding a net made from card, which is printed on one side and blank on the other.



Which of the following could be the net of the pyramid above?

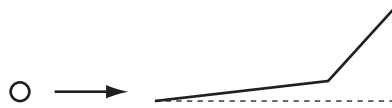


- 7 There were five judges in a break-dancing competition. Each judge gives each competitor a score from 0.0 to 6.0. To get the total score for each dancer, the highest and lowest marks are disregarded and the remaining three scores added up. The winner is the dancer with the highest total. The table below shows the judges' marks for the four leading competitors.

<i>Dancer</i>	<i>Judge 1</i>	<i>Judge 2</i>	<i>Judge 3</i>	<i>Judge 4</i>	<i>Judge 5</i>
Dizzy	5.9	5.6	5.6	5.3	5.3
Hectic	5.3	5.7	5.7	5.2	5.7
Spinner	5.3	5.1	5.7	5.2	6.0
Twister	5.3	5.5	5.5	5.9	5.4

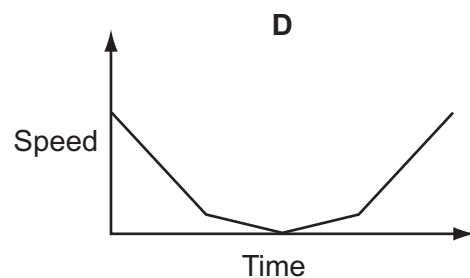
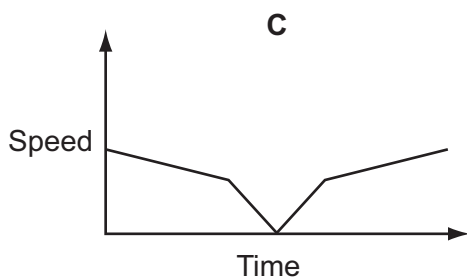
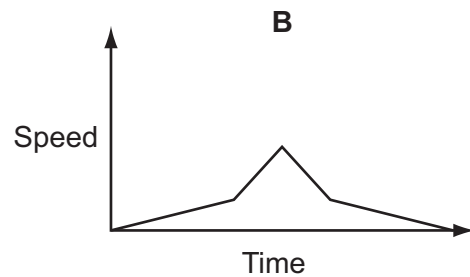
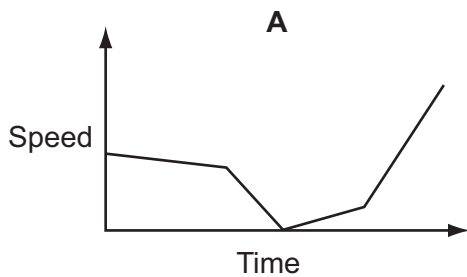
Who won the competition?

- A** Dizzy
B Hectic
C Spinner
D Twister
- 8 A ball is rolled towards a ramp that is shaped as shown below:



The speed is observed as the ball rolls up and down the ramp.

Which one of the following could show the graph of speed against time?



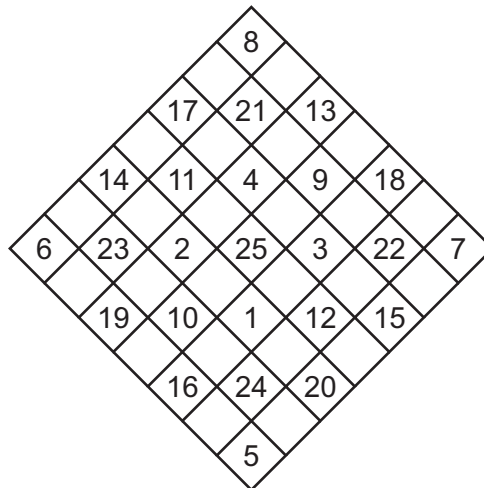
- 9 Every 7 days I visit my mother, so if I visit my mother on a Monday then I next visit her on the following Monday. Every 5 days I visit my sister. These are the only times that I visit them. Today is 1 January, and I will visit both my mother and my sister today. There are 31 days in January.

On which day will I next visit both of them?

- A 3 February
 - B 4 February
 - C 5 February
 - D 6 February
- 10 Pete is writing the songs for a new musical show. He is able to write any number of songs, each of which will last at least two minutes and no more than three minutes. The producer has decided that the show will run for at least two hours and at most two and a half hours, including an interval of 30 to 45 minutes. The songs are to make up at most 20% of the running time of the show, excluding the interval. The songs in the show are chosen by the producer from those written by Pete.

What is the maximum number of Pete's songs that the producer could choose to be in the show?

- A 8
- B 9
- C 12
- D 15



This is a dart-board at a funfair stall. The board has 49 squares: 25 squares containing the numbers from 1 to 25 and 24 blank squares. To play the game, a player throws four darts at the board. If a dart lands on a numbered square the player scores that many points, otherwise she scores 0. To win a prize, the player must score a total of 60 or less, and each dart must score at least 1.

Erica scored 12 with her first dart, then each successive dart scored higher than the previous one. Nevertheless, she won a prize, scoring exactly 60.

Which one of these additional pieces of information is sufficient, by itself, to confirm that Erica's darts scored 12, 13, 15 and 20?

- A Her second dart scored 13
 - B Her third dart scored 15
 - C Her second and third darts scored a total of 28
 - D Her third dart scored 2 more than her second dart
- 12** At the appointed time, my alarm clock emits 3 beeps of 3 seconds duration each, with a gap of 2 seconds between them. 90 seconds after the last of these beeps finishes, if I have not switched the alarm off in the meantime, it emits 4 beeps of 3 seconds duration each, with a gap of 2 seconds between them. This continues, with one extra beep added after each interval of 90 seconds, until it is switched off.

I usually get out of bed at the end of the set of 5 beeps. This morning I heard just one beep as I woke up. However, 90 seconds later there were 8 beeps and I leapt out of bed immediately afterwards.

How much later than usual was it this morning when I got out of bed?

- A 4 minutes 39 seconds
- B 5 minutes 33 seconds
- C 6 minutes 09 seconds
- D 6 minutes 15 seconds

13 At a 70th birthday party lunch the menu is shown below:

<i>Starter</i>
Melon
Prawns
Soup
~
<i>Main Course</i>
Beef
Lamb
Salmon
~
<i>Dessert</i>
Bread and Butter Pudding
Chocolate Fudge Cake
Eton Mess

The diners were asked to make their choices before the actual day and the order was placed. 5 diners chose no starter and 7 declined a dessert. The main course choices showed Salmon the least popular, with 3 times as many choosing Lamb and twice as many choosing Beef as Lamb.

On the day one diner who had chosen 3 items was unable to attend. The restaurant actually served 75 dishes.

How many diners were originally expected to attend?

- A 25
- B 26
- C 29
- D 30

14 The Rainbow dance troupe has 17 members. For a particular performance, each dancer needs a costume in one of the seven colours of the rainbow. Each of the seven colours must be worn by at least two dancers. The prices of costumes vary according to colour and are shown in the following table.

<i>Colour</i>	<i>Price</i>
Red, yellow or blue	\$11 each
Orange, green or violet	\$12 each or "Any two of the same colour for \$20"
Indigo	\$15 each or "Buy three, get one free"

What is the least possible cost of buying the 17 costumes?

- A \$171
- B \$182
- C \$183
- D \$187

- 15** Andrea, Ben and Charlie are employed on a beach by Hal to fill trailers full of sand. When working on their own, Hal notices that it takes Andrea exactly 40 minutes to fill a trailer, while Ben takes 60 minutes, and Charlie takes 80 minutes. If Andrea and Ben work together it takes them 50 minutes to fill two trailers and if all three work together it takes 60 minutes to fill three trailers.

Which one of the following is consistent with Hal's observations?

- A** Two people working together improves their individual work rate, and a third improves the work rate further
- B** Two people working together reduces their individual work rate, and a third reduces the work rate further
- C** Two people working together reduces their individual work rate, but a third leaves this reduced rate unchanged
- D** Two or three people working together leaves their individual work rate unchanged
- 16** Trains from Appleford to Orangetown take 20 minutes and trains from Orangetown to Bananabury take 30 minutes. It takes me 2 minutes to change trains at Orangetown. Both trains leave precisely according to the timetable below.

Trains leave Appleford for Orangetown at 10:03 and then every 4 minutes	Trains leave Orangetown for Bananabury at 10:02 and then every 5 minutes
----------------------------------------------------------------------------------	-----------------------------------------------------------------------------------

It takes me 15 minutes to walk from Bananabury station to my office.

Which is the latest train I can catch at Appleford if I must reach my office by 12:00?

- A** 10:47
- B** 10:50
- C** 10:51
- D** 10:53
- 17** Abdul in the UK wishes to telephone Sophie in Bangladesh, where the time is 6 hours ahead of the time in the UK. Abdul wakes up at 07:00 and goes to sleep at 23:00. Sophie wakes up at 06:00 and goes to sleep at 22:00. They are not available to speak during their lunch hours, which they both take between 13:00 and 14:00, but they are available otherwise when they are awake. All times given are local times.

What is the longest continuous conversation that they can have?

- A** 2 hours
- B** 5 hours
- C** 6 hours
- D** 8 hours

- 18** A social club is holding its annual meeting. A sausage and mash supper will be provided for each person. Each supper will consist of 3 sausages and a 0.5kg portion of mashed potatoes, together with an optional glass of juice. One bottle of juice will serve 5 people. The sausages, potatoes and juice will be bought from the local supermarket, and the costs are shown in the following table.

Sausages	Pack of 12: \$2.20 Special offer: 4 packs for the price of 3
Potatoes	2.5 kg bag: \$3.00 10 kg bag: \$10.50
Juice	\$5.00 per bottle Special offer: Buy one, get one half-price

At least 40 people, but no more than 50 people, are expected to attend the meeting and at least 10% will not want juice.

What is the least total cost to ensure that there is sufficient food and juice for every person at the meeting to have the supper?

- A** \$68.60
- B** \$76.50
- C** \$84.00
- D** \$90.60

- 19 The sending of Christmas cards can be difficult, with some people offended if they get one, or get an inappropriate one, and others offended if they do not. There are six different types of card available from a charity, and I have made a table of which ones would be suitable for the different friends and relations to whom I plan to send a card.

The cards are available for \$1 each, or \$4 for six of the same, or \$4 for packs with one of each type.

<i>Name</i>	<i>Crib scene</i>	<i>Furry angel</i>	<i>Snowy town</i>	<i>Tree</i>	<i>Candle</i>	<i>New year</i>
Granny	Yes					
Mike			Yes	Yes	Yes	
July	Yes		Yes	Yes	Yes	
Judy	Yes	Yes				
Ahmed			Yes	Yes	Yes	Yes
Little John				Yes	Yes	Yes
Big John		Yes	Yes			
Lizzy	Yes	Yes				Yes
Amy		Yes				
Sreejit						Yes
Sean		Yes	Yes		Yes	
Janice					Yes	
Tonybler	Yes	Yes	Yes	Yes	Yes	Yes
Ginger						Yes

What is the minimum cost for me to obtain suitable cards for everyone?

- A \$10
- B \$11
- C \$12
- D \$14

- 20 Jane has a wall in her kitchen 1900 mm long. She wants a row of wall units that exactly fits this space.

Wall Units	
Width (mm)	Cost (\$)
800	125
750	115
500	80
350	60
200	40

What is the lowest cost she could pay for the units?

- A \$290
 - B \$300
 - C \$310
 - D \$320
- 21 Josh wishes to buy some DVDs of his favourite films to give to his friends as presents. The store that he wants to get the DVDs from sells them for \$9 each. If he decides to travel to the store to get the DVDs it will cost Josh \$8 to travel there and back. Alternatively, the store offers a delivery service which costs \$3, plus 75¢ per DVD. Josh has worked out that it is cheaper for him to use the store's delivery service to get his DVDs than to travel to the store.

What is the largest number of DVDs that Josh could be intending to buy?

- A 6
- B 7
- C 10
- D 11

22 The Victon Cycling Challenge consisted of five races.

For each race points were awarded as follows:

Winner	9 points
Second	5 points
Third	2 points

The first race was won by Donna, with Bella second and Carla third.

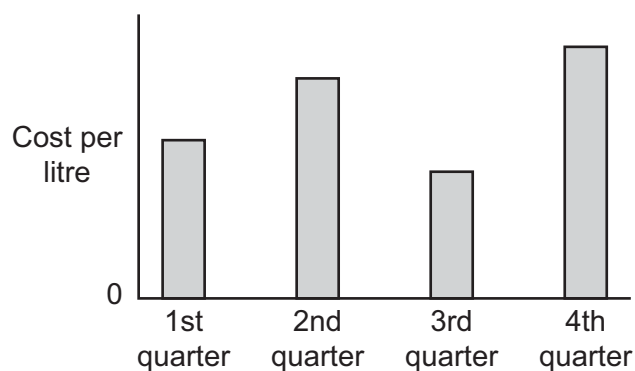
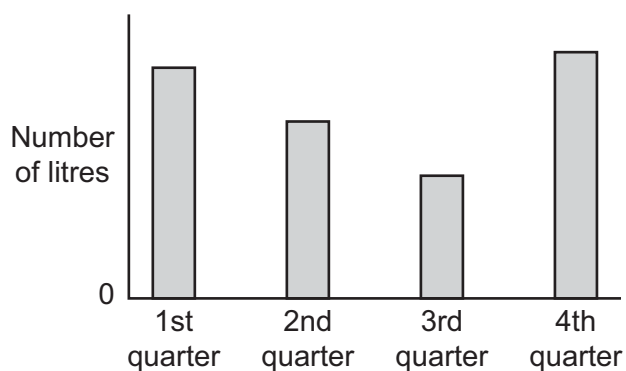
Anna won the next race, with Carla second and Donna third.

The overall result was a four-way tie between Anna, Bella, Carla and Donna, who had 20 points each. In fact, no other competitors scored any points at all.

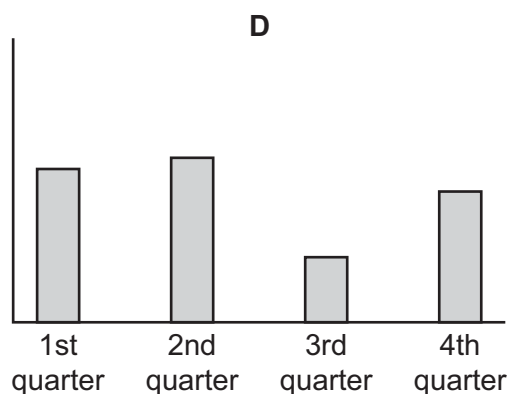
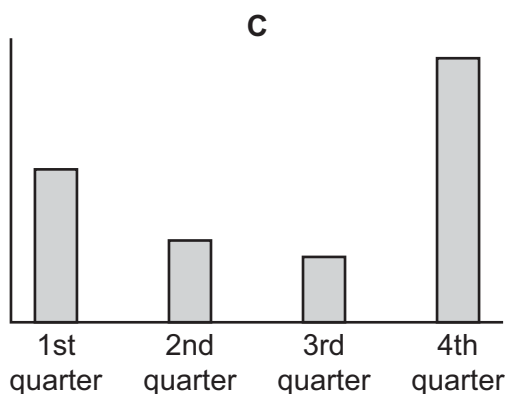
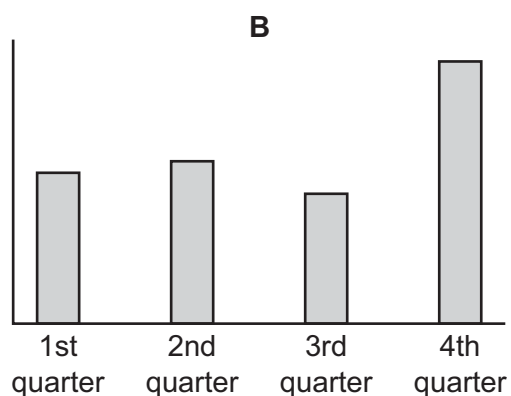
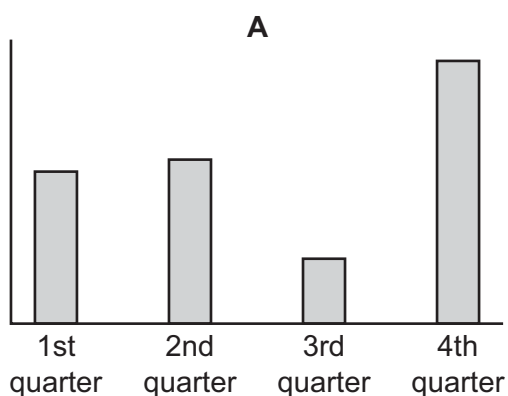
Which one of the following statements is definitely true?

- A** Anna won the last race
- B** Bella was second in the last race
- C** Carla was third in the last race
- D** Donna did not finish in the top three in the last race

- 23 The number of litres of milk purchased by a bakery, and the cost per litre, during each quarter in one year are shown in the two graphs below.



Which one of the following graphs, if suitably labelled, would show the amount of money spent on milk each month?



- 24** A teacher in a school uses star-shaped stickers to reward her students for good work. The stars are in three different colours: bronze, silver and gold, which are worth 1, 2 and 5 points respectively. She has used exactly 10 stars of each colour, and four of her students have the same total number of points, having each received the same number of stars.

What is the largest number of points that each of the four students could have?

- A** 16
 - B** 19
 - C** 20
 - D** 35
- 25** A three-dimensional shape is made by taking a cube and cutting off each of its corners. The cuts extend to less than halfway along each edge.

How many edges does the new shape have?

- A** 12
 - B** 20
 - C** 32
 - D** 36
- 26** Pearl bought a dress in a sale in June for \$60. The full price of the dress, in April, was \$96. At the beginning of May, the dress was reduced in price by a certain number of dollars. At the beginning of June it was reduced by an extra 25% off the sale price.

If Pearl had bought the dress in May, how much would she have saved compared with the full price?

- A** \$11
- B** \$16
- C** \$20
- D** \$36

- 27 In the early stages of the Fantasy-World Cup the 24 competing teams are divided into four Groups of six. In each Group all teams play each other once, and the Group Winner progresses to the semi-finals. Teams gain 3 points for a win, 2 points for a score draw (1 – 1, 2 – 2 etc.) and 1 point for a scoreless draw (0 – 0).

This is the final table for Group 3:

	<i>Played</i>	<i>Won</i>	<i>Drawn</i>	<i>Lost</i>	<i>Goals For</i>	<i>Goals Against</i>	<i>Points</i>
Narnia	5	3	2	0	10	2	12
Omnia	5	3	1	1	8	2	11
Xanadu	5	2	1	2	8	6	8
Utopia	5	2	1	2	5	6	7
Lilliput	5	1	1	3	2	9	5
Ruritania	5	0	2	3	2	10	4

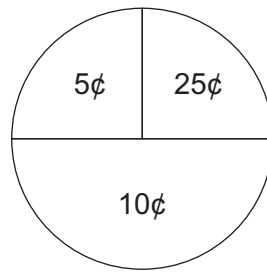
Narnia were losing 2 – 0 during their last match, but two late goals from Tumnus, Narnia's striker, ensured qualification for the semi-finals.

Against which team did Narnia draw 2 – 2 in their last group match?

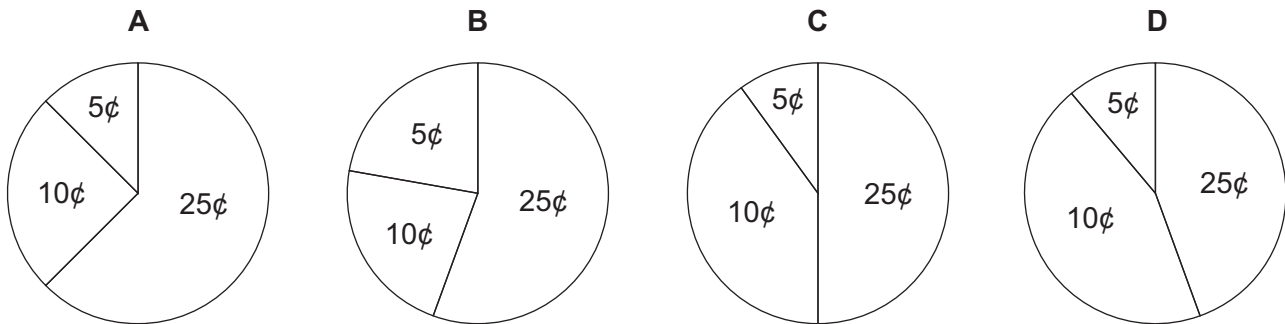
- A Lilliput
- B Omnia
- C Ruritania
- D Xanadu

- 28 For some time I have collected 25¢, 10¢ and 5¢ coins in a large jar. Last week the jar was full and when I emptied it I discovered that I had saved \$500.

The pie chart below represents the number of coins there were of each of the denominations.



Which one of the following pie charts represents the total value of each of the coin denominations that I had saved in my jar?



- 29 Amy and Bahula are sharing out some sweets. They take a handful each and there are none left in the box. Amy has the most so she gives Bahula as many as Bahula already has. Bahula then gives Amy as many as Amy now has. They now have the same number.

What is the smallest number of sweets there could have been in the box originally?

- A 5
- B 8
- C 16
- D 30

- 30** Dion lives in Bolandia, where a 50¢ coin weighs 7g, a 20¢ coin weighs 5g and a 10¢ coin weighs 3g. These are the only three coins in circulation.

Starting on November 1st, Dion put at least two 50¢ coins, at least two 20¢ coins and at least two 10¢ coins into a jar every day. After he had made his addition to the collection on November 30th, he decided to weigh the money. He discovered that he had saved exactly 1 kilogram of coins during the month.

What is the difference between the maximum possible amount and the minimum possible amount that Dion could have saved in his jar during November?

- A** \$3.10
- B** \$3.20
- C** \$3.30
- D** \$3.40

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