Junior Maths Mastery Challenge Sample

Paper B

Section A

Questions 1 to 5 carry 3 marks each.

1. Find the value of the following.

$$1 + 2 + 3 + \ldots + 7 + 8 + 9 + 8 + 7 + \ldots + 3 + 2 + 1$$

$1 + 2 + 3 + \ldots + 8 + 9 + 8 + \ldots + 3 + 2 + 1 = 2 + 4 + 6 + 8 + 10 + 12 + 14 + 16 + 9$
$2 + 16 = 18$
$4 + 14 + 18$
$6 + 12 = 18$
$8 + 10 = 18$
$18 + 18 + 18 + 18 + 9 = 81$

[Arithmetic]

(A) 72 (B) 81 (C) 99
(D) 109 (E) None of the above

2. Each shape below represents a different number.

△ × □ = 15

□ × ○ = 35

[Arithmetic / Repeated identity]

What is the value of △ × ○ ?

$5 \times 3 = 15$ and $5 \times 7 = 35$

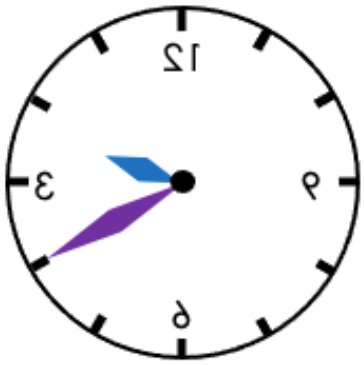
So, □ = 5, △ = 3 and ○ = 7.

△ × ○ = $3 \times 7 = 21$

(A) 10 (B) 14 (C) 20
(D) 21 (E) None of the above

3. Lina started doing her homework at 11:30 am. After she finished her homework, she saw the reflection of her wall clock through a mirror as shown in the diagram. How many minutes did she spend doing her homework?

[Spatial visualisation]



Afternoon

The time shown on the clock was 2:20 pm.

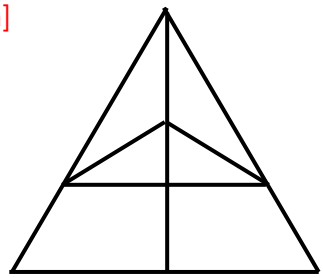
From 11:30 am to 2:20 pm, the duration is 2 h 50 min.

(A) 150 min (B) 160 min (C) 170 min

(D) 250 min (E) None of the above

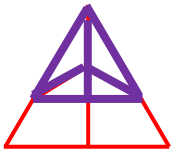
4. How many triangles are there in the figure?

[Spatial visualisation]

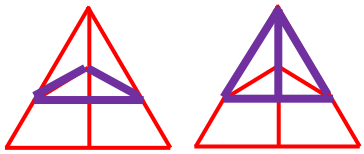


The figure itself is 1 large triangle.

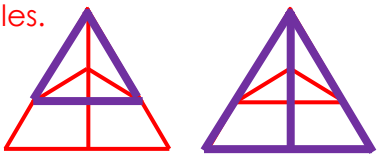
Count the small triangles.
There are 4 such triangles.



Count the triangles that are made up of two small triangles.
There are 3 such triangles.



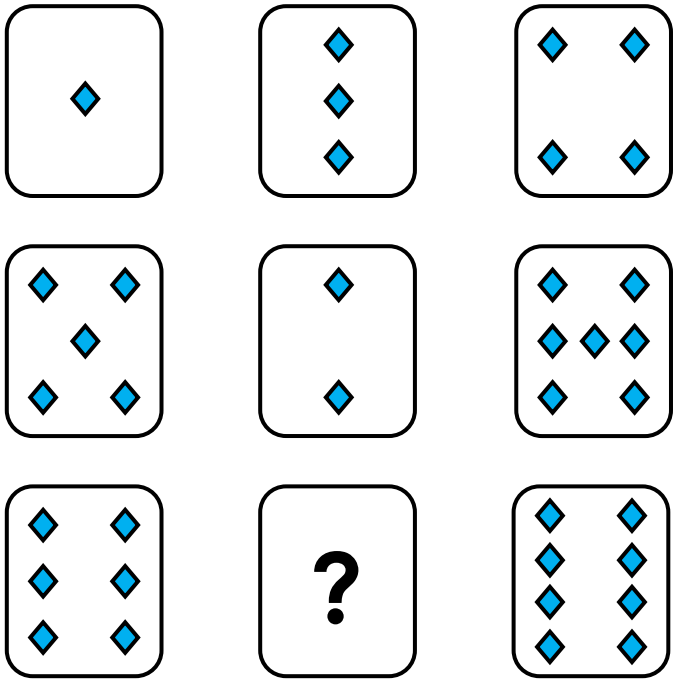
Count the triangles that are made up of more than two triangles.
There are 3 such triangles.



1 + 4 + 3 + 3 = 11
There are 11 triangles in the figure.

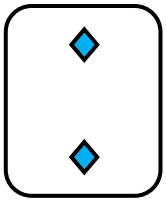
(A) 11 (B) 12 (C) 13
(D) 14 (E) 15

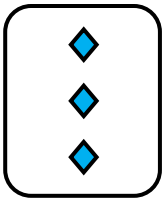
5. Study the pattern below.

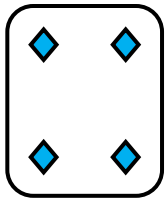


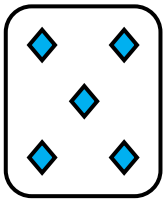
What is the missing figure? [Patterns and sequences]

Count the number of diamonds on in each figure.
1 + 3 = 4
5 + 2 = 7
6 + 2 = 8
The missing figure should have 2 diamonds.

(A) 

(B) 

(C) 

(D) 

(E) None of the above

Questions 6 to 10 carry 4 marks each.

6. A bus left the terminal with some passengers.

   At the 1st bus stop, 16 passengers alighted and 5 passengers boarded.

   At the 2nd bus stop, 7 passengers alighted and 12 passengers boarded.

   There were 46 passengers onboard the bus when it left the 2nd bus stop. How many passengers were onboard the bus when it left the terminal?

   [Problem solving / work backwards]

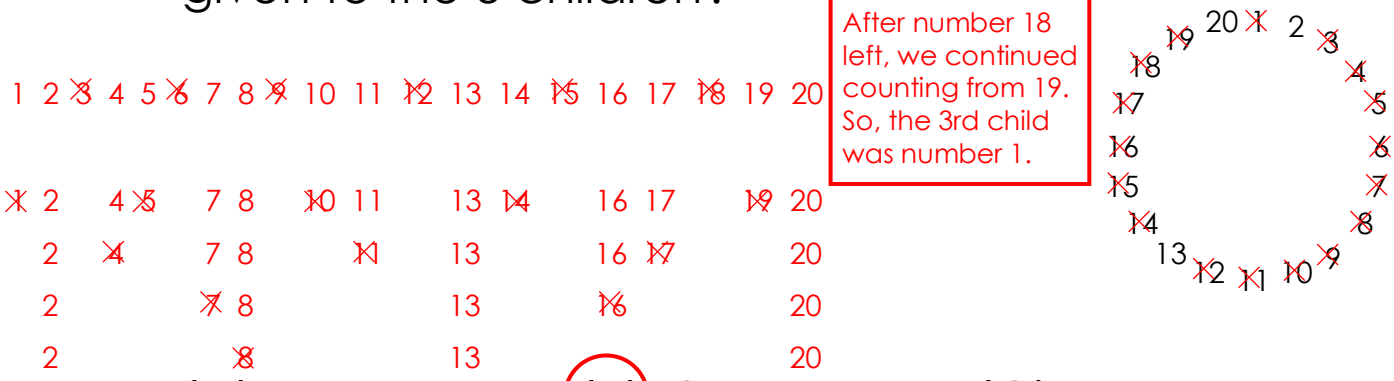
46 – 12 = 34
34 + 7 = 41
There were 41 passengers onboard the bus when it left the 1st bus stop for the 2nd bus stop.

41 – 5 = 36
36 + 16 = 52
There were 52 passengers onboard the bus when it left the terminal.

(A) 40 (B) 42 (C) 44
(D) 46 (E) None of the above

7. 20 children were sitting in a circle. They were given numbers 1 to 20 in order. Starting from number 1, every 3rd child was asked to leave the circle until 3 children remained. What was one of the numbers given to the 3 children? [Problem solving / Act it out]

After number 18 left, we continued counting from 19. So, the 3rd child was number 1.



(A) 1 (B) 2 (C) 17

(D) 19 (E) None of the above

8. There are 5 red balls, 4 blue balls and 3 orange balls in a bag. Without looking into the bag, Ben removed 3 balls. How many possible different combinations of the colours are there? [Combinatorics]

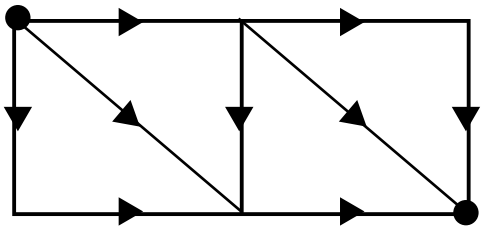
The different combinations are as follows:
1) 3 red
2) 3 blue
3) 3 orange
4) 2 red, 1 blue
5) 2 red, 1 orange
6) 2 blue, 1 red
7) 2 blue, 1 orange
8) 2 orange, 1 red
9) 2 orange 1 blue
10) 1 red, 1 blue, 1 orange

(A) 10 (B) 12 (C) 14

(D) 16 (E) 18

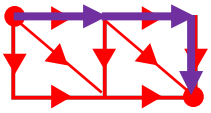
9. The lines in the diagram below show the paths from Zoe's house to Leon's house. The arrowheads show the directions allowed along each path. How many different ways can Zoe walk from her house to Leon's house? [Combinatorics]

Zoe's house



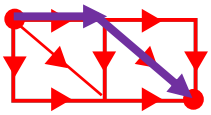
Leon's house

Zoe's house



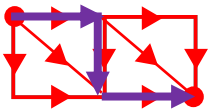
Leon's house

Zoe's house



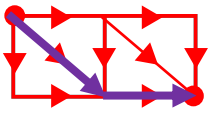
Leon's house

Zoe's house



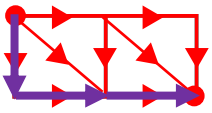
Leon's house

Zoe's house



Leon's house

Zoe's house



Leon's house

(A) 6 (B) 7 (C) 8

(D) 9 (E) None of the above

10. Jane bought a blue, red, yellow and orange T-shirt. Ken, Lisa, Mandy and Tom took a T-shirt of their favourite colour.

    - Ken dislikes yellow and red.
    - Lisa dislikes red and orange.
    - Mandy's favourite colour is orange.
    - Tom's favourite colour is the colour both Ken and Lisa dislike.

    [Logical reasoning]

    Which of the following statements is **false**?

Ken and Lisa both dislike red.
Tom's favourite colour is red. He took the red T-shirt.

Mandy took the orange T-shirt.

Since Mandy took the orange T-shirt and Ken dislikes yellow and red, Ken took the blue T-shirt.

So, Lisa took the yellow T-shirt.

(A) Ken took the blue T-shirt.
(B) Lisa did not take the blue T-shirt.
(C) Lisa did not take the yellow T-shirt.
(D) Mandy took the orange T-shirt.
(E) Tom took the red T-shirt.

Section B

Questions 11 and 12 carry 6 marks each.

11. Each letter represents a different digit.

$$\begin{array}{cccc} & A & B & C \\ & & B & C \\ + & & & C \\ \hline & D & E & F \end{array}$$

Find the greatest possible 3-digit number ABC can represent. [Cryptarithm]

Since A and D represent different digits, there must be renaming in B + B.
It is not possible for A to be 9 since ABC + BC + C is a 3-digit number.
So, we let A = 8. The next greatest digit is 7. We let B = 7.

$$\begin{array}{cccc} & {\scriptstyle 1}8 & 7 & C \\ & & 7 & C \\ + & & & C \\ \hline & 9 & 4 & F \end{array}$$

The remaining digits are 1, 2, 3, 5 and 6.
If C = 6, then 6 + 6 + 6 = 18 and F = 8 but it is not possible.
If C = 5, then 5 + 5 + 5 = 15 and F = 5 but it is not possible.
If C = 4, then 4 + 4 + 4 = 12 and F = 2 and E = 5. It is possible.
So, the greatest possible 3-digit number ABC can represent is 874.

$$\begin{array}{cccc} & {\scriptstyle 1}8 & {\scriptstyle 1}7 & 4 \\ & & 7 & 4 \\ + & & & 4 \\ \hline & 9 & 5 & 2 \end{array}$$

12. Helen has 5 blue hair clips, 3 yellow hair clips and 6 pink hair clips in a box. Without looking into the box, she removes 1 hair clip at a time. What is the minimum number of hair clips she must take out to be sure there are 3 hair clips of different colours?

[Number Theory]

In the worst case scenario, Helen takes out 5 blue hair clips, 6 pink hair clips and 1 yellow hair clip with the yellow hair clip in her last pick.

5 + 6 + 1 = 12
She must take out a minimum of 12 hair clips to be sure that there are 3 hair clips of different colours.