Creating Reasoning Routines, Building Problem-Solvers

Session 3

Building Problem-Solving Across the Curriculum

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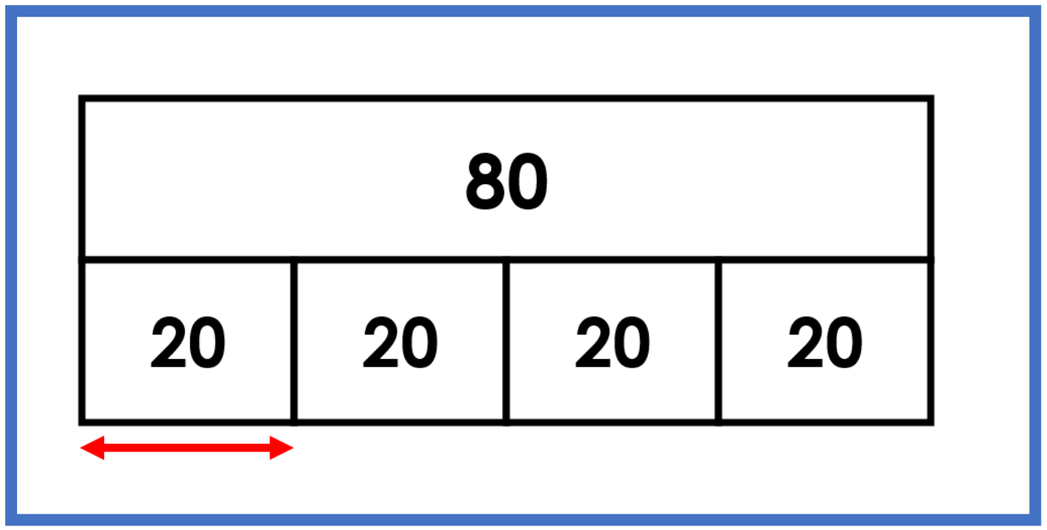
Y5 & Y6

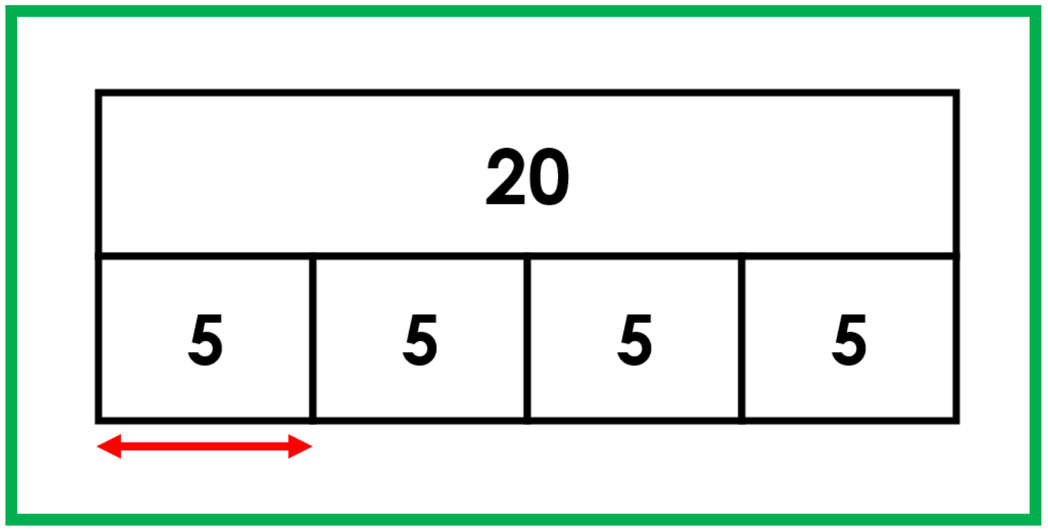
$\frac{1}{4}$ of a number is 20.

What is the number?

$\frac{1}{4}$ of a number is 20.

What is the number?

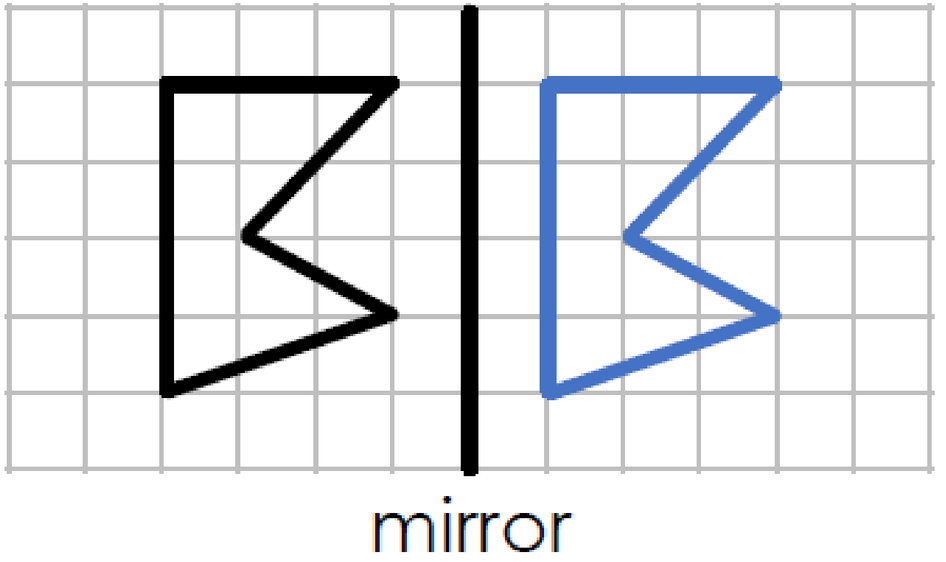




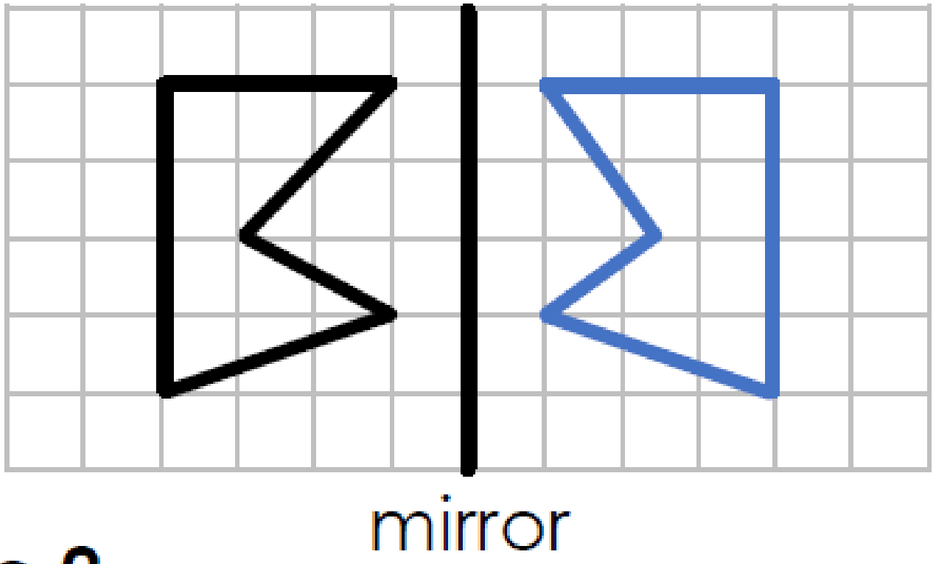
Explain the Mistakes

Reflect the shape in the mirror line.

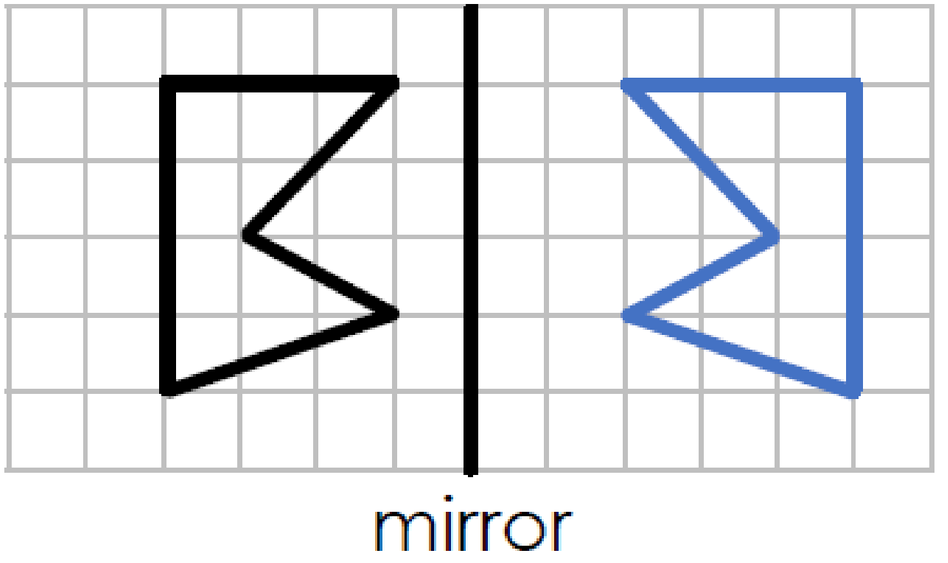
Mistake 1



Mistake 3

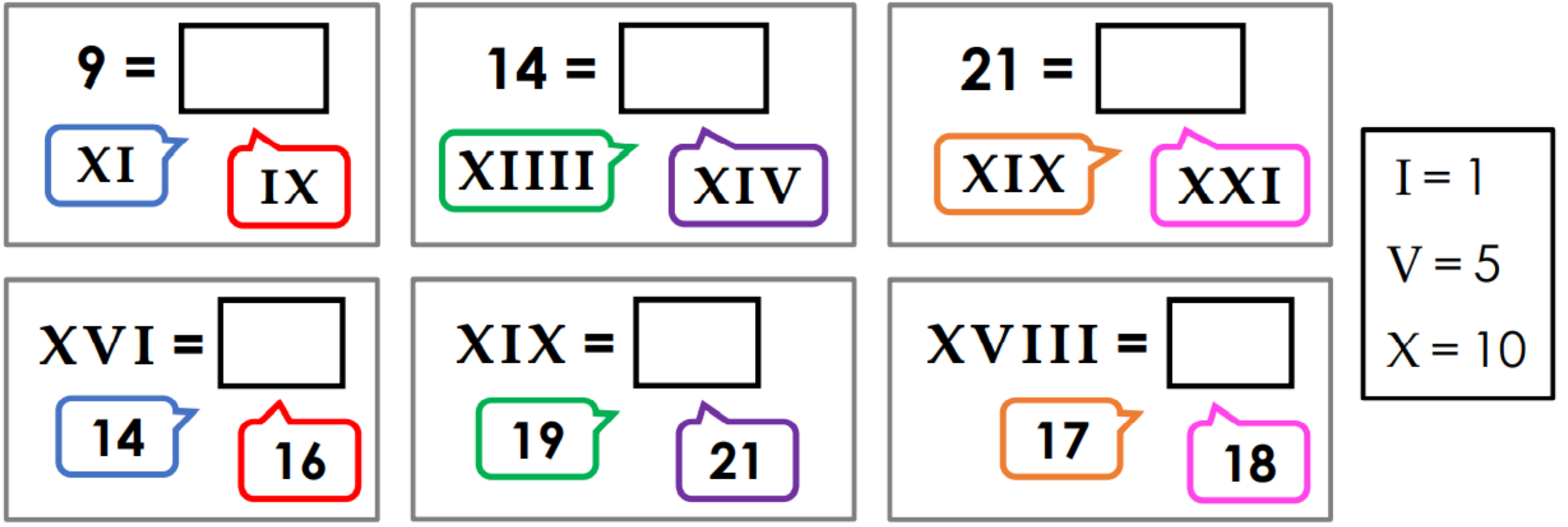


Mistake 2



Which Answer?

What is the missing Roman Numeral or number?



Explain the mistakes.

Correct or Incorrect? ✓ or ✗

Which of these regroups have been done correctly?

$$\begin{array}{r} {}^{4}\not{5}\,{}^{1}6\;8 \\ -\;4\;7\;3 \\ \hline 5 \\ \hline \end{array}$$

$$\begin{array}{r} {}^{2}\\ 5\;\not{3}\;6^{1} \\ -\;3\;0\;8 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} {}^{6}\\ \not{7}\,{}^{1}8\;6 \\ -\;3\;7\;0 \\ \hline 6 \\ \hline \end{array}$$

$$\begin{array}{r} {}^{7}\,{}^{1}5 \\ \not{8}\;\not{6}\,{}^{1}4 \\ -\;3\;6\;5 \\ \hline \\ \hline \end{array}$$

How Many Ways?

$$\frac{\square}{8} + \frac{1}{\square} = \frac{\square}{4}$$

The answer must be a proper fraction.

Level 1: *I can find a way*

Level 2: *I can find different ways*

Level 3: *I know how many ways there are*

$162 \div 3$

$162 \div 6$

$324 \div 6$

$694 - 365$

$674 - 385$

$551 - 262$

$\frac{1}{10}$ of 40 = ☐

$\frac{1}{5}$ of 40 = ☐

$\frac{2}{5}$ of 40 = ☐

$\frac{4}{10}$ of 40 = ☐

$28 \div 4 =$ ☐

$28 \div 4 =$ ☐ + 1

$28 \div 4 =$ ☐ × 1

$28 \div 4 =$ ☐ ÷ 1

(a) I chose a number. I multiplied my number by 3. Then I added 5.
Now, my number is 26. **What number did I choose?** 7

(b) I chose a number. I multiplied my number by 3. Then I added 6.
Now, my number is 27. **What number did I choose?** 7

(c) I chose a number. I multiplied my number by 3. Then I subtracted 6.
Now, my number is 27. **What number did I choose?** 11

(d) I chose a number. I divided my number by 3. Then I subtracted 6.
Now, my number is 27. **What number did I choose?** 99

33
x 3
99

The answer to question [D] *is* ***the same/larger/smaller*** *than question* [C]
because…

Inverse

Task C

My number was ☐

I **multiply/divide** my number by **6**

I **add/subtract 3**

Now my number is **27**

What is the **largest number** that could go in the blue box? 180

What is the **smallest number** that could go in the blue box? 4

To make the number in the blue box as large as possible…

– and ÷, the start must be as big as possible!

NEW

Scaling and Ratio

Build 1

Max has **3** times as many conkers as Ben.

How many conkers does Ben have?

What information could be hidden?

Max has **3** times as many conkers as Ben.

Altogether, they have **12** conkers.

How many conkers does Ben have?

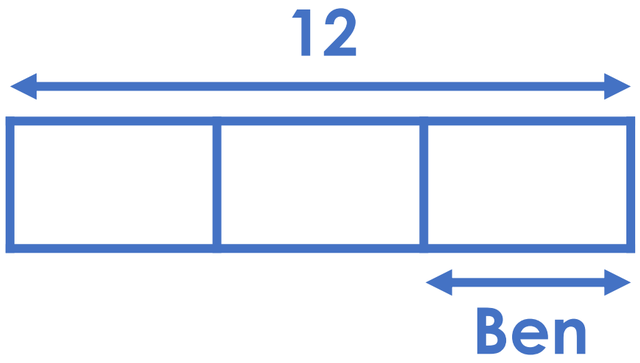
Build 1

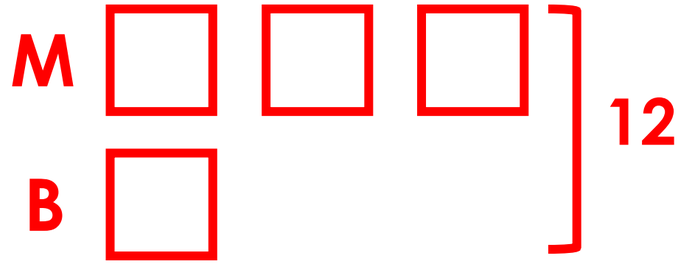
Max has **3** times as many conkers as Ben.

Altogether, they have **12** conkers.

How many conkers does Ben have?

Which picture represents the question?





For every **3** seeds that were planted,
1 seed grew.

60 seeds were planted.

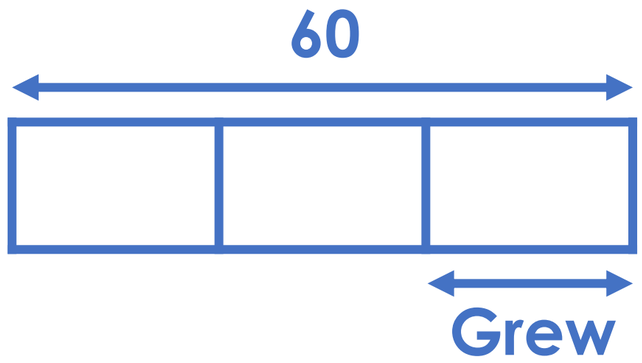
How many seeds grew?

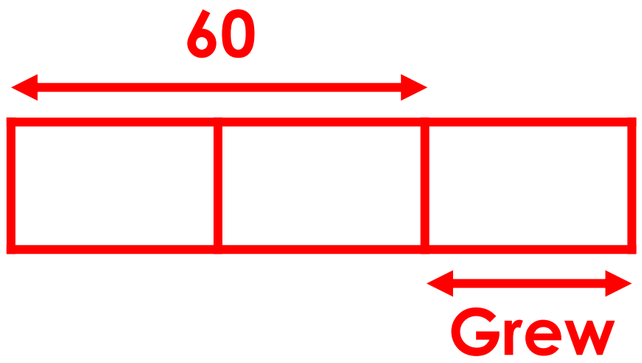
For every **3** seeds that were planted,
1 seed grew.

60 seeds were planted.

How many seeds grew?

Which picture represents the question?



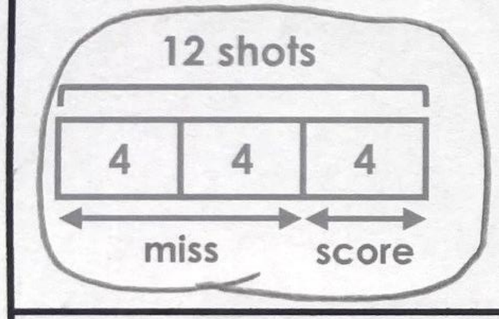


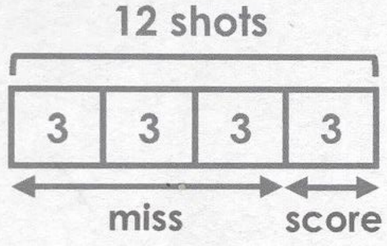
Scaling and Ratio

Task A

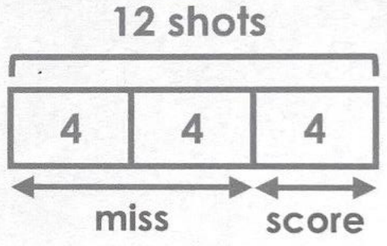
Which bar model correctly represents each question?

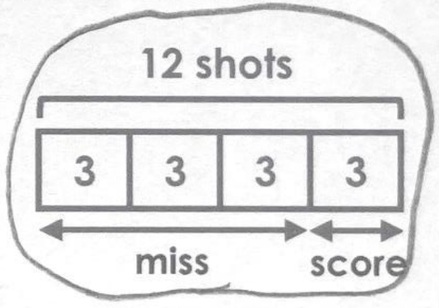
Jay played basketball. For every 3 shots he took, he scored 1 basket.
Jay took 12 shots.
How many baskets did Jay score?



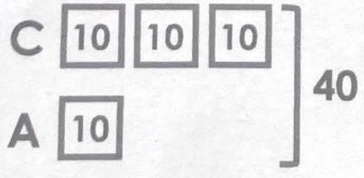


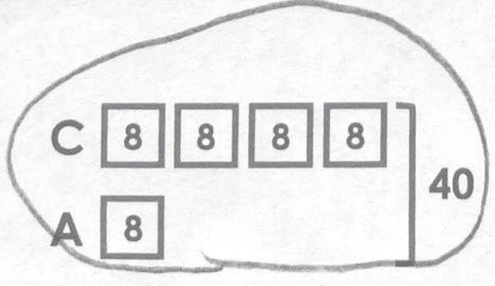
Kam played basketball. For every 3 shots he missed, he scored 1 basket.
Kam took 12 shots.
How many baskets did Kam score?



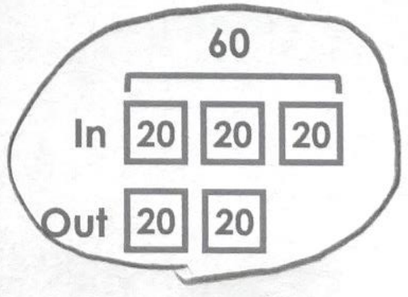


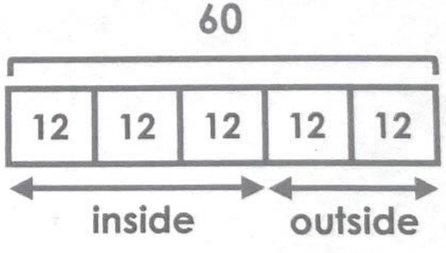
There is 1 adult for every 4 children on the school trip. 40 people go in total.
How many adults go on the school trip?





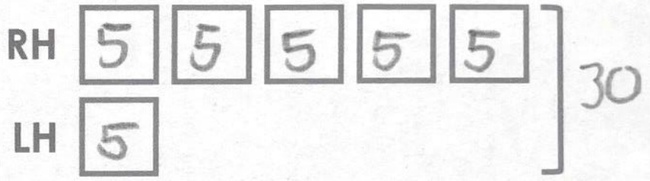
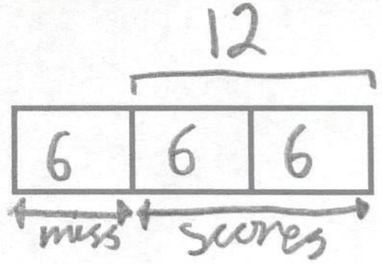
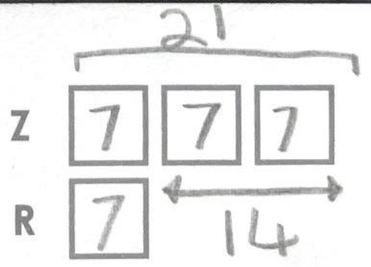
For every 3 children inside, there are 2 children outside. 60 children are inside.
How many children are outside?





Scaling and Ratio

Task B

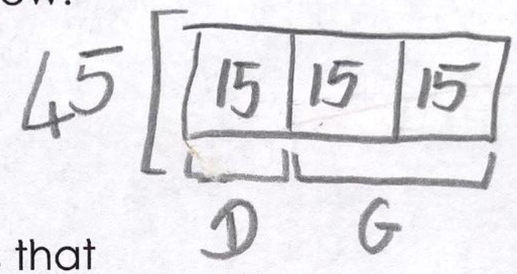
Question	Complete the bar model and answer:
For every 5 right-handed children in the class, there is 1 left-handed child. There are 30 children in the class. **How many are left-handed children are there in the class?**	 30 ÷ 6 = 5 5
For every 3 penalties that Fred takes, he scores 2 goals. Last season, Fred scored 12 penalties. **How many penalties did Fred take?**	 12 + 6 = 18 Scores = 12 Miss = 6 18 penalties
It takes Zara three times as long to walk to school as Rose. It takes Rose 7 minutes to walk to school. **How much longer does it take Zara to walk to school than Rose?**	 3 × 7 = 21 2 × 7 = 14 14 minutes

Scaling and Ratio

Task C

(a) For every 3 seeds that Hannah plants, 2 grow.
Hannah plants 45 seeds.
How many seeds grow?

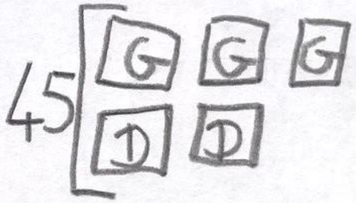
30



45 ÷ 3 = 15
15 × 2 = 30

(b) Kara plants some seeds. For every 3 seeds that grow, 2 seeds do not grow. Kara plants 45 seeds.
How many seeds grow?

27



45 ÷ 5 = 9
9 × 3 = 27

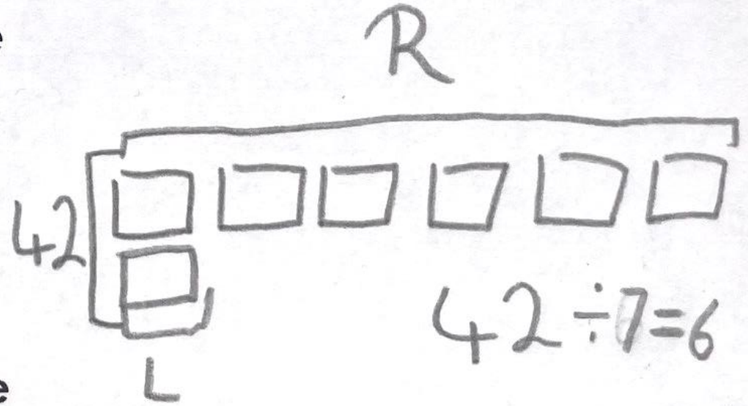
(c) At the tennis club, there are 6 times as many right-handed players as left-handed players.
There are 42 right-handed players at tennis club.
How many left-handed players are there at the tennis club?

7

42 ÷ 6 = 7

(d) At the cricket club, there are 6 times as many right-handed players as left-handed players.
There are 42 players at the cricket club.
How many left-handed players are there at the cricket club?

6



42 ÷ 7 = 6

Odd one out

3, 6, 9, 12

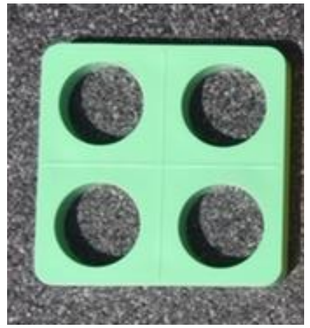
4, 7, 10, 13

4, 8, 12, 16

Numicon shows 1st term

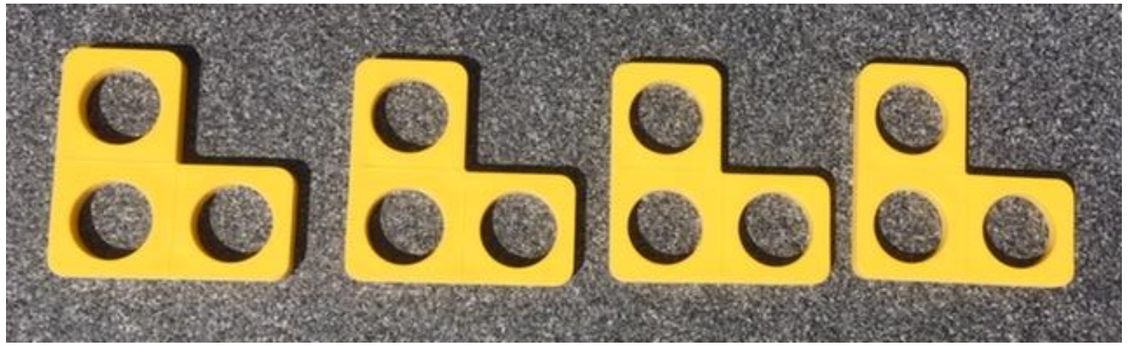
3, 6, 9, 12

4, 7, 10, 13



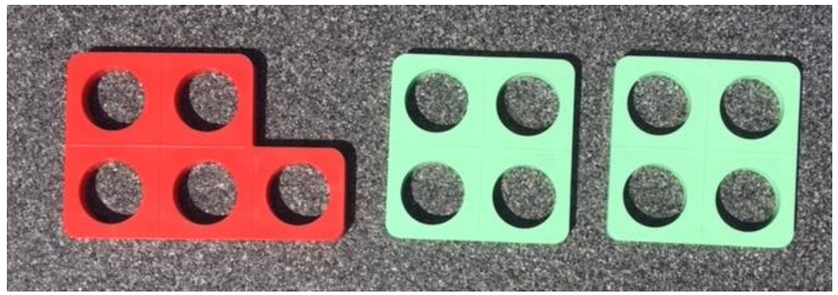
Numicon shows 4th term

3, 6, 9, 12



4, 7, 10, 13

5, 9, 13



4th term

10th term

Explain

Here is a sequence of numbers: **1, 5, 9, 13...**

Do you agree with these statements?

25 is in the sequence because it is 12 more than 13

26 is in the sequence because it is double 13

Explain why.

At the bike shop, it costs **£6** to hire a bike plus **£4** for each hour that it is used.

How much does it cost to hire a bike for 5 hours?

At the bike shop, it costs **£6** to hire a bike plus **£4** for each hour that it is used.

How much does it cost to hire a bike for 5 hours?

Explain the Mistakes:

£6 × 5 + £4 = £34

At the bike shop, it costs **£6** to hire a bike plus **£4** for each hour that it is used.

How much does it cost to hire a bike for 5 hours?

Correct Answer:

£4 × 5 + £6 = £26

£4	**£4**	**£4**	**£4**	**£4**	**£6**

Fixed Amount + Variable Amount

Task A

Question	Which Answer?
Mrs Evans bought 8 footballs online. They cost £7 each plus a £5 postage fee. **What was the total cost?**	**Answer A:** £7 + £5 = £12 £12 × 8 = £96 **Answer B:** £7 × 8 = £56 £56 + £5 = £61
It costs £6 per hour to hire a bike and £3 per hour to hire a helmet. **How much does it cost to hire a bike and a helmet for 4 hours?**	**Answer A:** £6 + £3 = £9 £9 × 4 = £36 **Answer B:** £6 × 4 = £24 £24 + £3 = £27
Membership at the tennis club costs £15 per year. Members can hire a tennis court for £6 per match. **How much does it cost to play 8 tennis matches?**	**Answer A:** £15 × 8 + £6 = £126 **Answer B:** £6 × 8 + £15 = £63

Which question is the ***odd one out?*** *Explain why.* The middle one because it add before multiplying.

Extend: *Write a question where the answer can be calculated in this way:*

£12 × 6 + £4 = £76

Make Your Own Pizza
£3.50 for the pizza base
75p per topping

Amy has £7.

How many toppings can she afford?

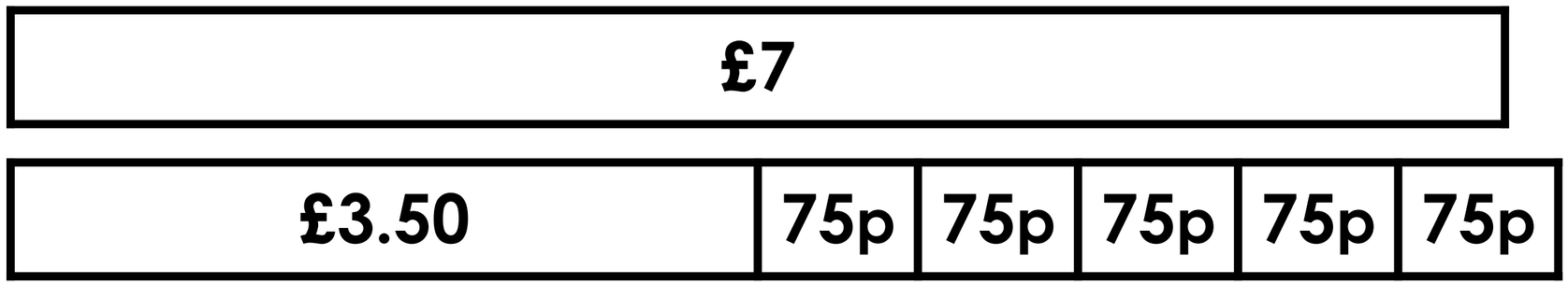
Make Your Own Pizza

£3.50 for the pizza base

75p per topping

Amy has £7.

How many toppings can she afford?



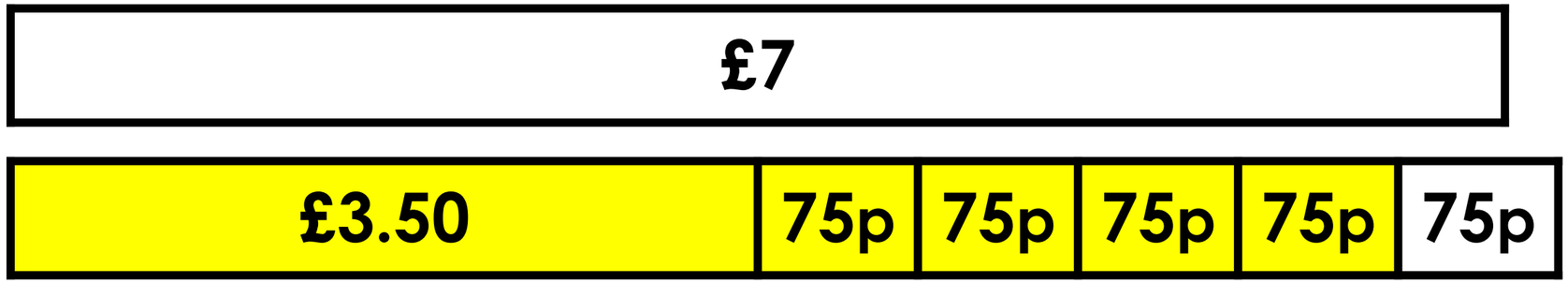
Make Your Own Pizza

£3.50 for the pizza base

75p per topping

Amy has £7.

How many toppings can she afford?



Amy can afford 4 toppings.

Fixed Amount + Variable Amount

Task B

(a) To go surfing, each child needs surfboard and a wetsuit.
It costs £8 to hire a surfboard and £3 to hire a wetsuit.
How much does it cost for 7 children to go surfing?

8+3=11
11x7=77

(b) Tom prints 30 of his photos at the online store. It costs 15p to print each photo. It costs £1.95 to post the photos.
How much does Tom pay in total?

30x15p=£4.50
£4.50+£1.95=£6.45

(c) Some friends go to a show. Each ticket costs £8. They pay £4 to park at the theatre. In total, it costs the friends £52.
How many friends go to the show? 6

(d) Mr Jones has £75 to spend on rugby balls. At the online store, the delivery fee is £4. Each rugby ball costs £12.
How many rugby balls can Mr Jones buy? 5

(e) At Clara's Cycles, it costs £9 per hour to hire a bike.
At Beth's Bikes, it costs £8 plus £6.50 per hour to hire a bike.
Jade wants to hire a bike for 3 hours.
Which shop will cost the least? Beths Bikes

Gym Prices:

£8 per session for non-members

£5 per session for members

Membership: £20 per year

You save money by being a member of the gym if…

Success…

A challenge…

Next steps…

Question:

View Deconstructing Word Questions Samples

The sum of the digits for a whole-number is 6.

All the digits are different.

What is the smallest that the number could be?
What is the largest that the number could be?

Example: the sum of the digits for 214 is 7 (2 + 1 + 4 = 7)

512

59

For each number…

- How many digits
- Sum of the digits

561

1056

89

The sum of the digits of a number is 8

The sum of the digits for a whole-number is 6.

All the digits are different.

What is the smallest that the number could be?
What is the largest that the number could be?

Example: the sum of the digits for 214 is 7 (2 + 1 + 4 = 7)

The sum of the digits for a whole-number is 6.

All the digits are different.

What is the smallest that the number could be?
What is the largest that the number could be?

Example: the sum of the digits for 214 is 7 (2 + 1 + 4 = 7)

SUPPORT

Examples:

24 is a 2-digit number. The sum of the digits is 6 *(2 + 4 = 6)*.

204 is a 3-digit number. The sum of the digits is 6 *(2 + 0 + 4 = 6)*.

Tip for making the largest number: *It's possible to make a 4-digit number where the sum of the digits is 6* ***if you use small digits.***

EXPLAIN

Agree or disagree:

'To make a large number when the sum of the digits is 6, you need to use a 5.'

'To make a large number where the sum of the digits is 6, use as many digits as possible.'

EXTEND

The sum of the digits for a whole-number is 11.

All the digits are different.

What is the largest that the number could be?

What is the smallest that the number could be?

4 10 7

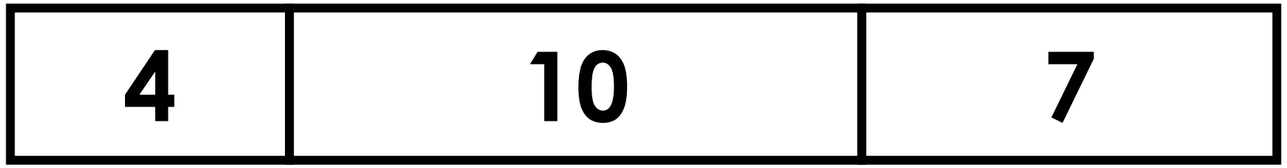
4 10 7

The sum of these numbers…

The difference between the largest and smallest number is…

4 10 7

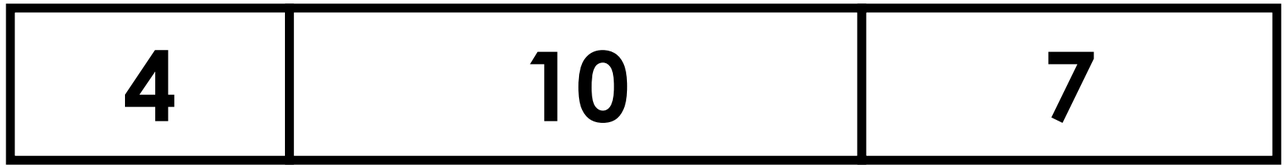
The sum of these numbers…



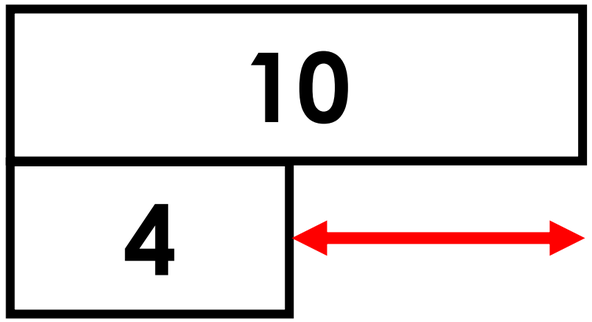
The difference between the largest and smallest number is…

4 10 7

The sum of these numbers…



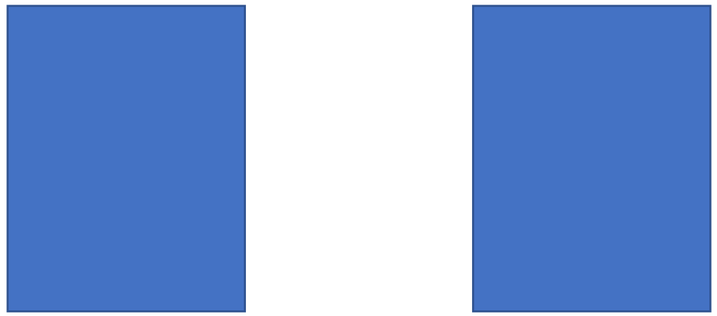
The difference between the largest and smallest number is…



3 6 8 7

The sum of these numbers…

The difference between the largest and smallest number is…

3  7

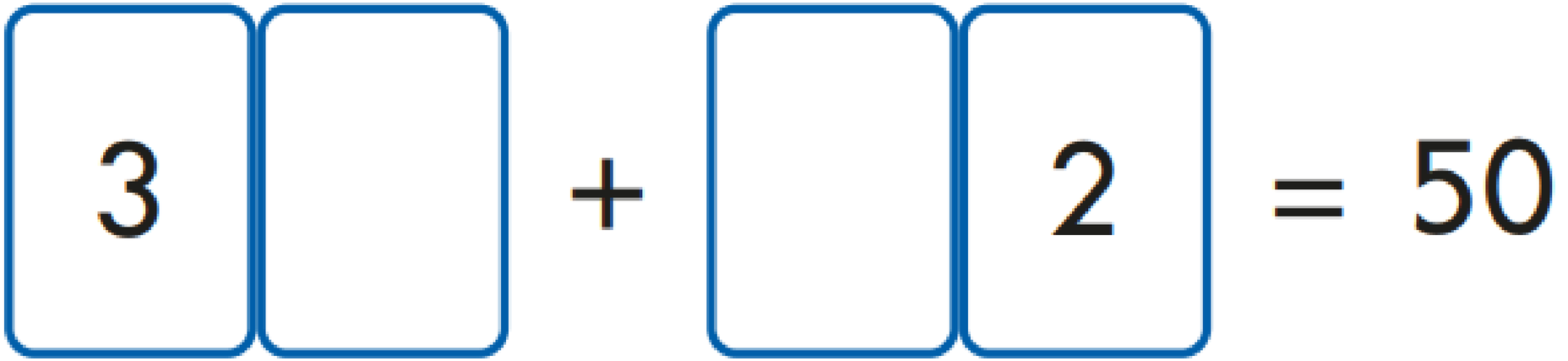
The sum of these numbers is **20**

The difference between the largest and smallest number is **4**

The sum of these numbers is **9**

The difference between the largest and smallest number is **5**

Write a digit in each box to complete this number sentence.



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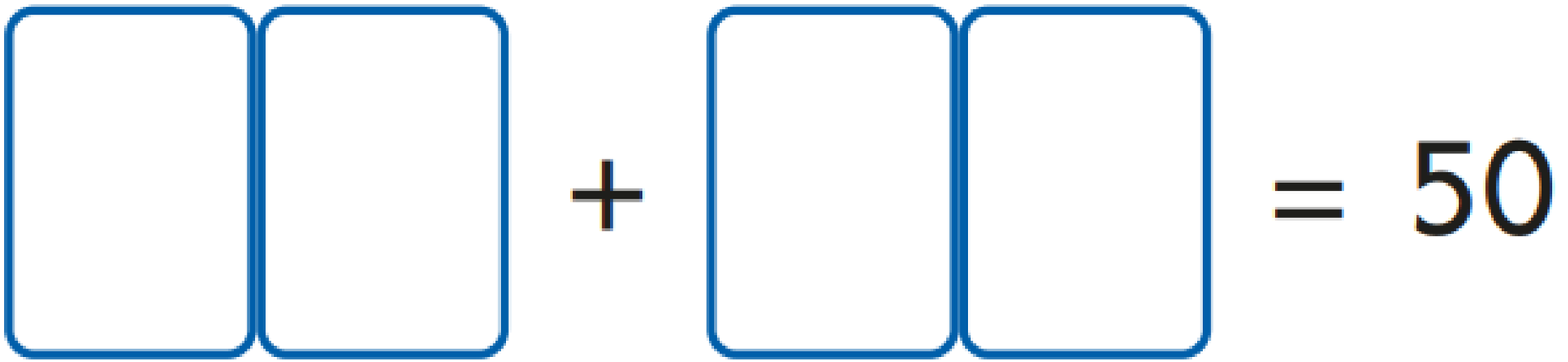

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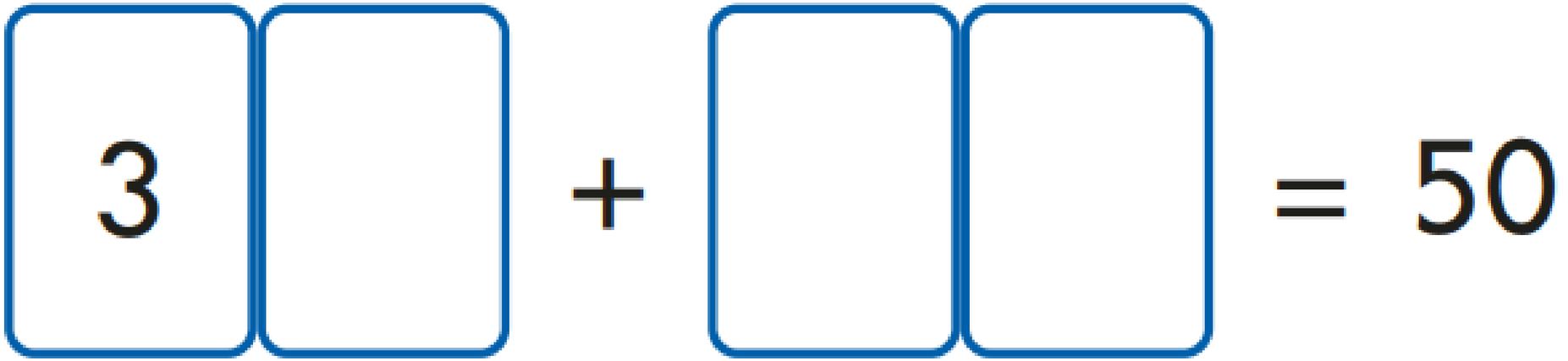
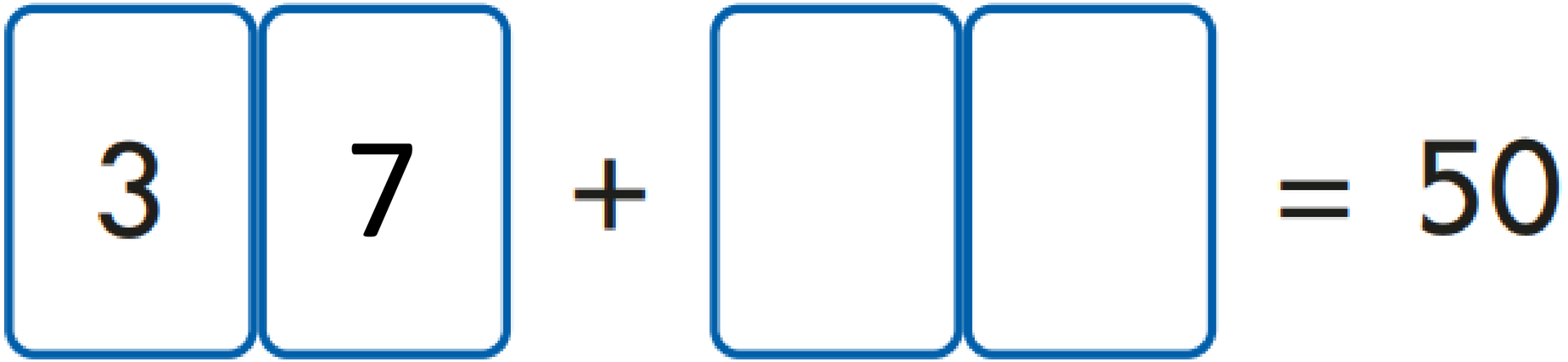
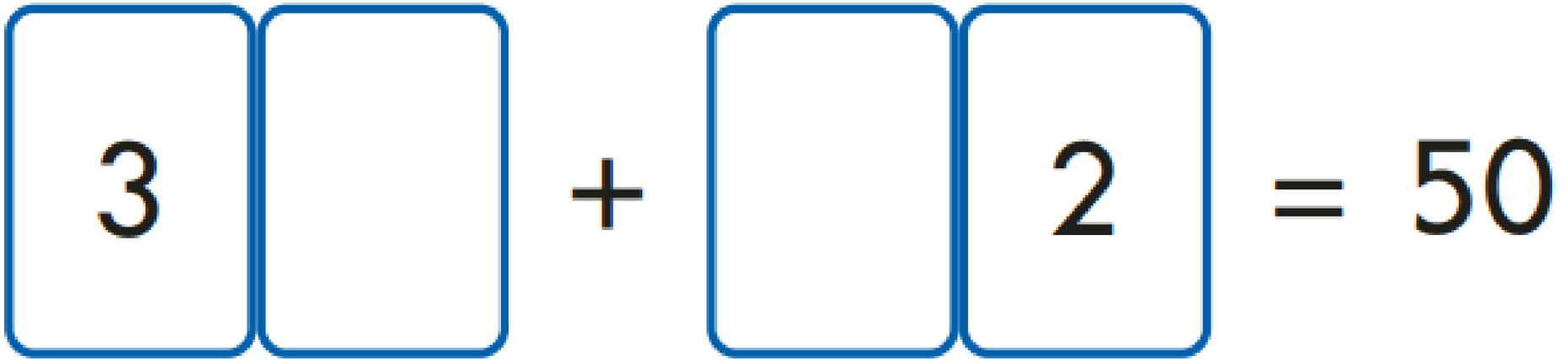
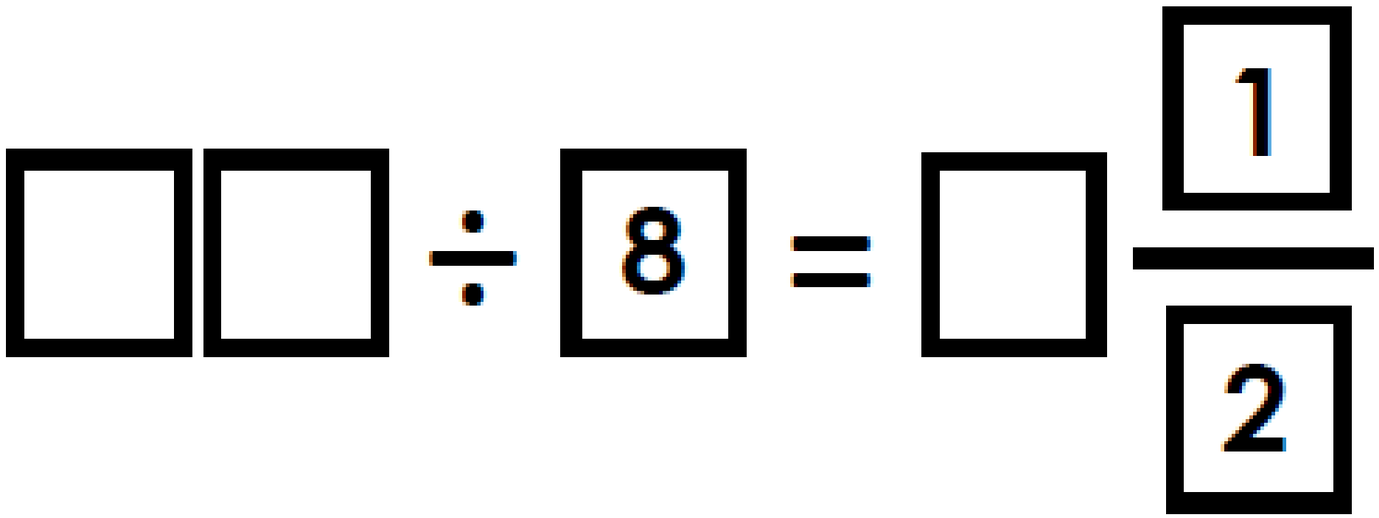


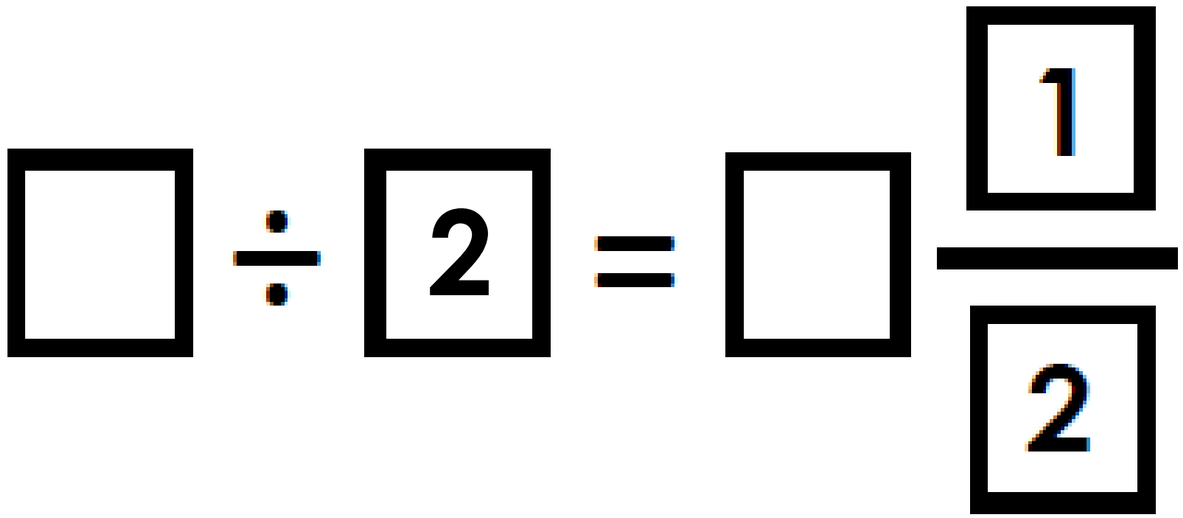
Write a digit in each box to complete this number sentence.



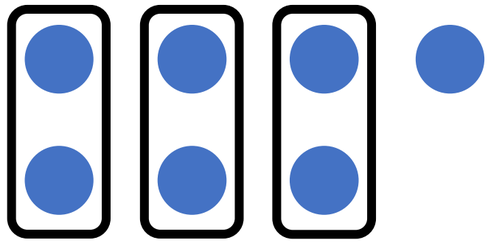
Write a digit in each box to complete this number sentence.

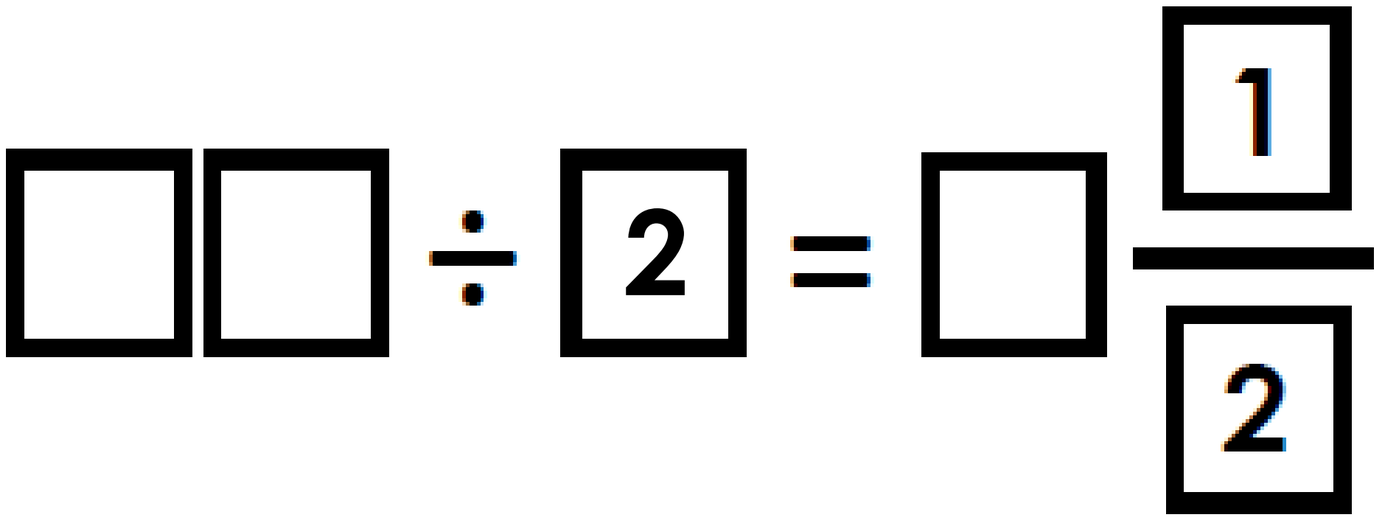



8
1
2


÷
2
=
1
2

$$7 \div 2 = 3\frac{1}{2}$$




2
1
2

True or False?

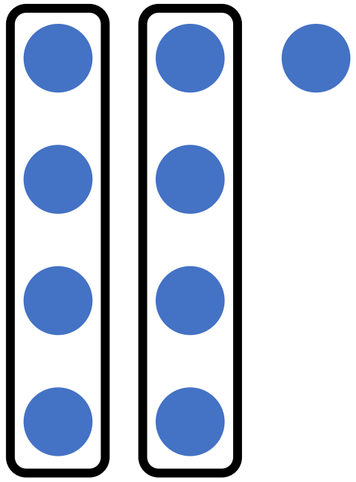
$$\square \div 4 = \square \frac{1}{2}$$

True or False?

$$9 \div 4 = 2\frac{1}{2}$$

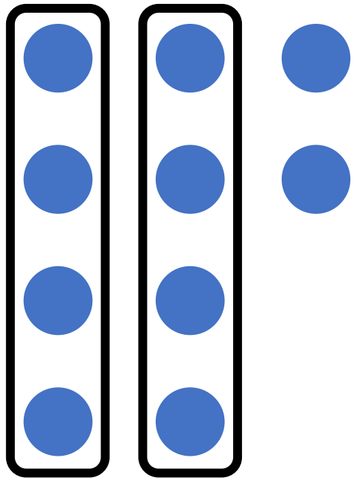
True or False?

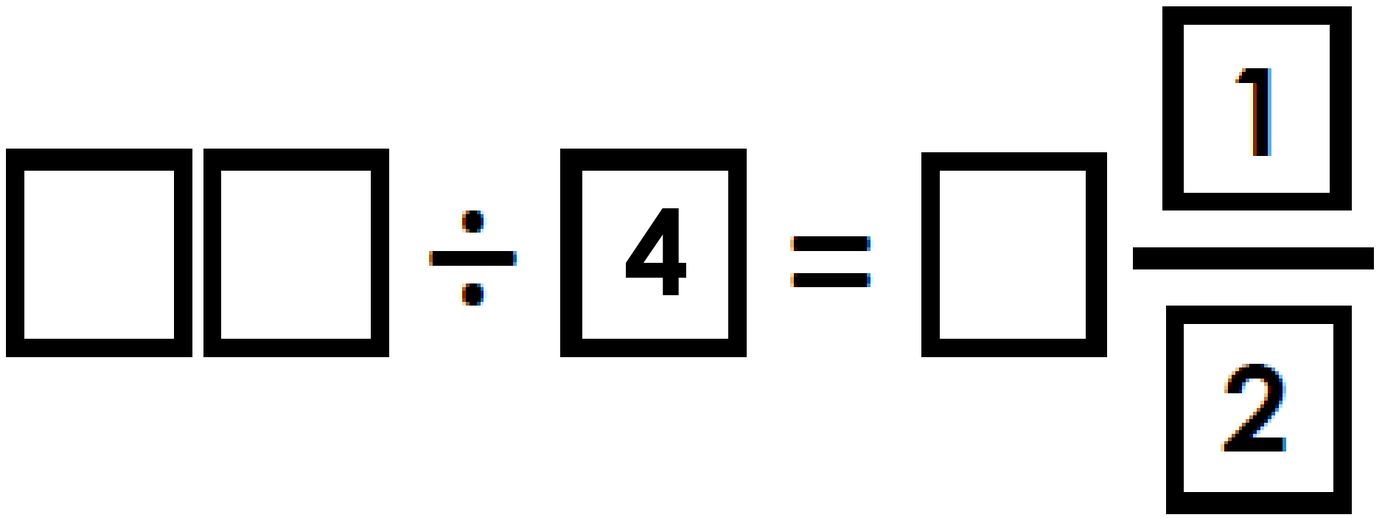
$$9 \div 4 = 2\frac{1}{2}$$



True or False?

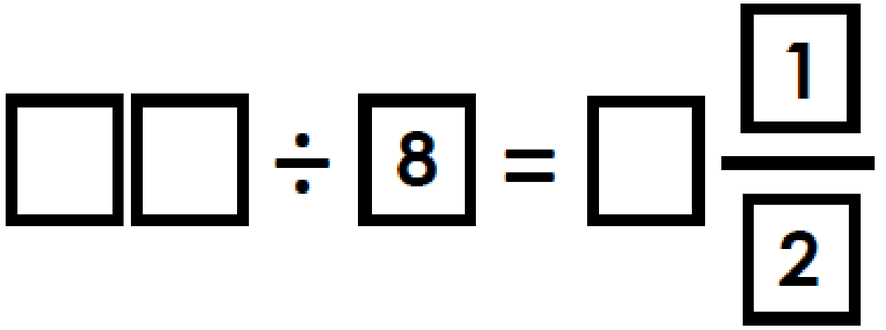
$$10 \div 4 = 2\frac{1}{2}$$ ✓




4
1
2

Task 16 Question: Remainder of one-half

Complete the calculation using digits 0 → 9. You can only use each digit once. Position the digits 1, 2 and 8 as shown.



Level 1: I can find an answer

Level 2: I can find different answers

Level 3: I know how many possible answers there are

EXPLAIN

Agree or disagree:

$\square \div 8 = 4\frac{1}{2}$ $\qquad$ $\square \div 4 = 8\frac{1}{2}$

'The number in the blue box is the same is the number in the red box.'

32 ÷ 4 = 8

32 ÷ 8 = 4

But when you add the halfs on it changes the question

32 + 2 = 34

32 ÷ 4 = 8 ½ $\qquad$ 4 x 0.5 = 2

32 ÷ 8 = 4 ½ $\qquad$ 8 x 0.5 = 4

32 + 4 = 36

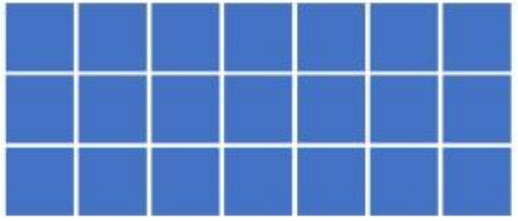
TASK

$\frac{1}{\square}$ of $\square$ = 6

For this task you will need some small squares.

Make a rectangle with an area of 24 squares.
Make the perimeter as large as possible.

Example:



Area of this shape = 21 squares

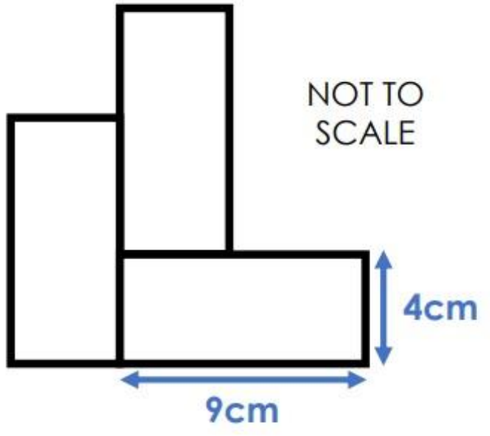
Perimeter of this shape = 20

Rounded to the nearest 10, my number is 400.

My number is a multiple of 3.

What could my number be?

There are different possible answers.



This shape is made using three identical rectangles.

Each rectangle has a length of 9cm and a width of 4cm.

What is the perimeter of the shape?

0 4 5 8

□□ × □□ =

TASK

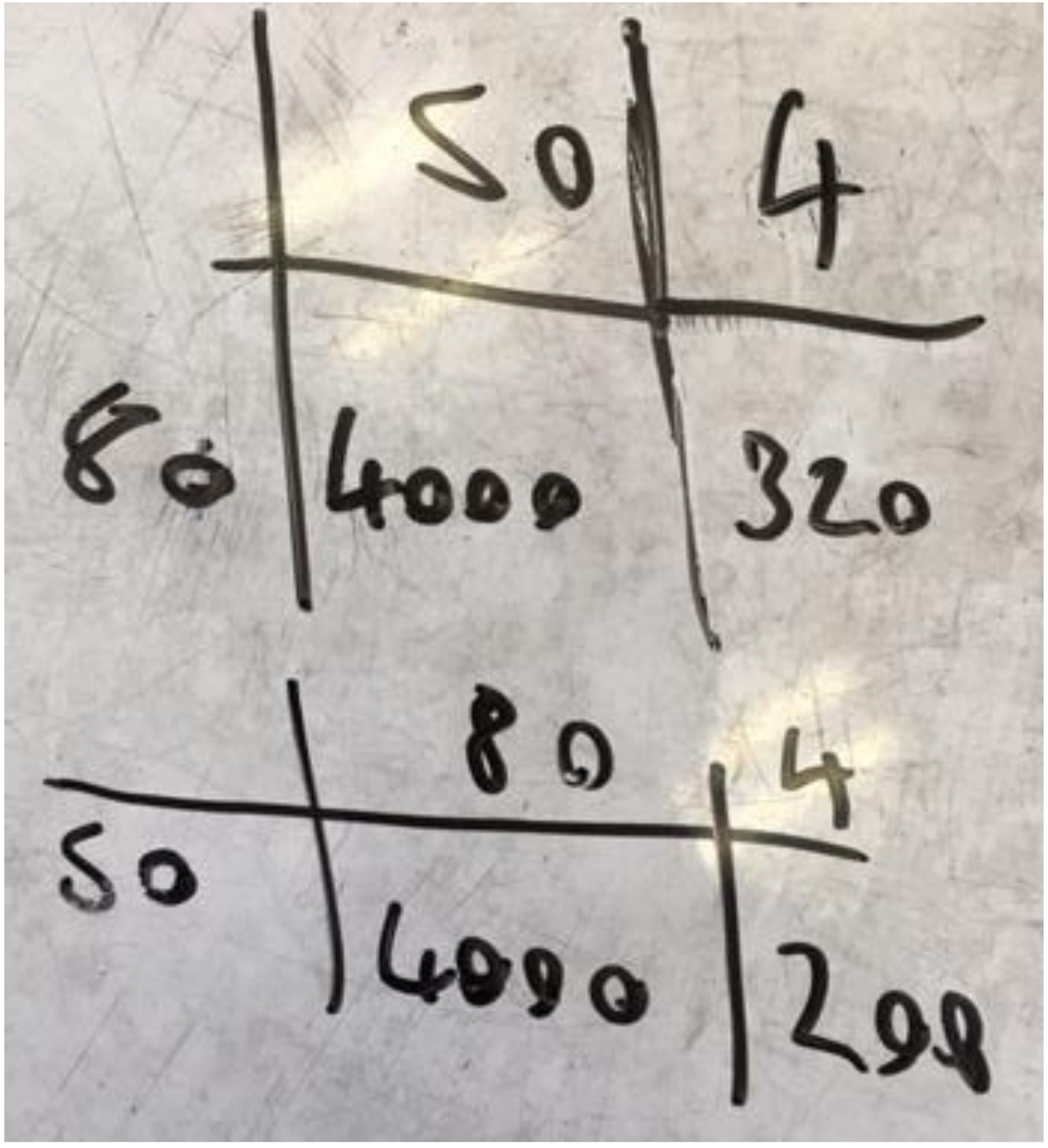
Position the digits 0, 4, 5 and 8 to make the product as large as possible.

0 **4** **5** **8**

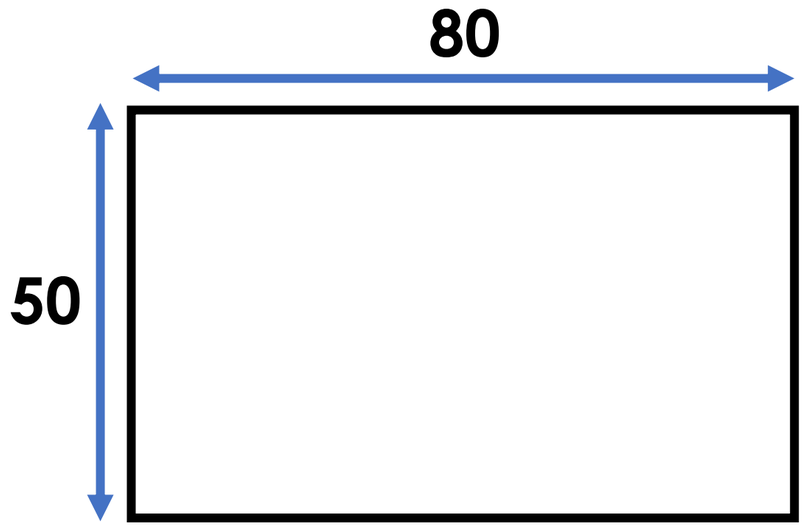
TASK

Position the digits 0, 4, 5 and 8 to make the product as large as possible.

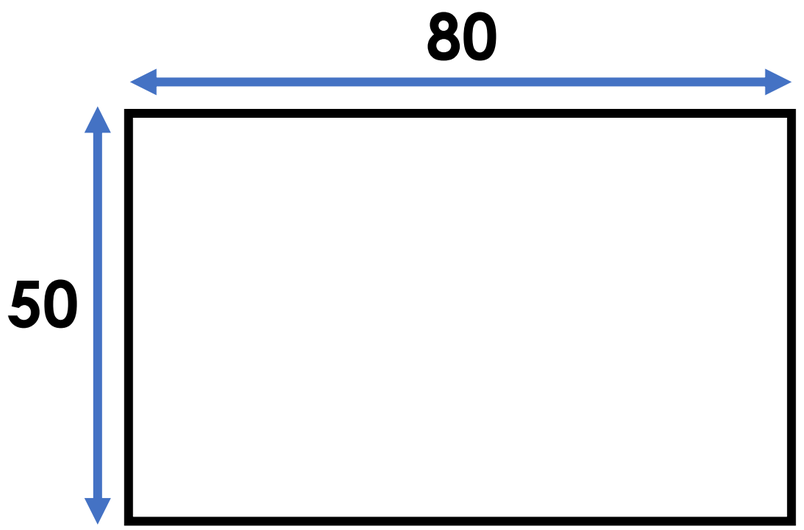
0 **4** **5** **8**


50
4
80
4000
320
80
4
50
4000
200

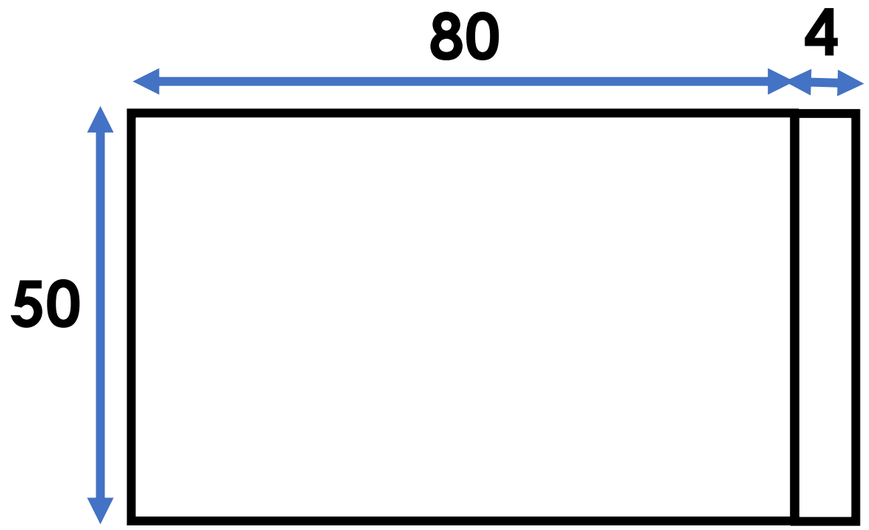
8 4 × 5 0



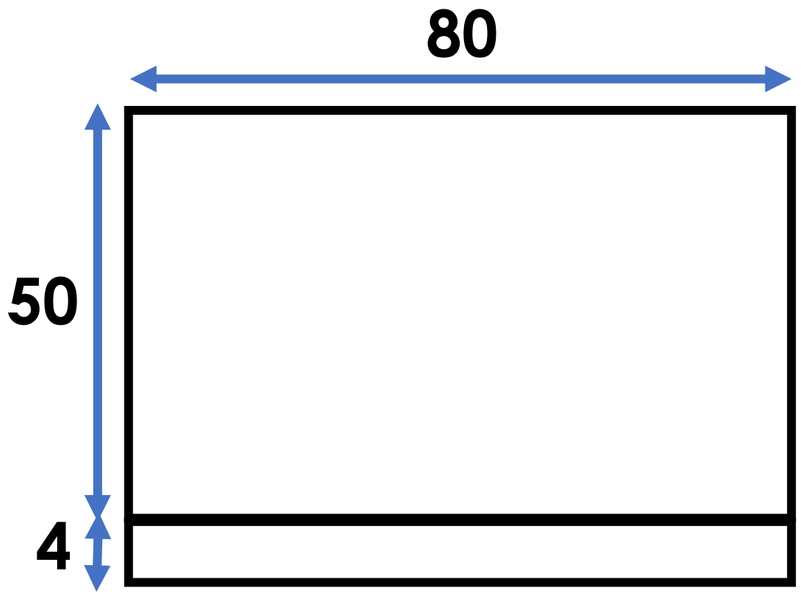
8 0 × 5 4



8 4 × 5 0



8 0 × 5 4



$$10 \times 10 = 100$$

$$11 \times 9 = 99$$

$$12 \times 8 = 96$$

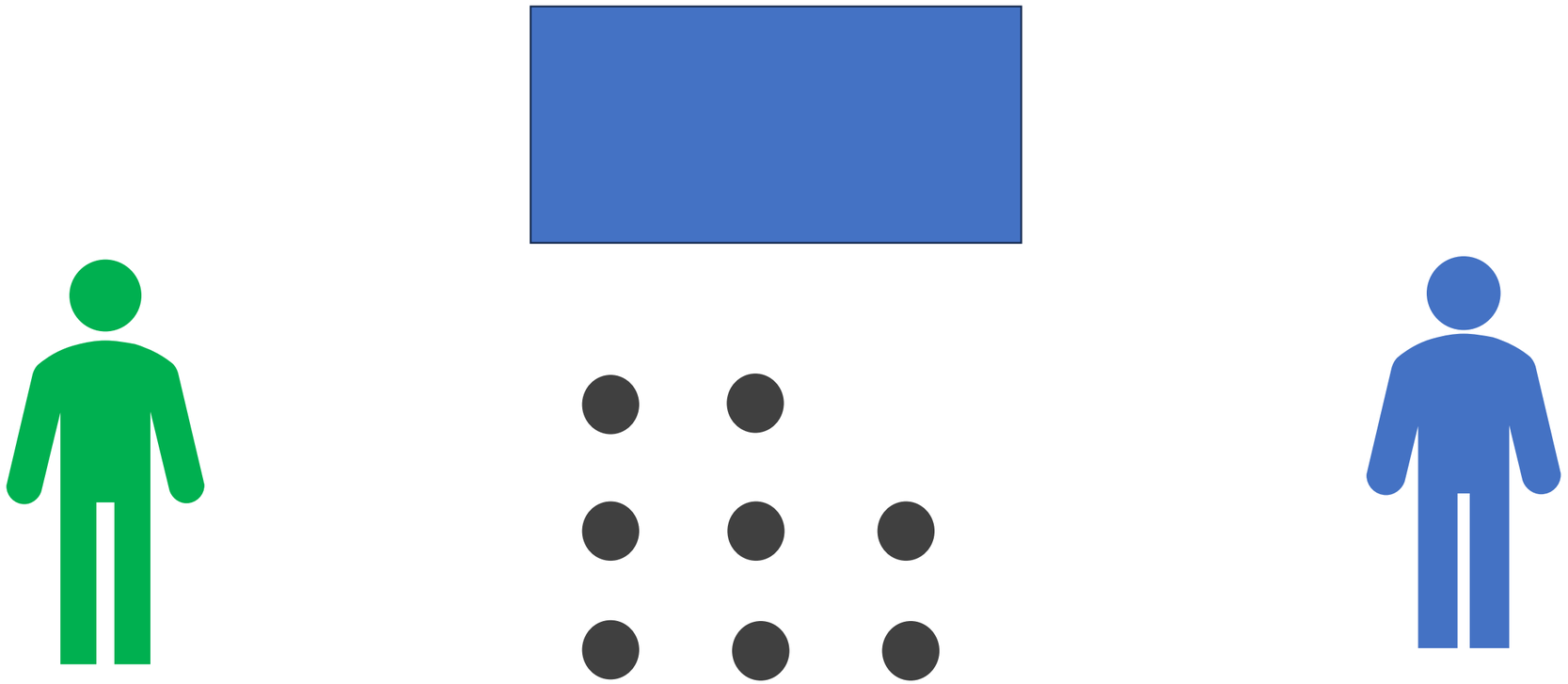
$$13 \times 7 = 91$$

$10 \times 10 = 100$

$11 \times 9 = 99$ -1

$12 \times 8 = 96$ -4

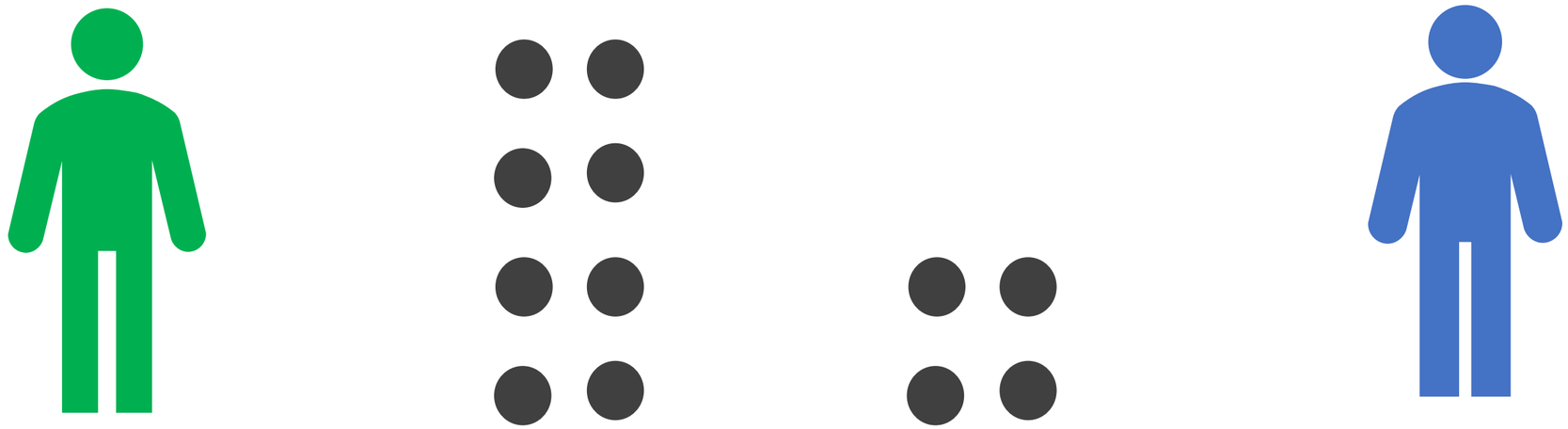
$13 \times 7 = 91$ -9



Take any number of counters from one pile.

Take the same number from both piles.

Win if you take the last counter.



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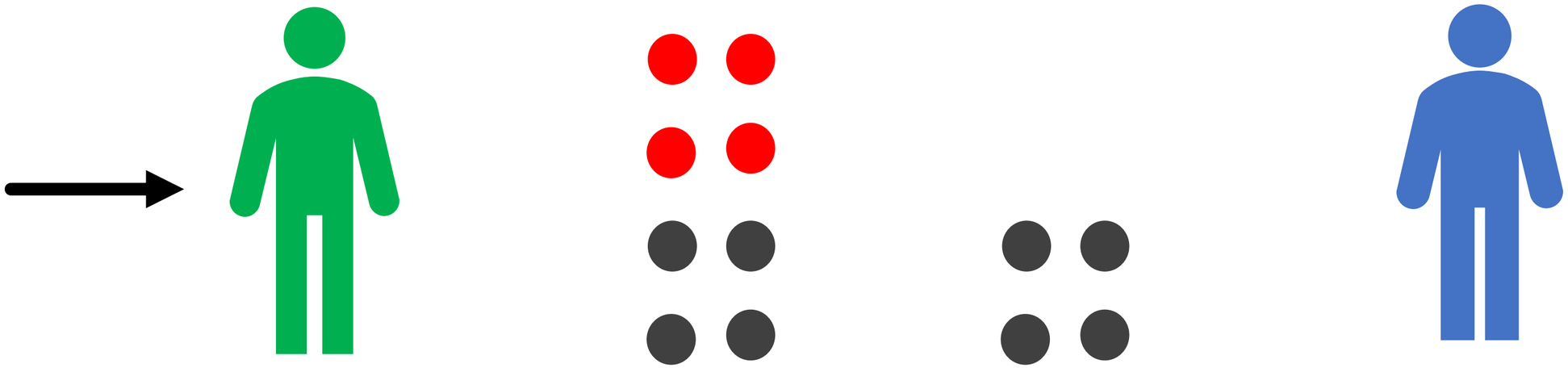

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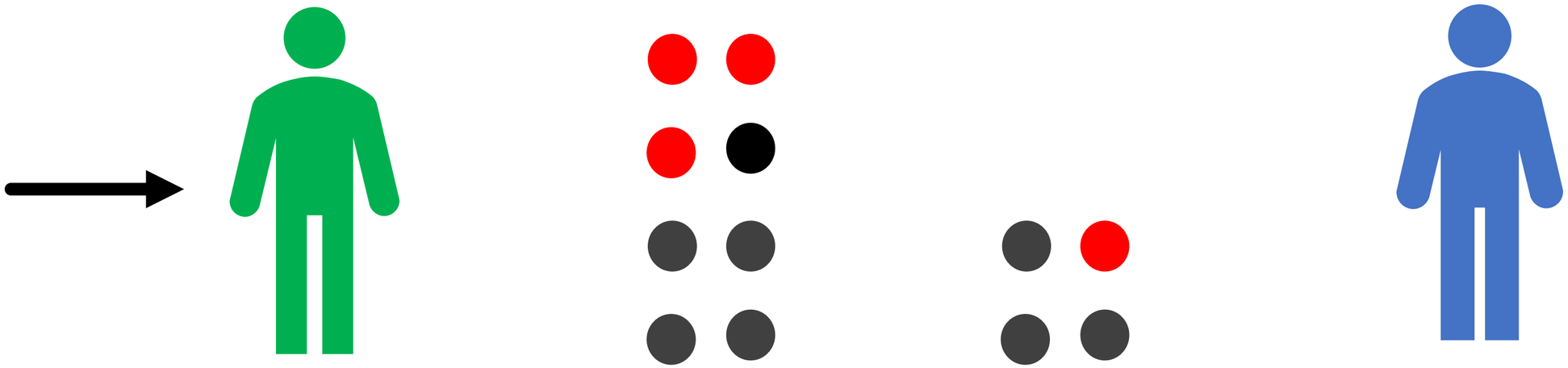

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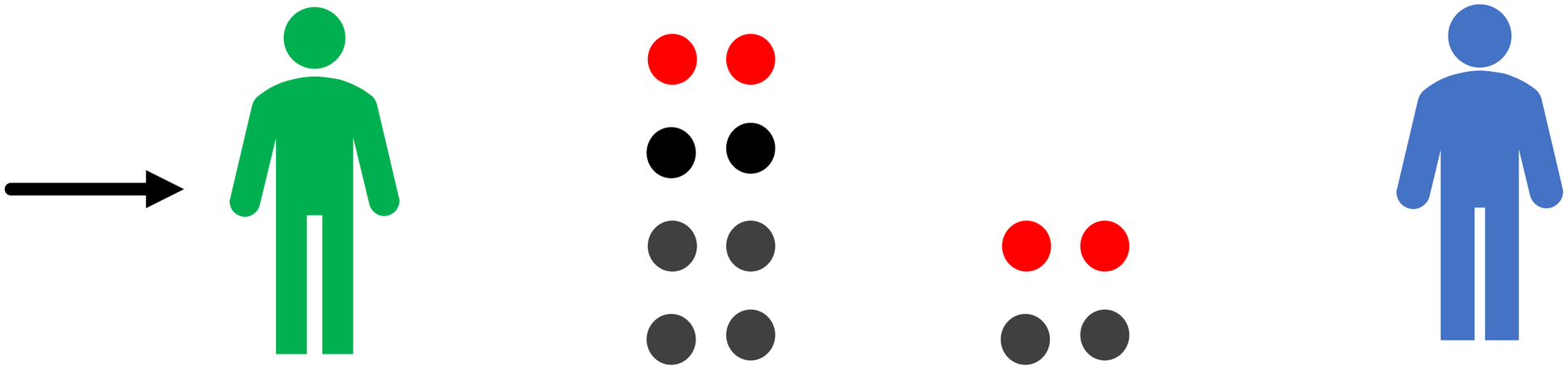

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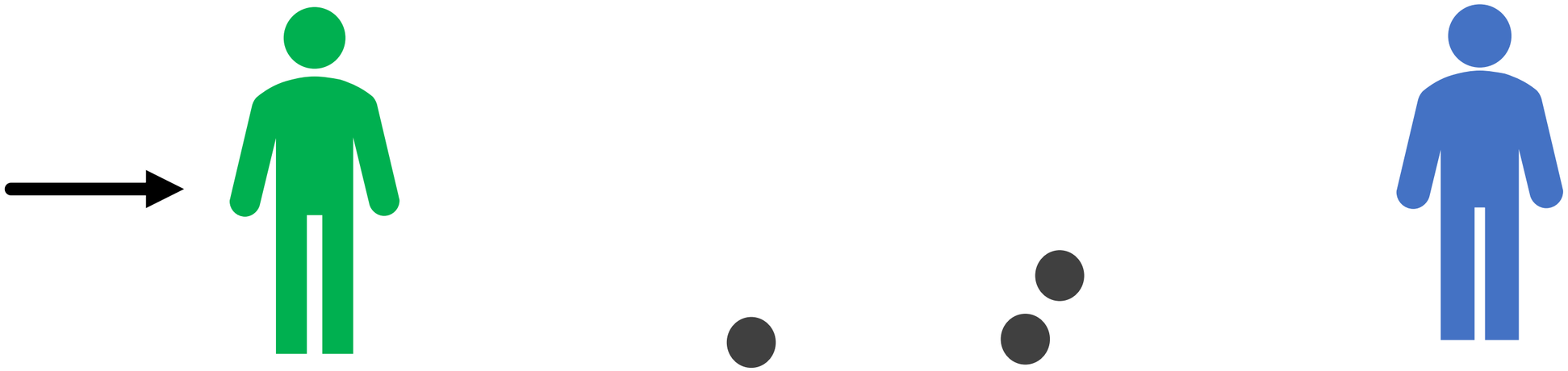

Take any number of counters from one pile.

Take the same number from both piles.

Win if you take the last counter.