# Creating Reasoning Routines, Building Problem-Solvers

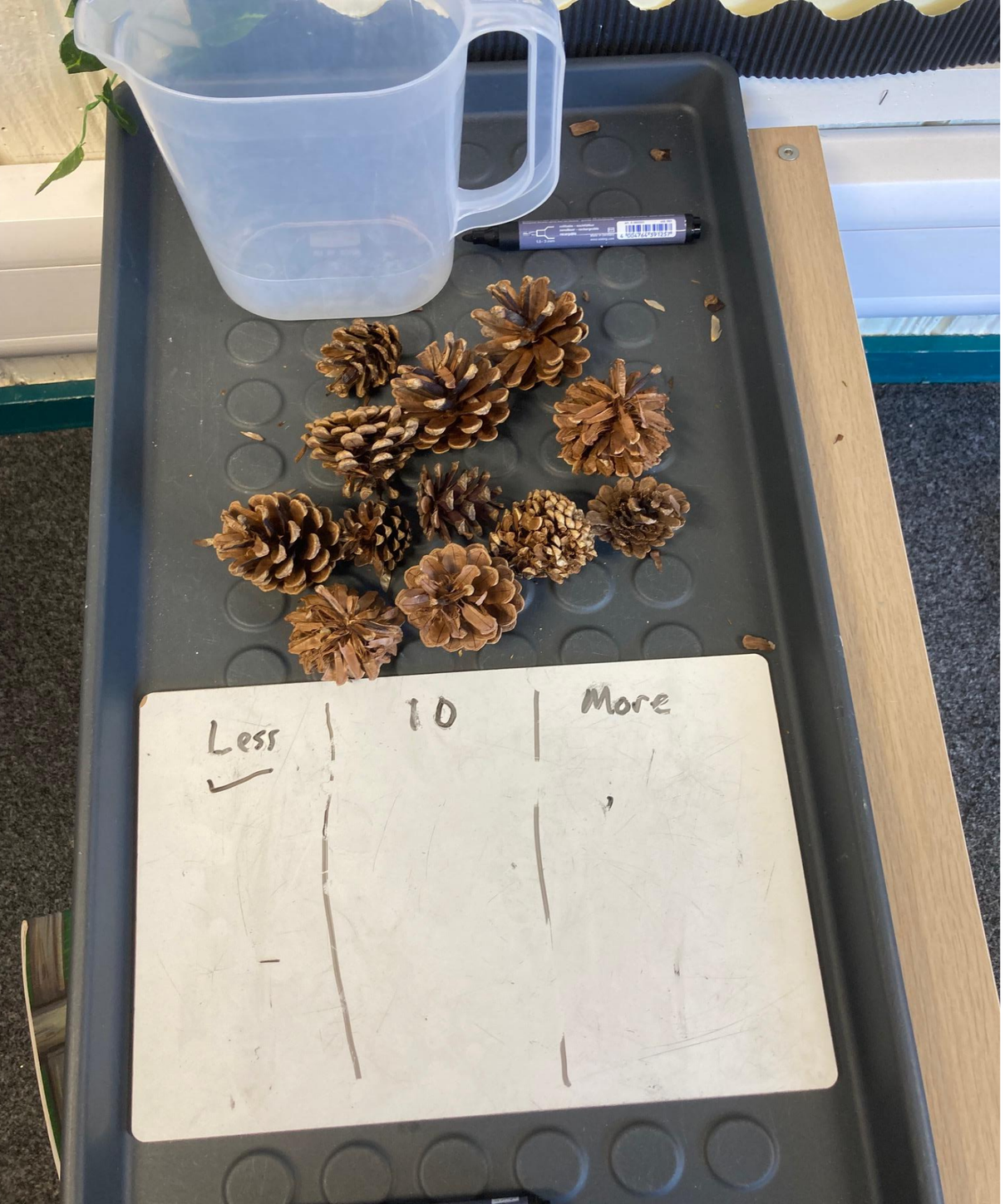
## *Session 2*

***Developing Reasoning Across the Curriculum***

**www.iseemaths.com**

**Y1 & Y2**

When the counting task has a purpose that makes sense and has significance, children's counting skills operate at a higher level of thinking.



# Routines Within Interactive Teaching

**Raising the internal narrative:**

- Gap between question and response/discussion
- Silent examples

**Mass participation:**

- Form of answer before question
- Wait time 2, other perspectives

**Managing discussions**

**Feedback**

**I already…**

**I will try…**

**Use this for…**

**Problems will be…**

There are **2** plates of cookies.

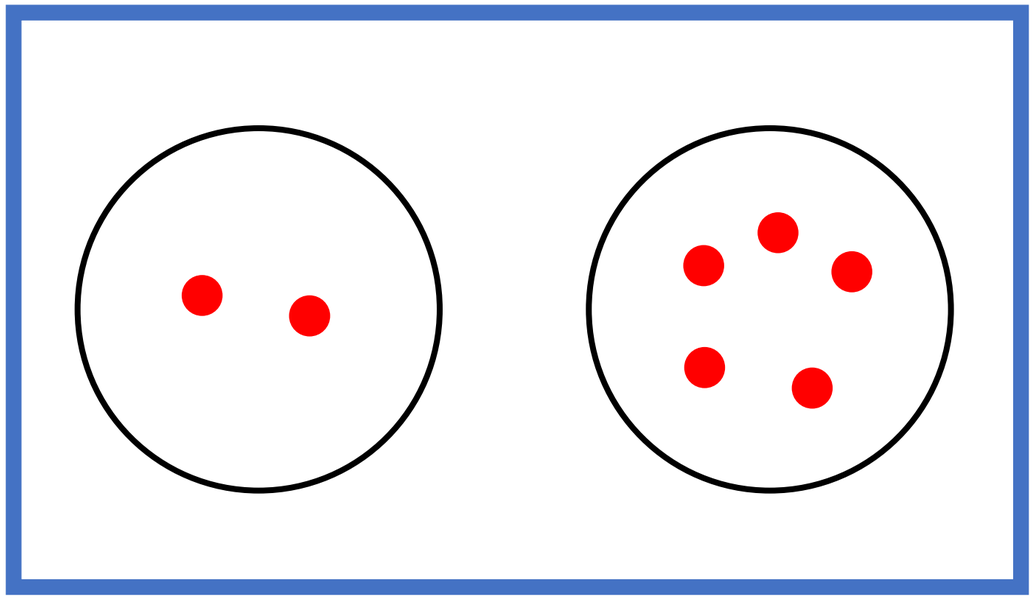
There are **5** cookies on each plate.

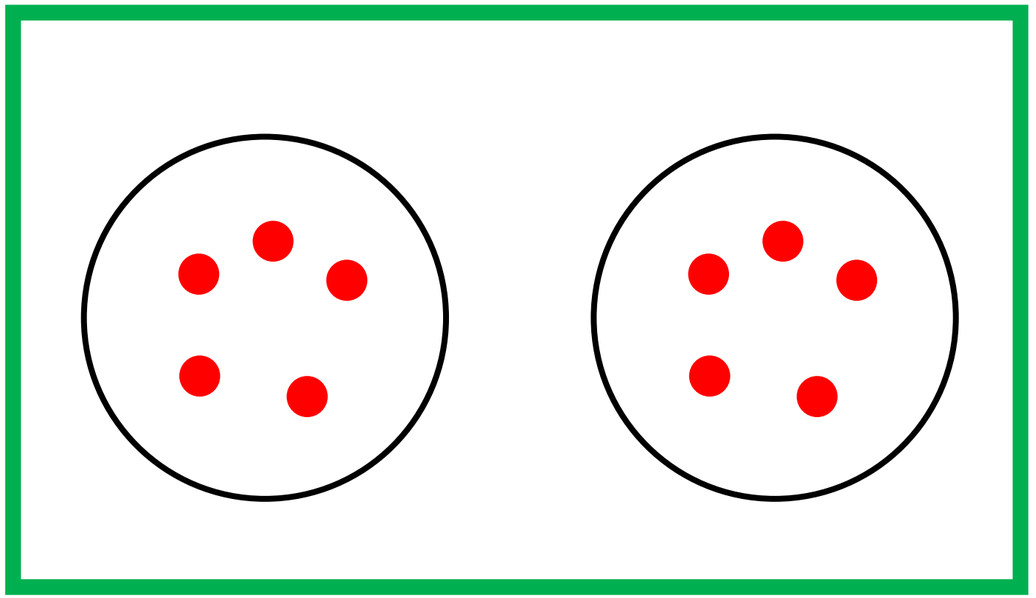
**How many cookies are there altogether?**

There are **2** plates of cookies.

There are **5** cookies on each plate.

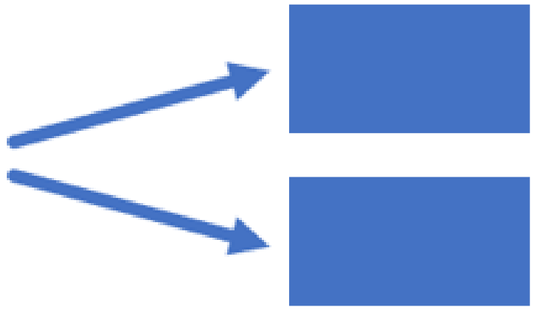
**How many cookies are there altogether?**





# Which Answer?

Sixty-three

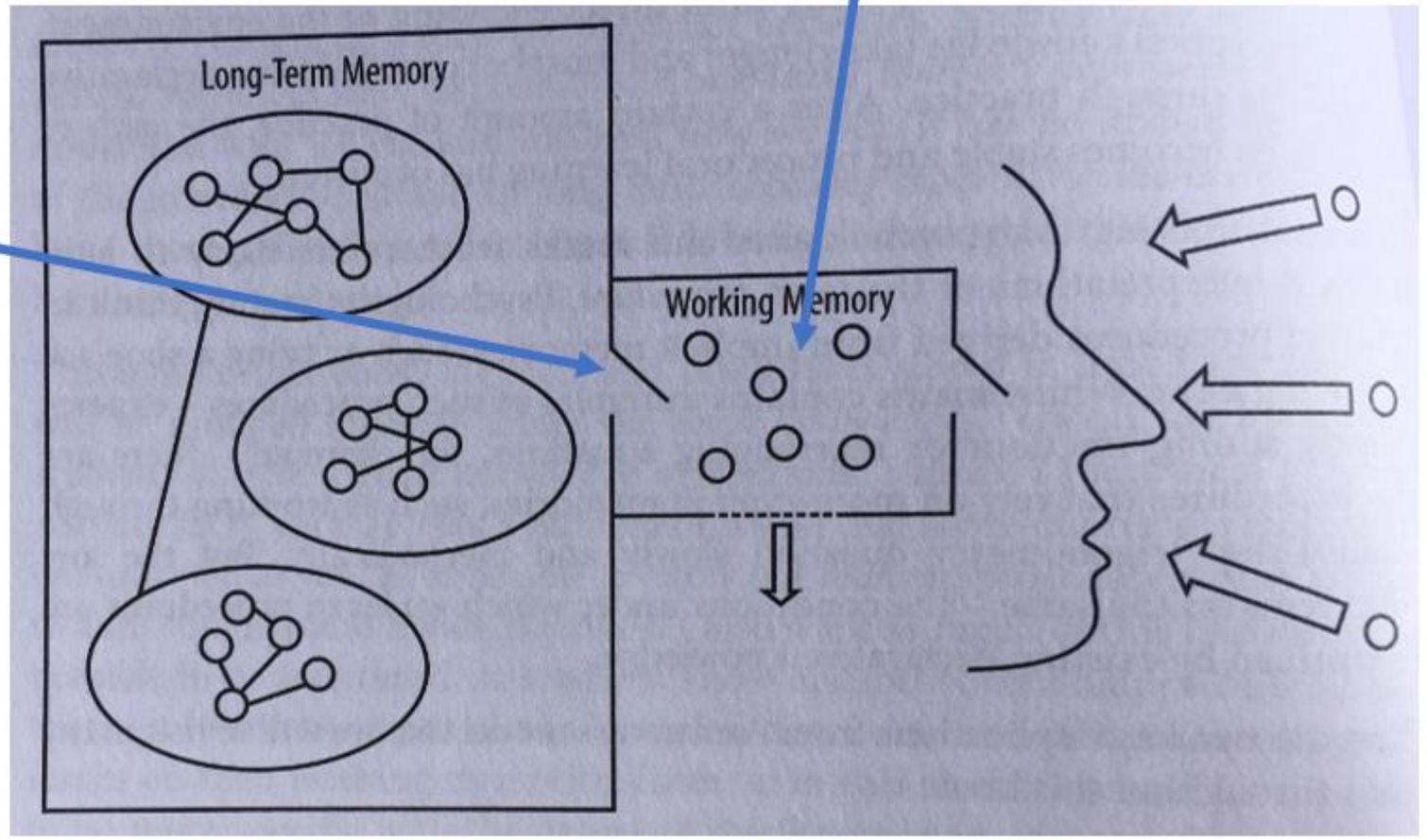


# Which Answer?

# Reasoning: the process of sense-making

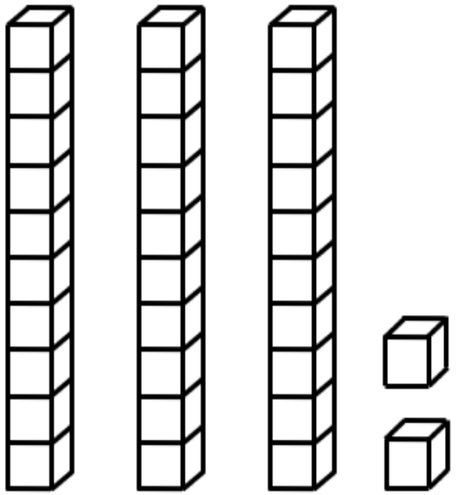
Simultaneous visual/oral processing

Prior learning, initial success




Novice

Expert



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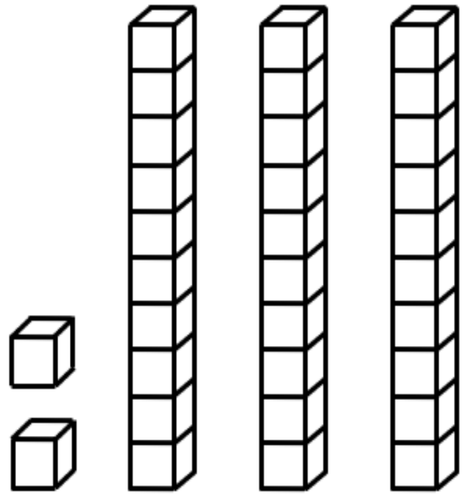

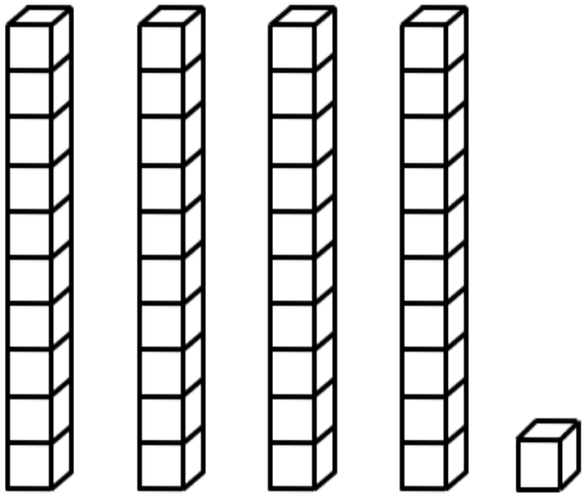

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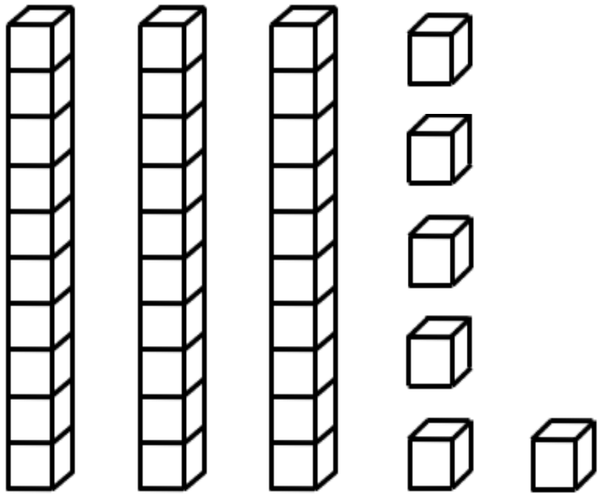
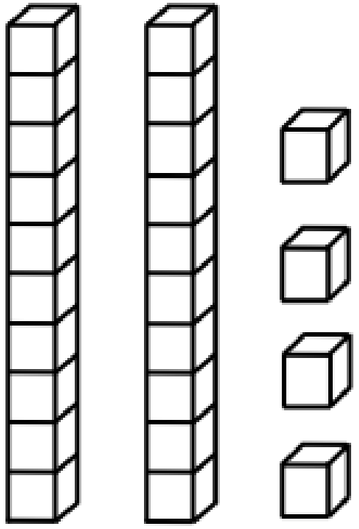


# Which Answer?



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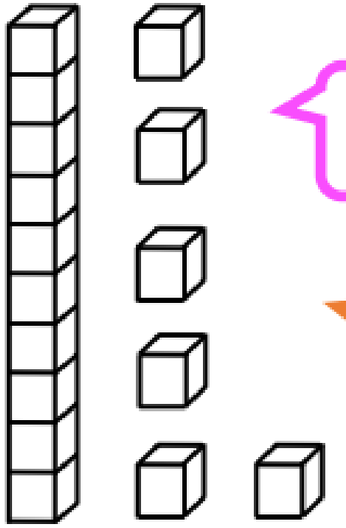

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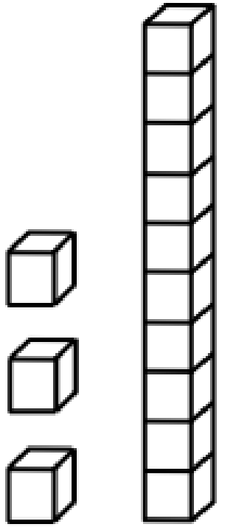
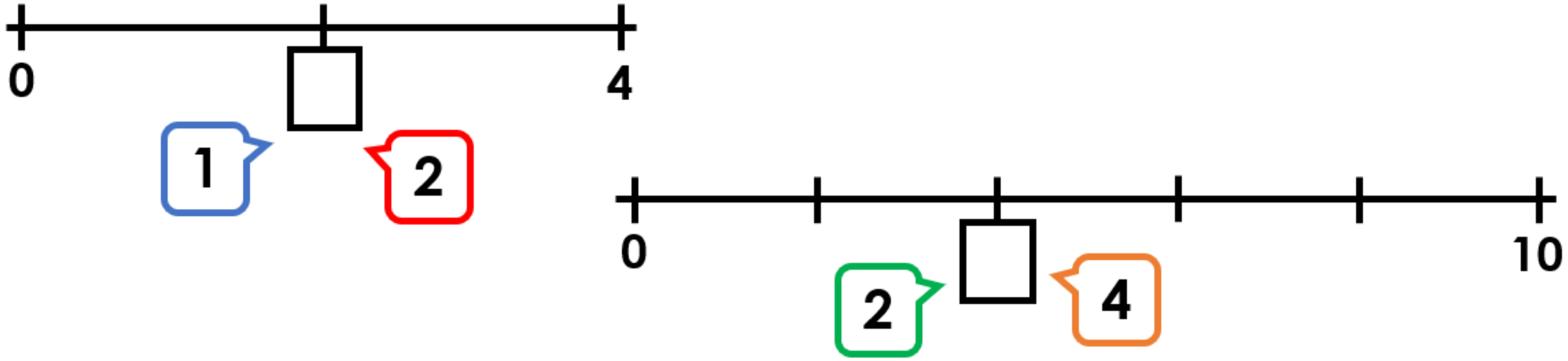


31

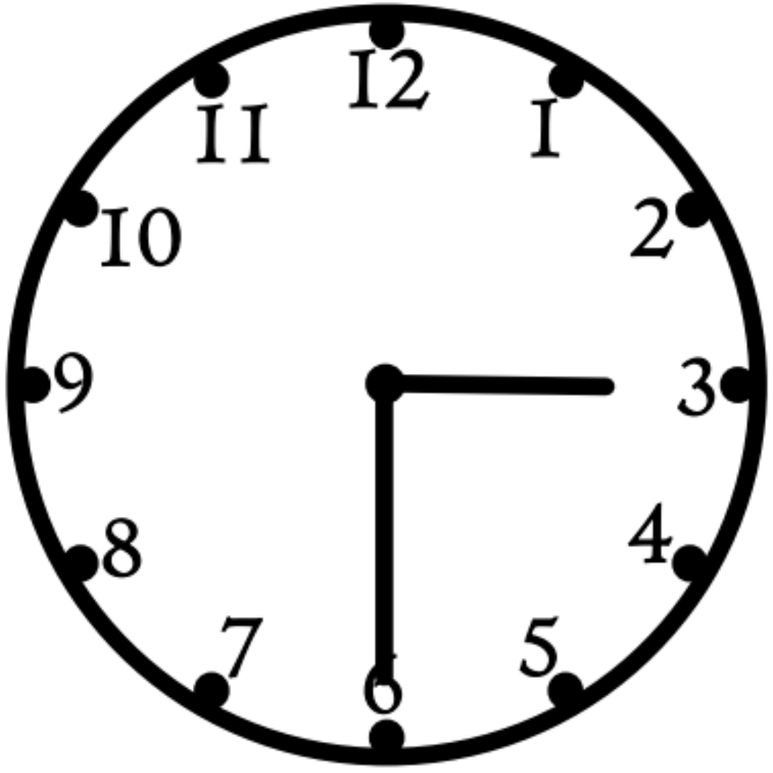
13

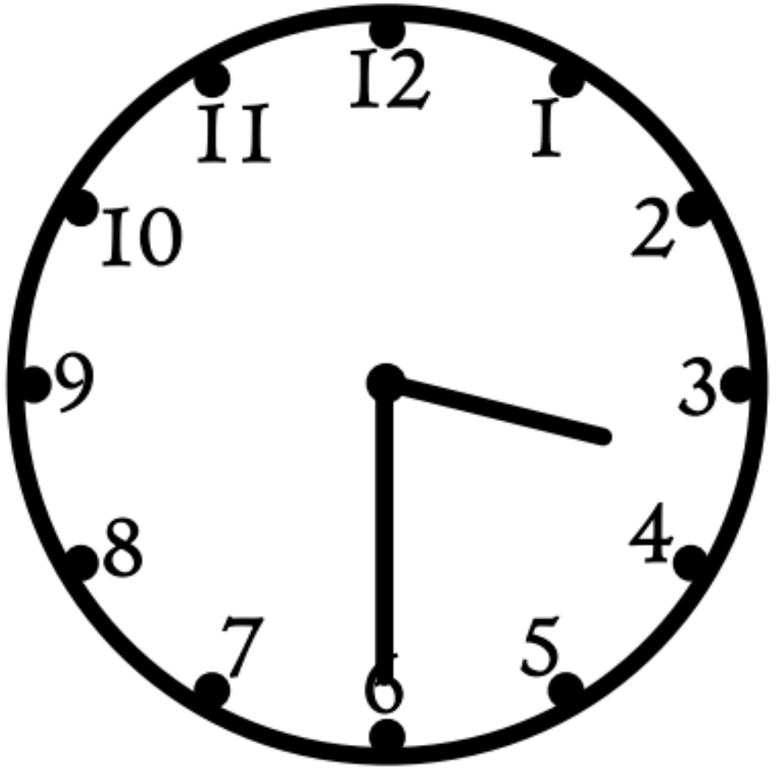
***Explain the mistakes.***

# Which Answer?

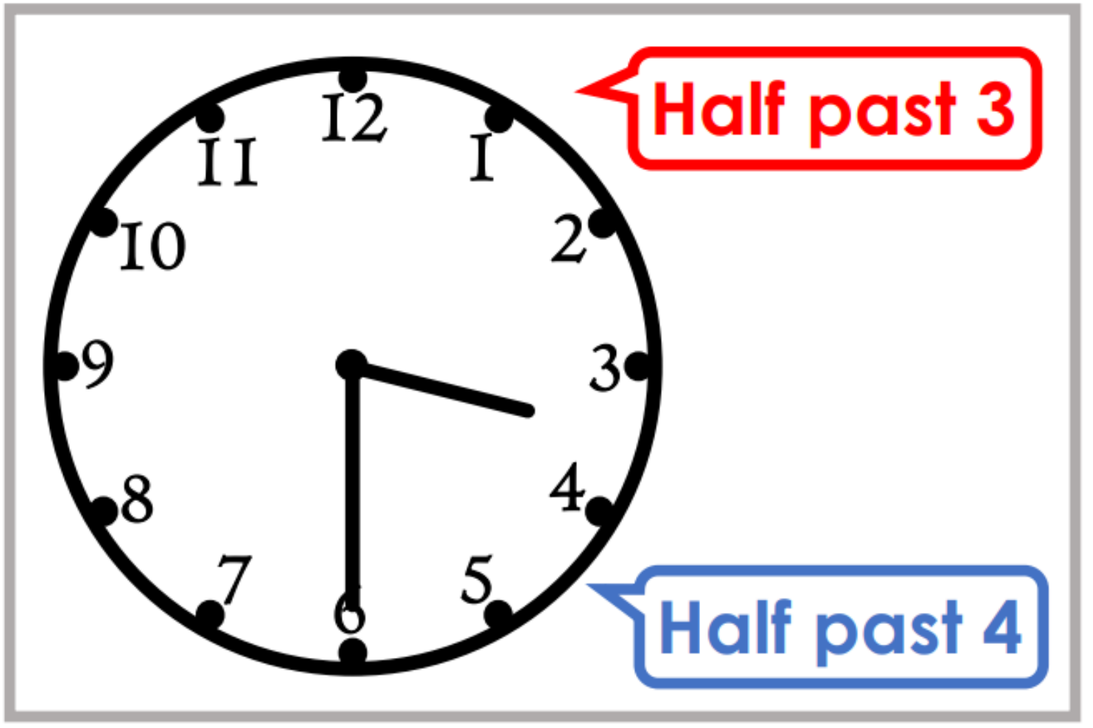


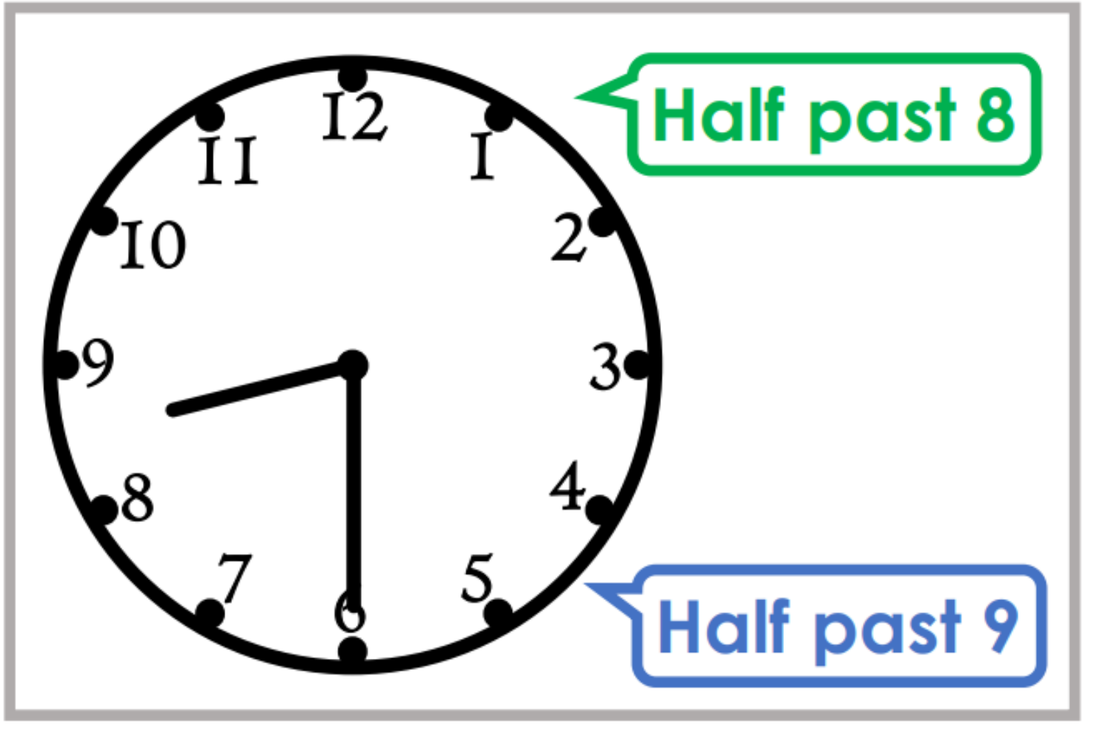
# Spot the difference

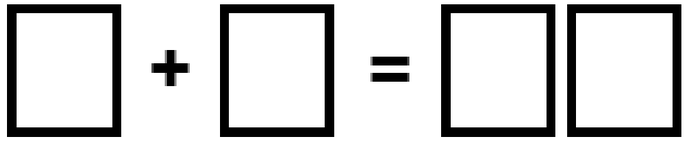


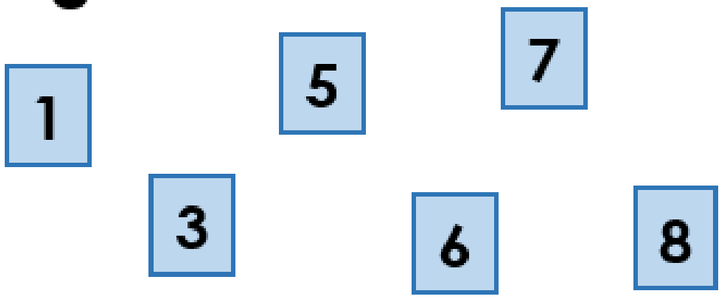
# Which answer?





**Answer using four of the digits:**

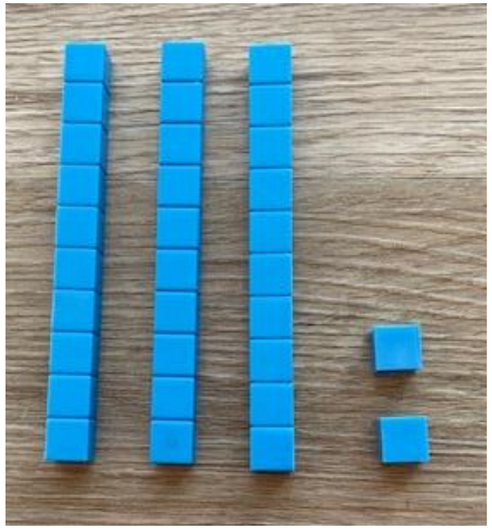


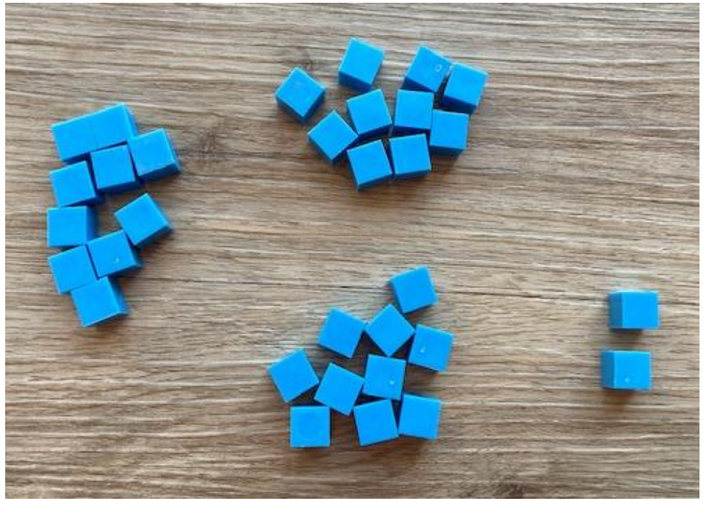

*Answers:*

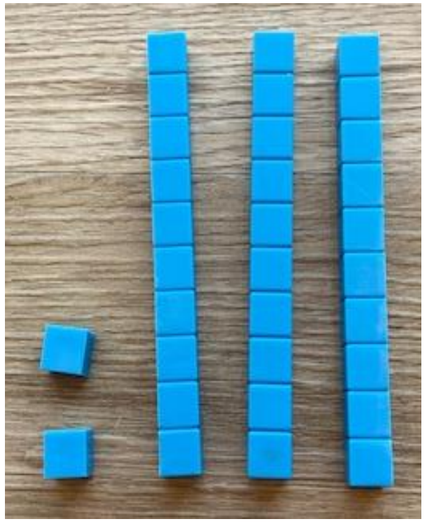
***Level 1:*** *I can find an answer*

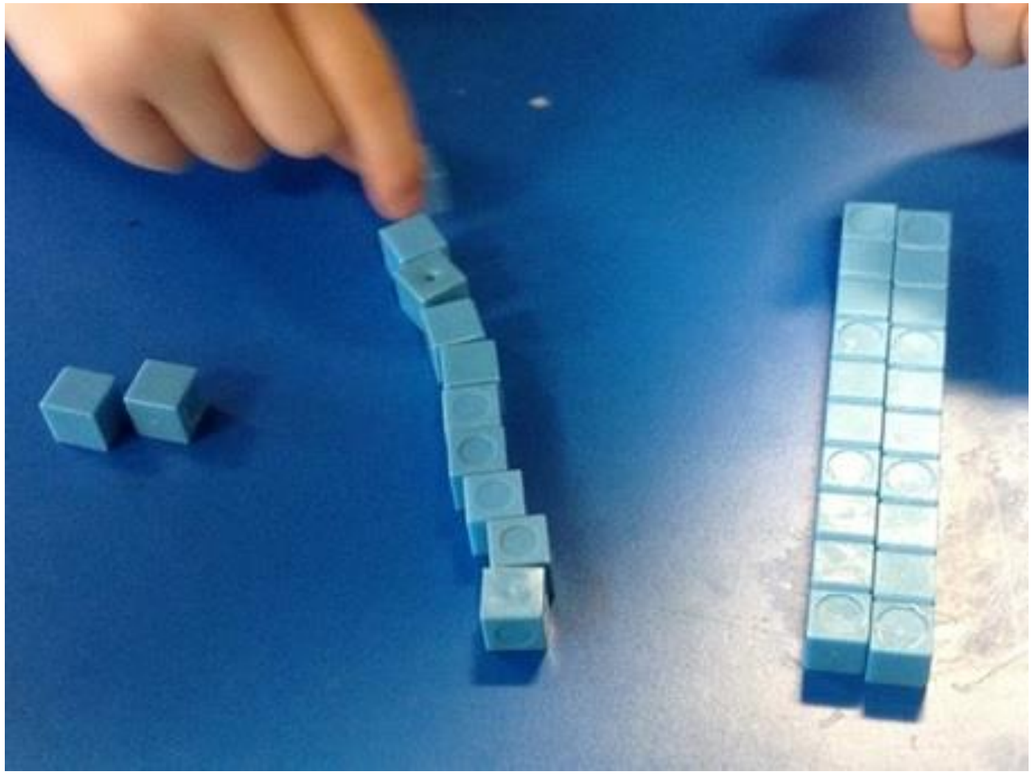
***Level 2:*** *I can find different answers*

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



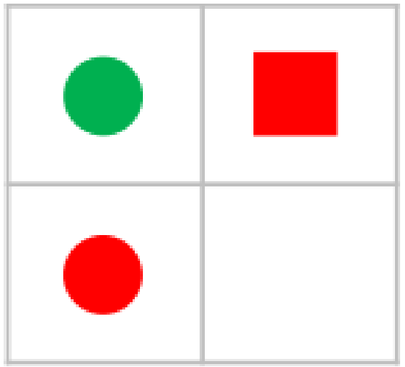




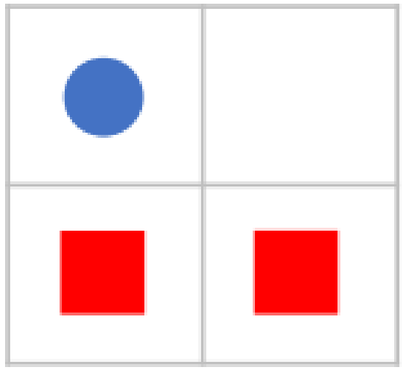


# Finish the Pictures

4 shapes in total.
2 green shapes.
3 circles.



4 shapes in total.
3 red shapes.
2 circles.



# Finish the Pictures

3 shapes in total.
1 red shape.
2 circles.

3 shapes in total.
2 blue shapes.
1 square.

# Creating Reasoning Routines, Building Problem-Solvers

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**Y1 & Y2**

# Re-Proposing and Extending Mathematical Play

*Real life moves too fast to reflect on the learning that is happening at the time.*

**Recreate moments, re-proposals, content control**

*A balloon first rose 200 meters from the ground, then moved 100 meters to the east, then dropped 100 meters. It then travelled 50 meters to the east, and finally dropped straight to the ground. How far was the balloon from its original starting place?"*

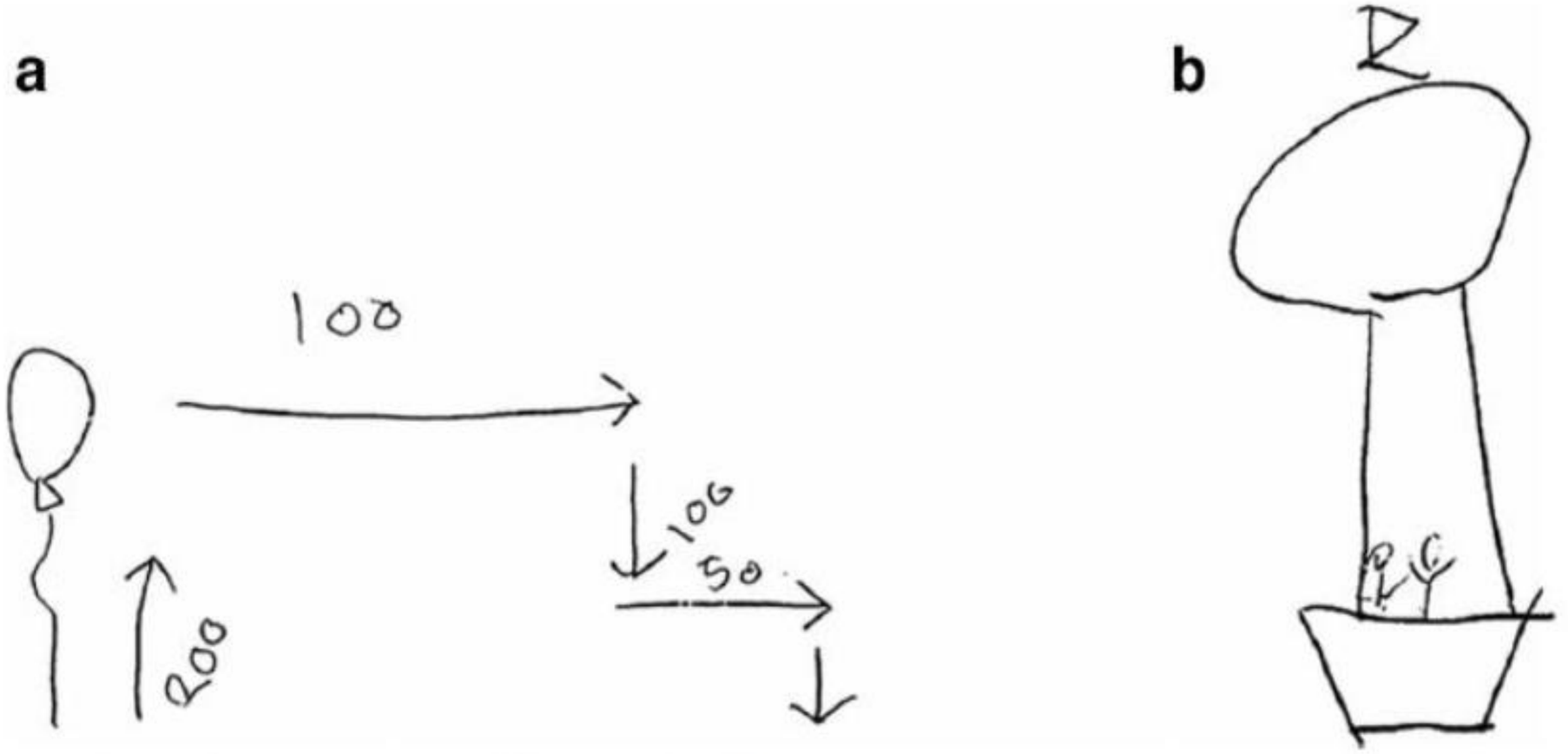
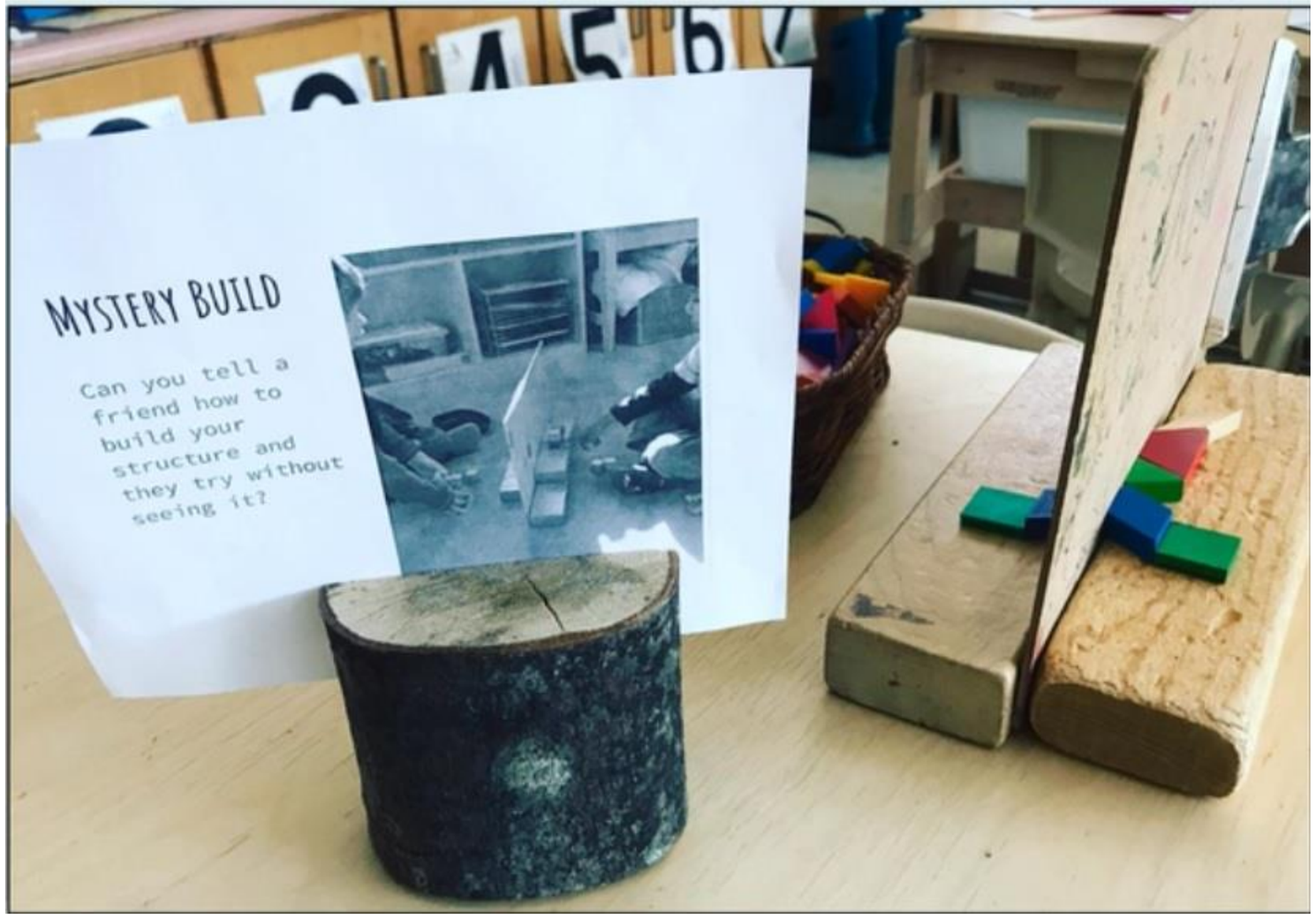
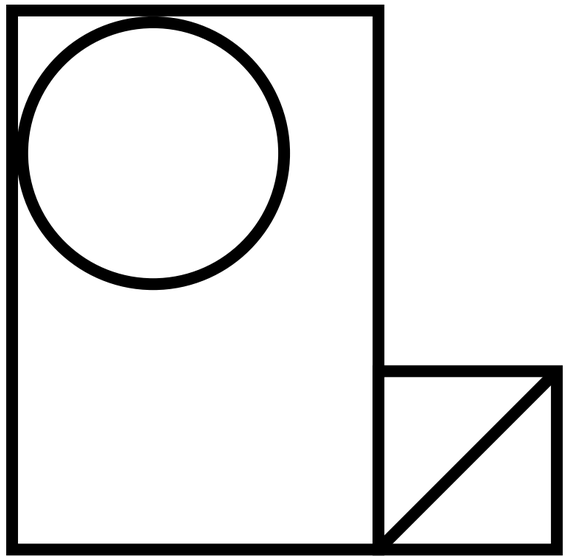
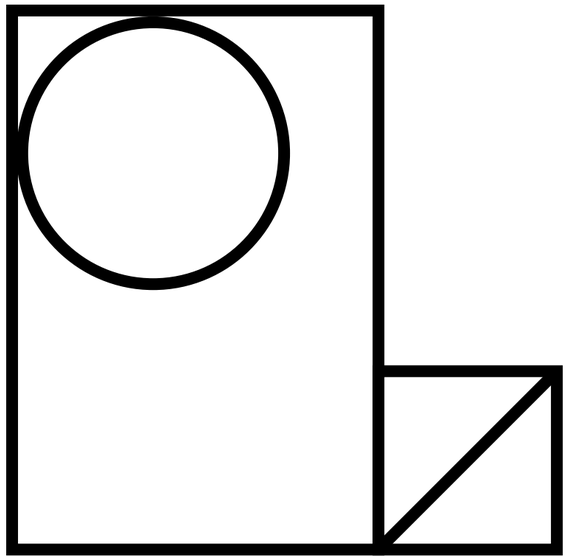


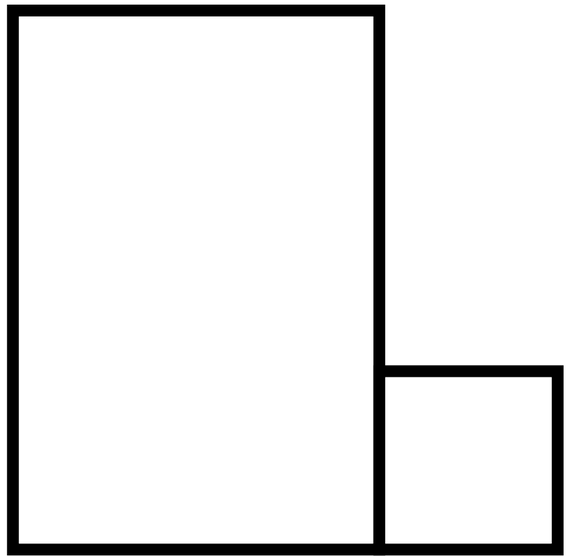

**Fig. 5** An example of a visual-schematic representation (**A**) vs. a pictorial representation (**B**)

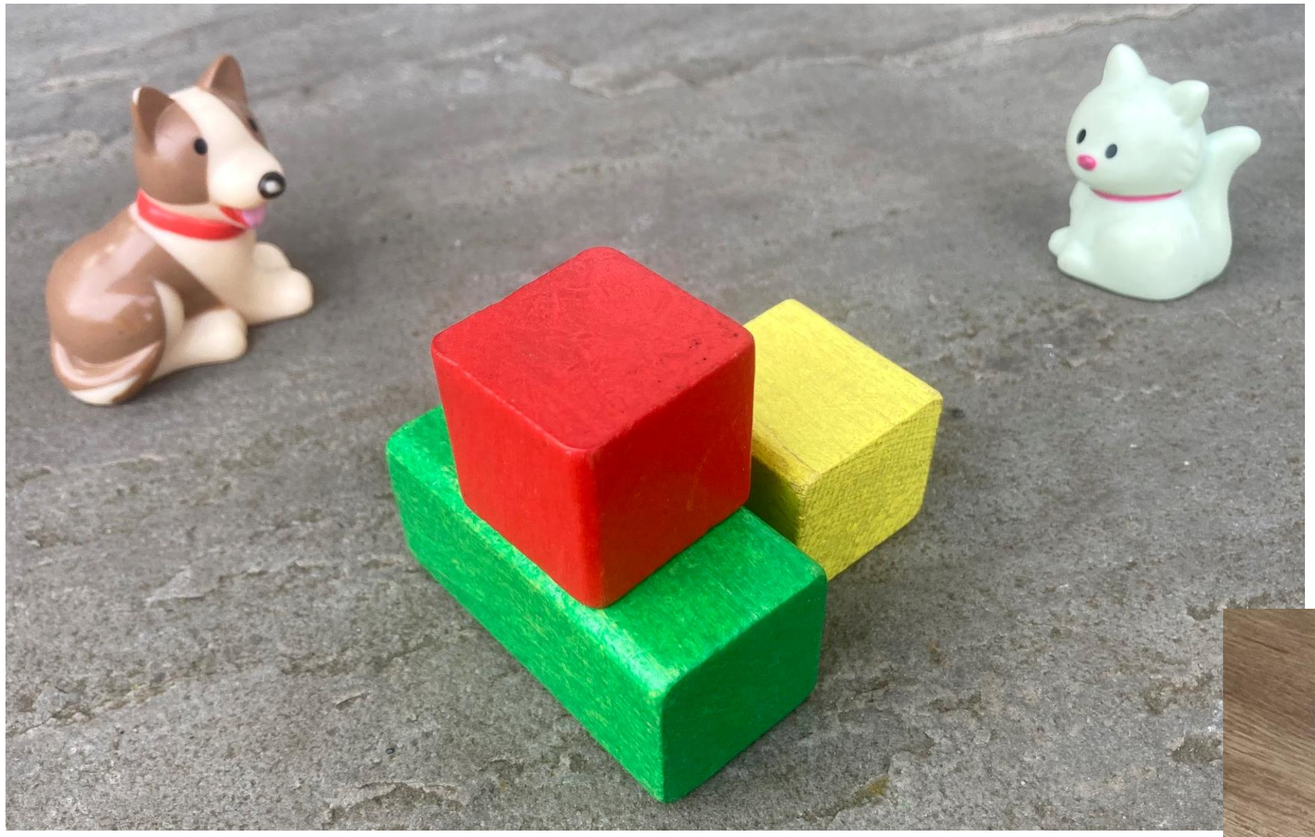
See it, Cover it, Build it

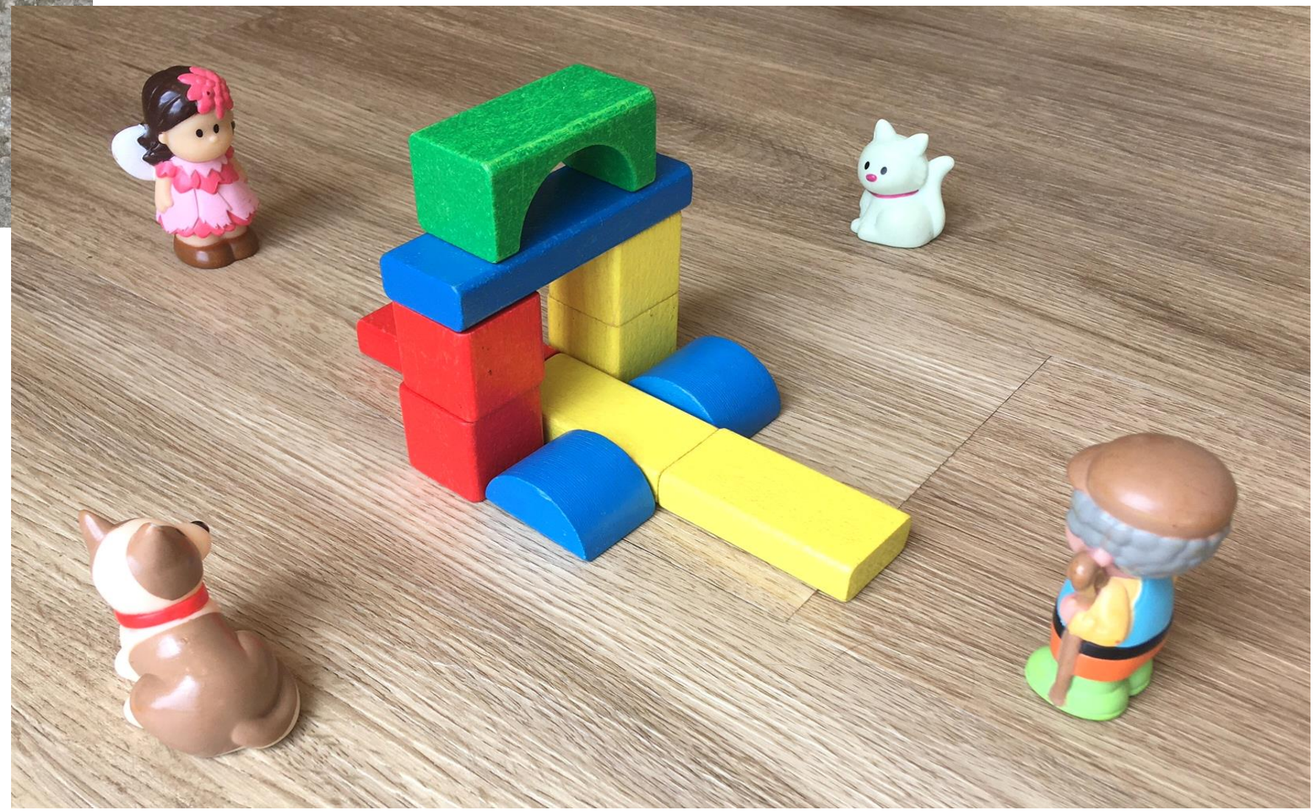

MYSTERY BUILD
Can you tell a friend how to build your structure and they try without seeing it?









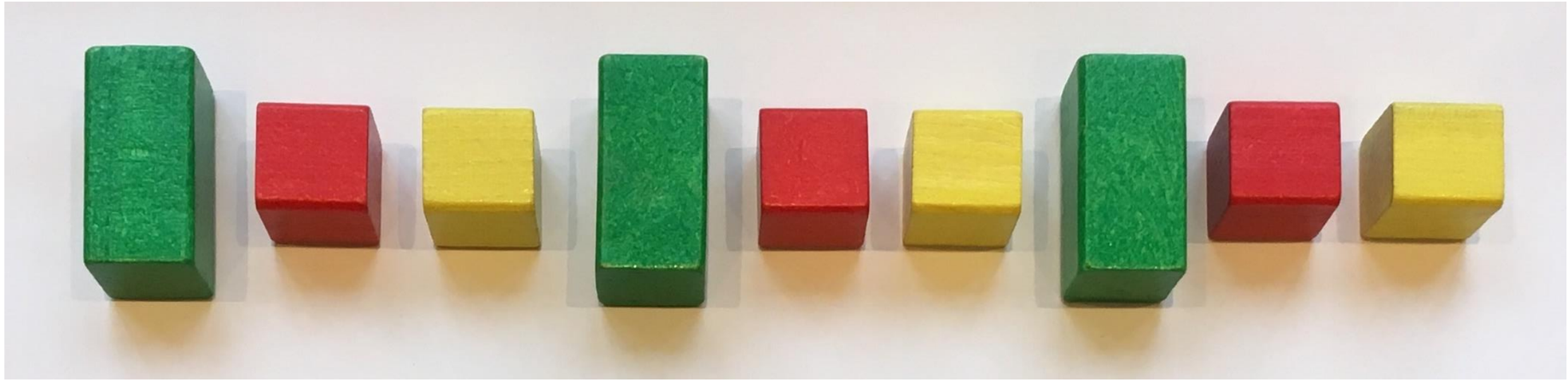


Max and Ruth Edwards

A five year old's holiday map, showing the route from the campsite to the river.

A six year old's map of the route home from school via the park

Oli and Jenni Back



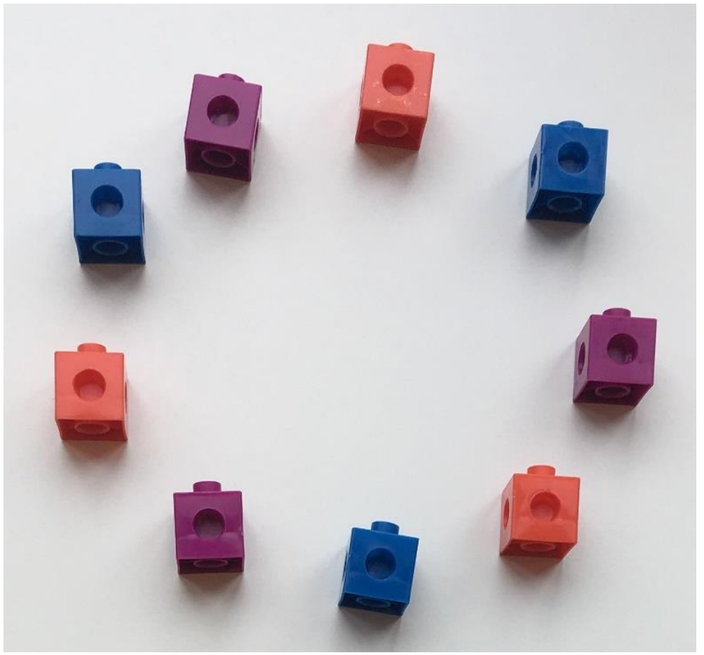
Continue and make patterns

Spot and correct mistakes

Represent with other objects

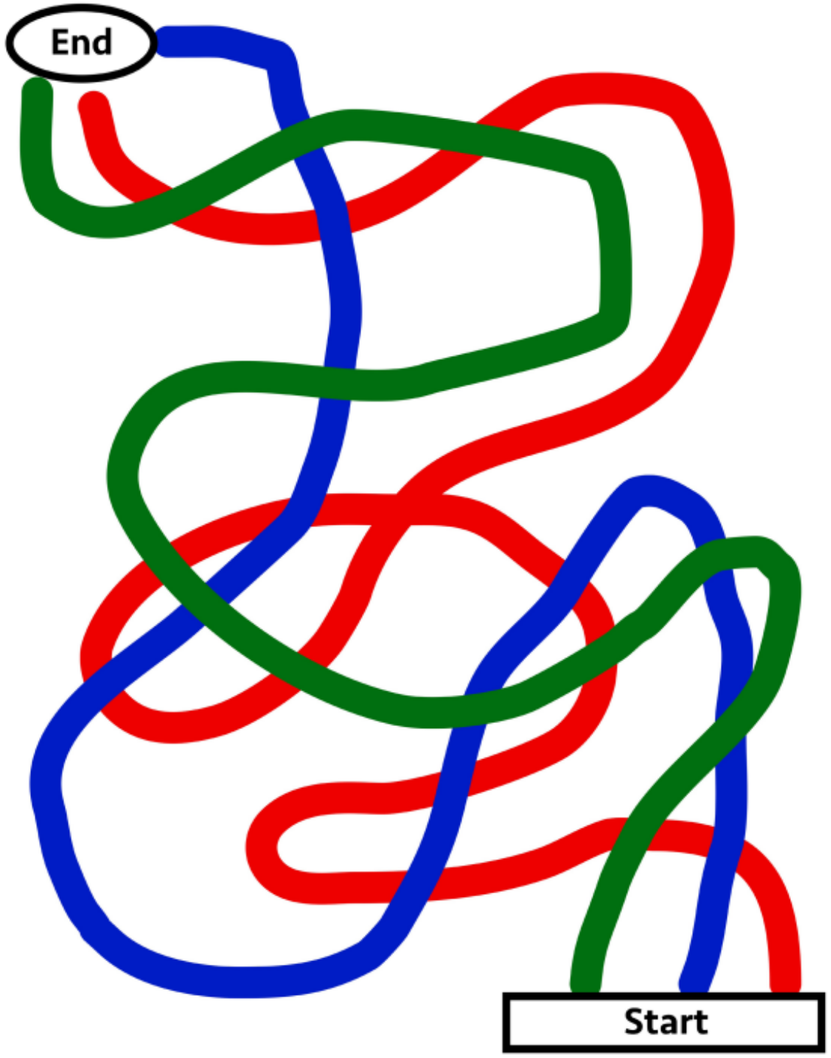
Identify the ‘unit of repeat’

Circular patterns



youcubed at Stanford University

# Finger Maze 1




[Finger Discrimination Article]

[Finger Discrimination Tasks]

# Developing Visual Working Memory

**Self-regulation and ownership**

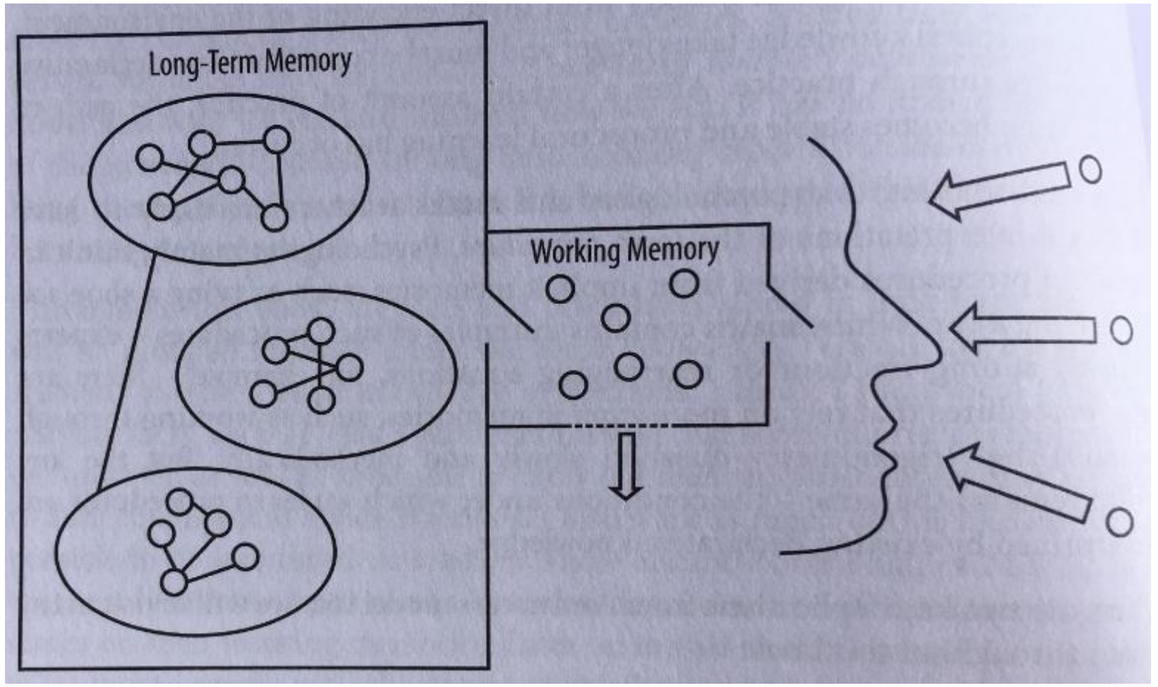
Number skills in and out of context

**Spatial reasoning**

Finger discrimination

92. In some schools, pupils were not explicitly taught how to apply the mathematics they had recently learned to mathematical problems. Their only exposure to solving mathematical problems was through answering the final few questions of a predominantly procedure-focused exercise. Often, many pupils did not reach this stage of the exercise. These pupils, therefore, had very little experience of applying mathematical methods beyond routine and established applications. Pupils in these schools were notably less confident when solving mathematical problems.

Link



When students are presented with a mathematics word problem, their first response often is to try to compute an answer, even before they have tried to understand the problem.

Expert problem solvers typically spend more time thinking about problems and trying to understand them than do novices, who tend to immediately execute a solution.

**Removing Opportunities to Calculate Improves Students' Performance on Subsequent Word Problems.** *Givvin and Stigler (2019)*

Rob has 4 more cherries than John.

John has 5 cherries.

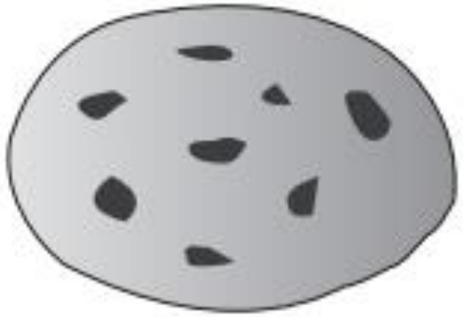
**How many cherries does Rob have?**

*Mastery Assessment, Y1 (adapted)*

Rob has more cherries than John.

Rob has cherries.

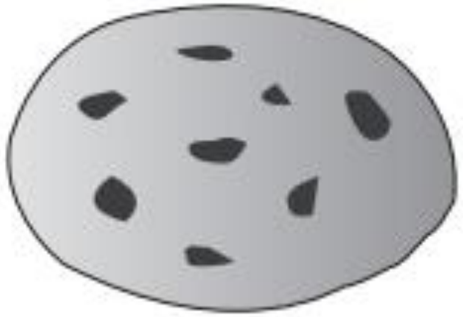
John has cherries.



| biscuits | cakes |
| --- | --- |
| **20p** each | **25p** each |

Sam buys **3** biscuits and **1** cake.

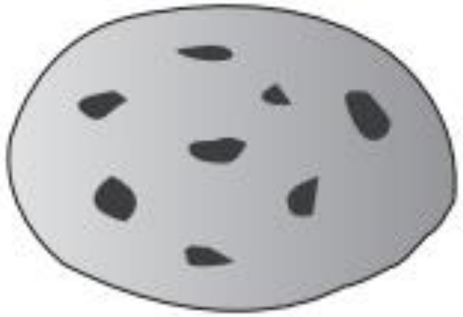
How much does Sam spend **altogether?**



| biscuits | cakes |
| --- | --- |
| **20p** each | **25p** each |

Sam buys

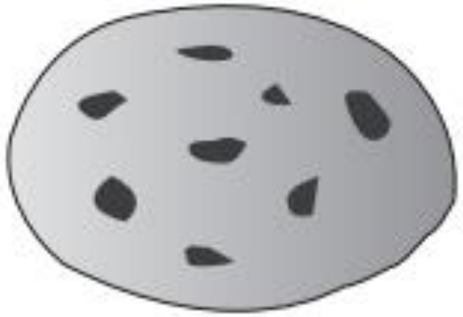
How much does Sam spend **altogether?**



| biscuits | cakes |
| --- | --- |
| **20p** each | **25p** each |

Sam buys ☐ biscuits and **1** cake.

How much does Sam spend **altogether?**

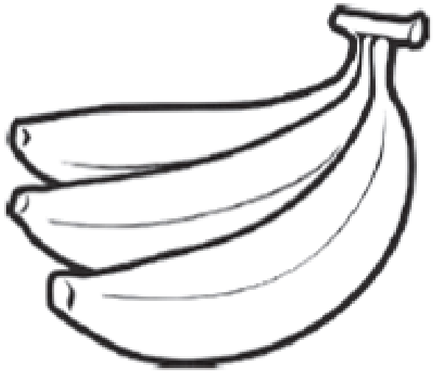


| biscuits | cakes |
| --- | --- |
| **20p** each | **25p** each |

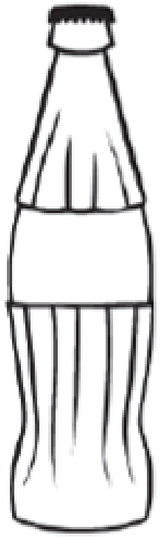
Sam buys **3** biscuits and **1** cake.

How much does Sam spend **altogether?**

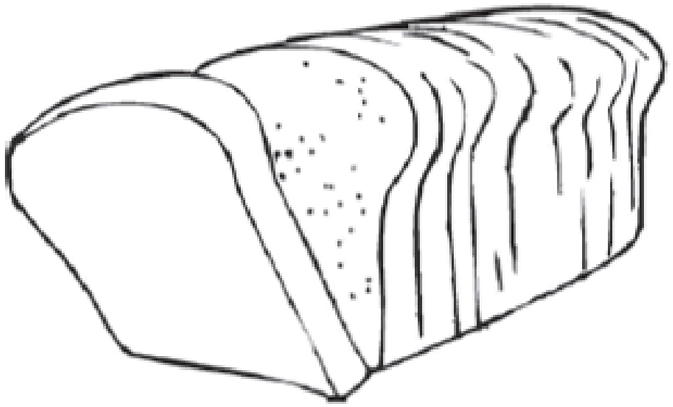
Here is the cost of some items in a shop.



Banana 20p



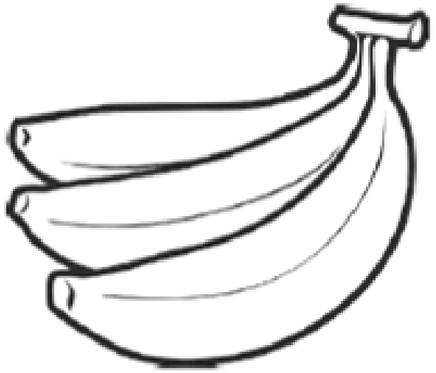
Drink 50p



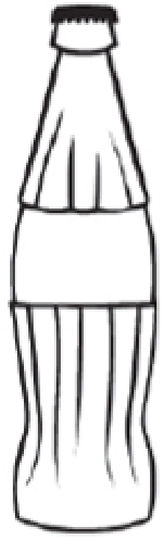
Bread 40p

**How many bananas can he buy?**

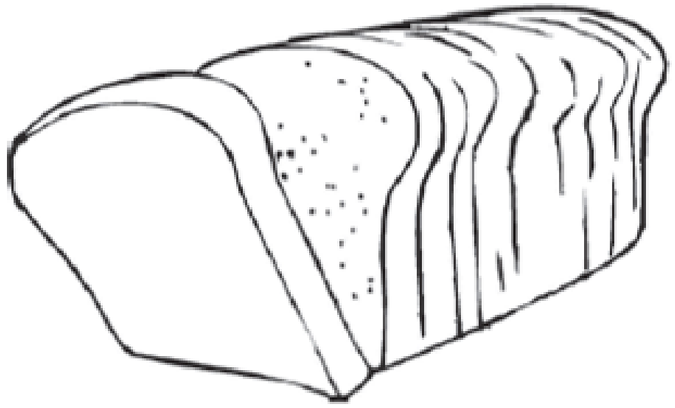
Here is the cost of some items in a shop.



Banana 20p



Drink 50p



Bread 40p

Sam has £1.

**How many bananas can he buy?**

Ollie spends 30 pence on a teddy.

He pays with two coins.

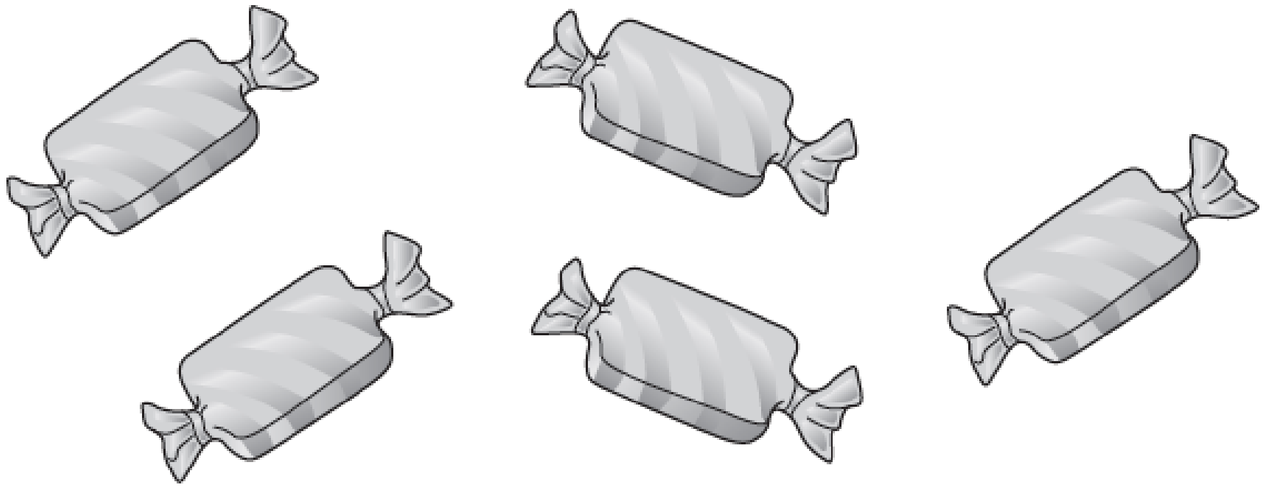
Tick the coins Ollie pays with.

Ollie spends 30 pence on a teddy.

He pays with ____ coins.

Tick the coins Ollie pays with.

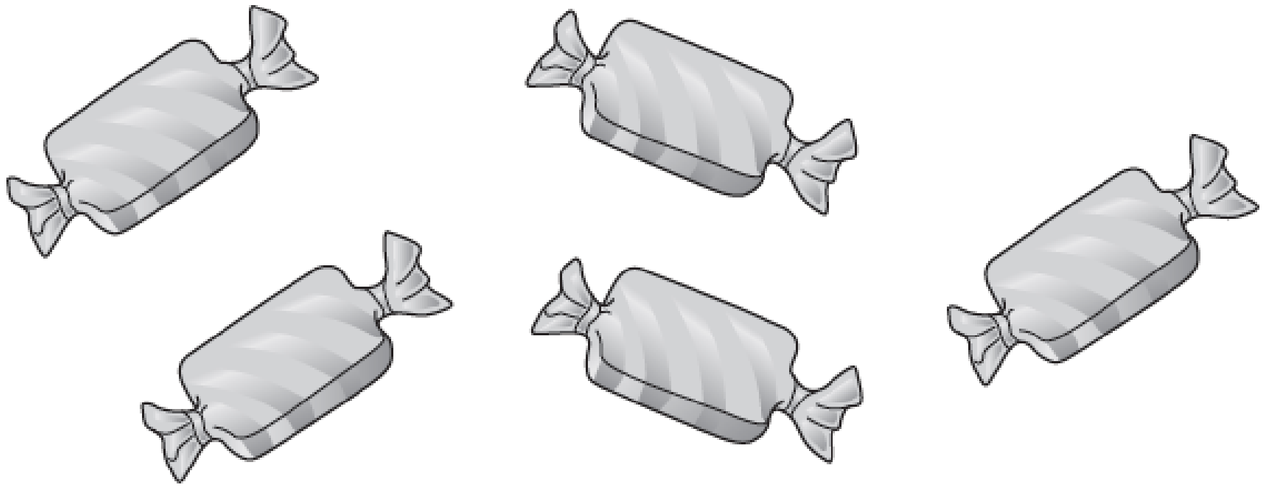
Bilal spends **10p** on these sweets:



Each sweet costs the same amount.

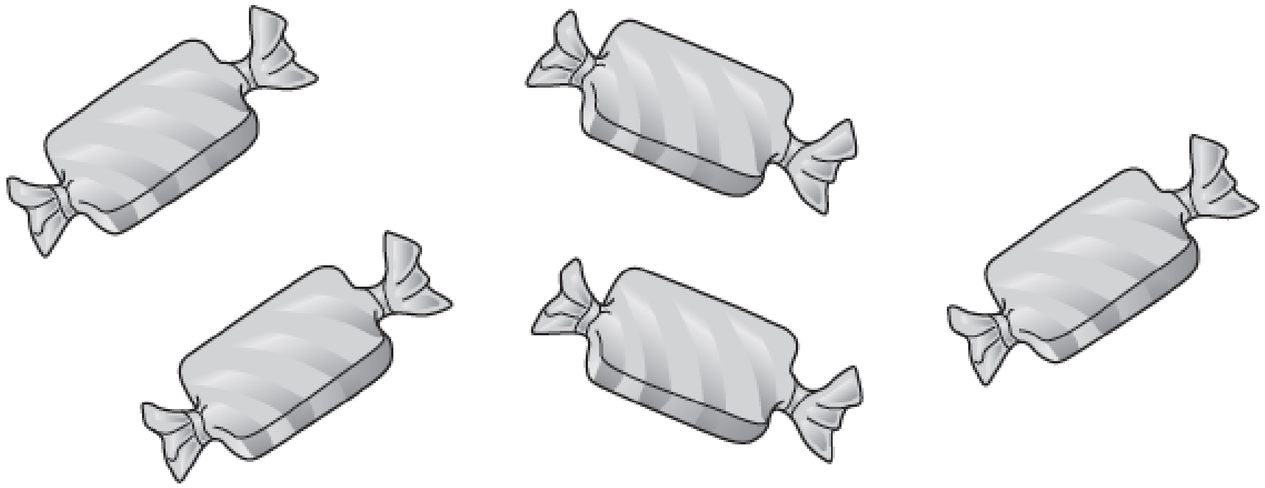
Work out the cost of **3** of these sweets.

Bilal spends ☐ on these sweets:



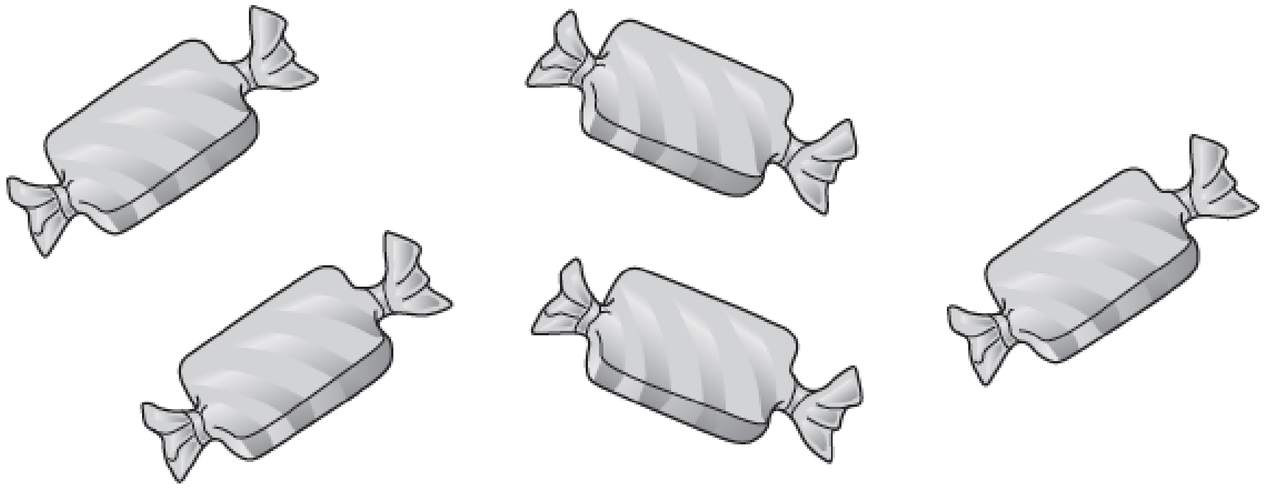
Each sweet costs the same amount.

Bilal spends **10p** on these sweets:



Each sweet costs the same amount.

Bilal spends **10p** on these sweets:



Each sweet costs the same amount.

Work out the cost of **3** of these sweets.

Sally buys 3 cinema tickets.

**How much does Sally spend?**

Sally buys 3 cinema tickets.

Each ticket costs £5.

**How much does Sally spend?**

Sally buys 3 cinema tickets.

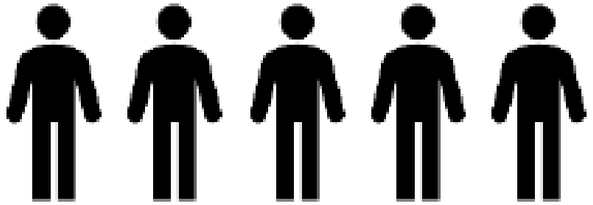
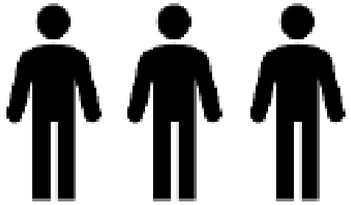
Each ticket costs £5.

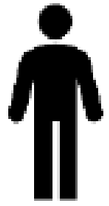
**How much does Sally spend?**

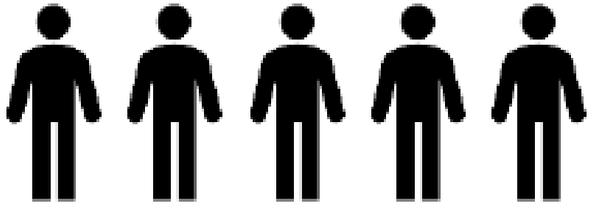
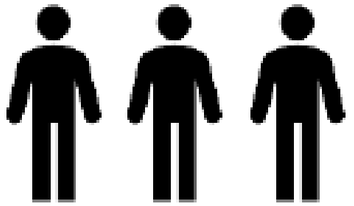
| | | |
|---|---|---|
| **£5** | **£5** | **£5** |

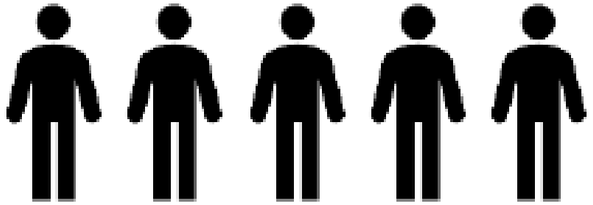
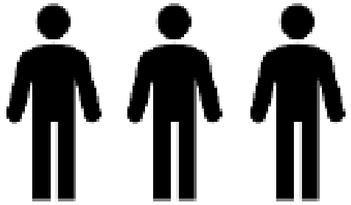
| | |
|---|---|
| **£5** | **£3** |

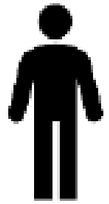
*How many more children have school dinners than packed lunches?*

| | |
|---|---|
| School dinners |  |
| Packed lunches |  |

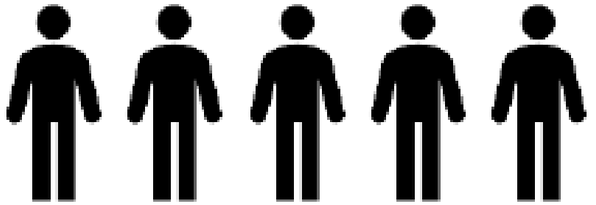
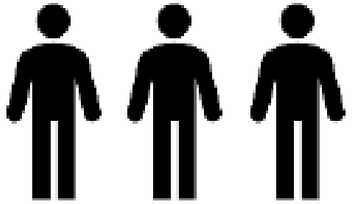
 = 5 children

| | |
|---|---|
| School dinners |  |
| Packed lunches |  |

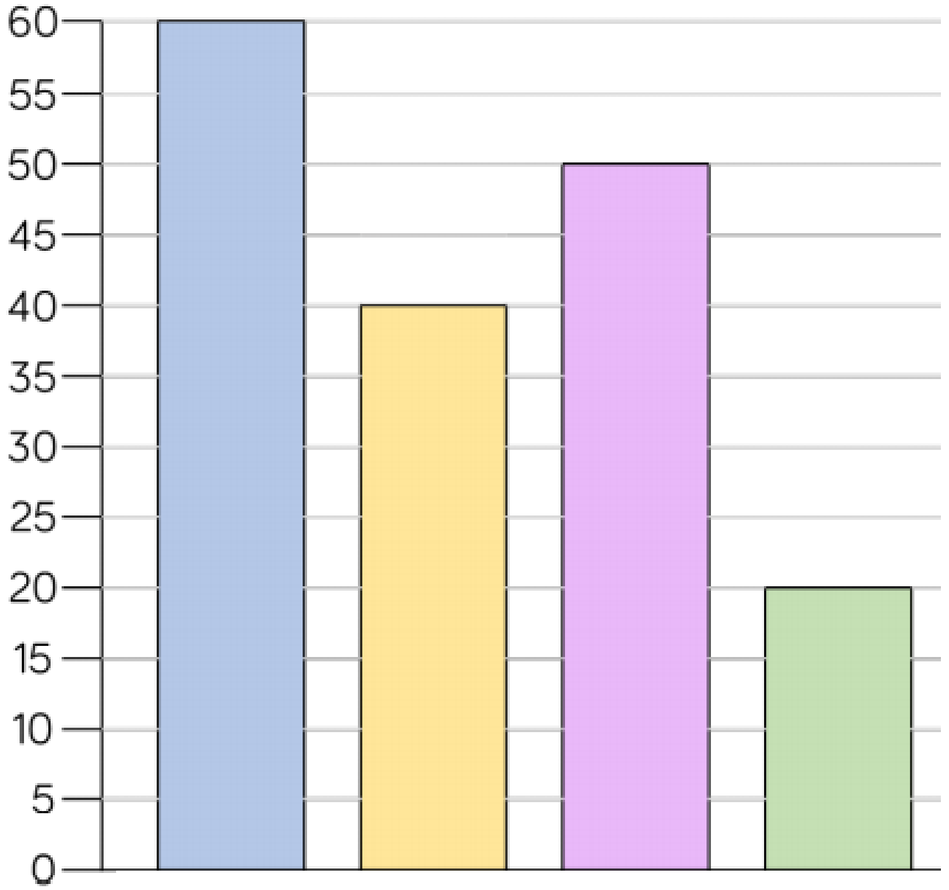
| | |
|---|---|
| School dinners |  |
| Packed lunches |  |

 = 5 children

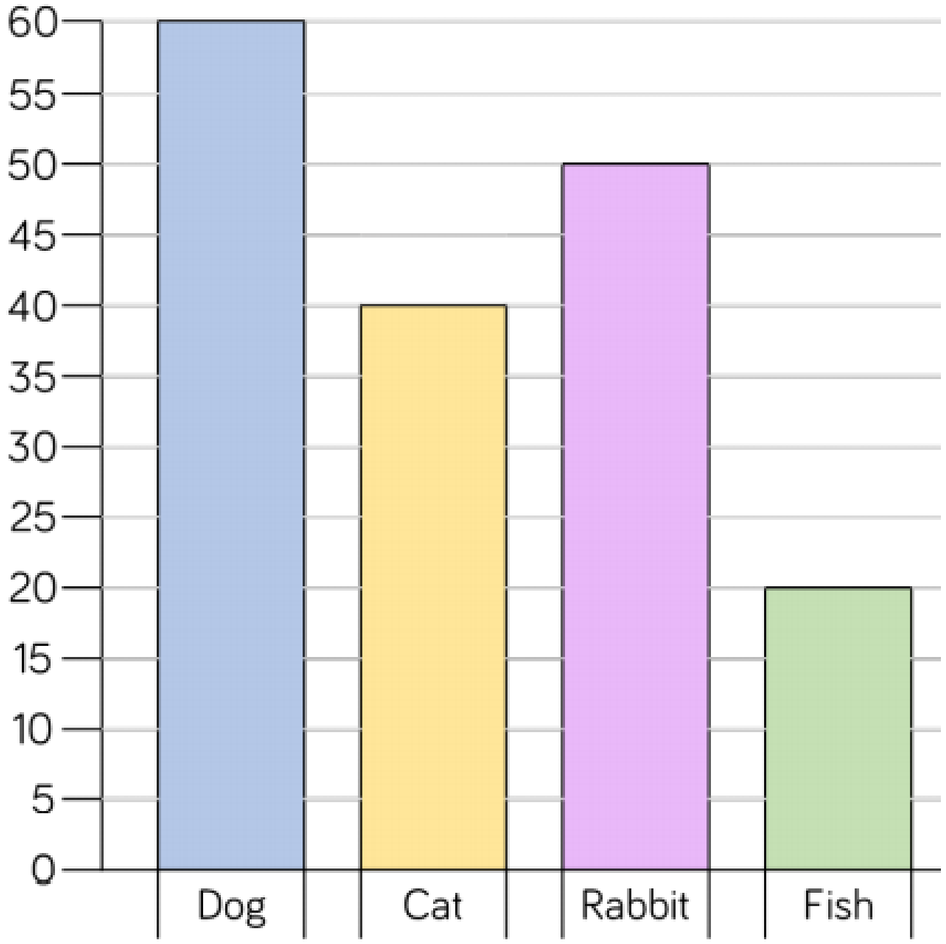
*How many more children have school dinners than packed lunches?*

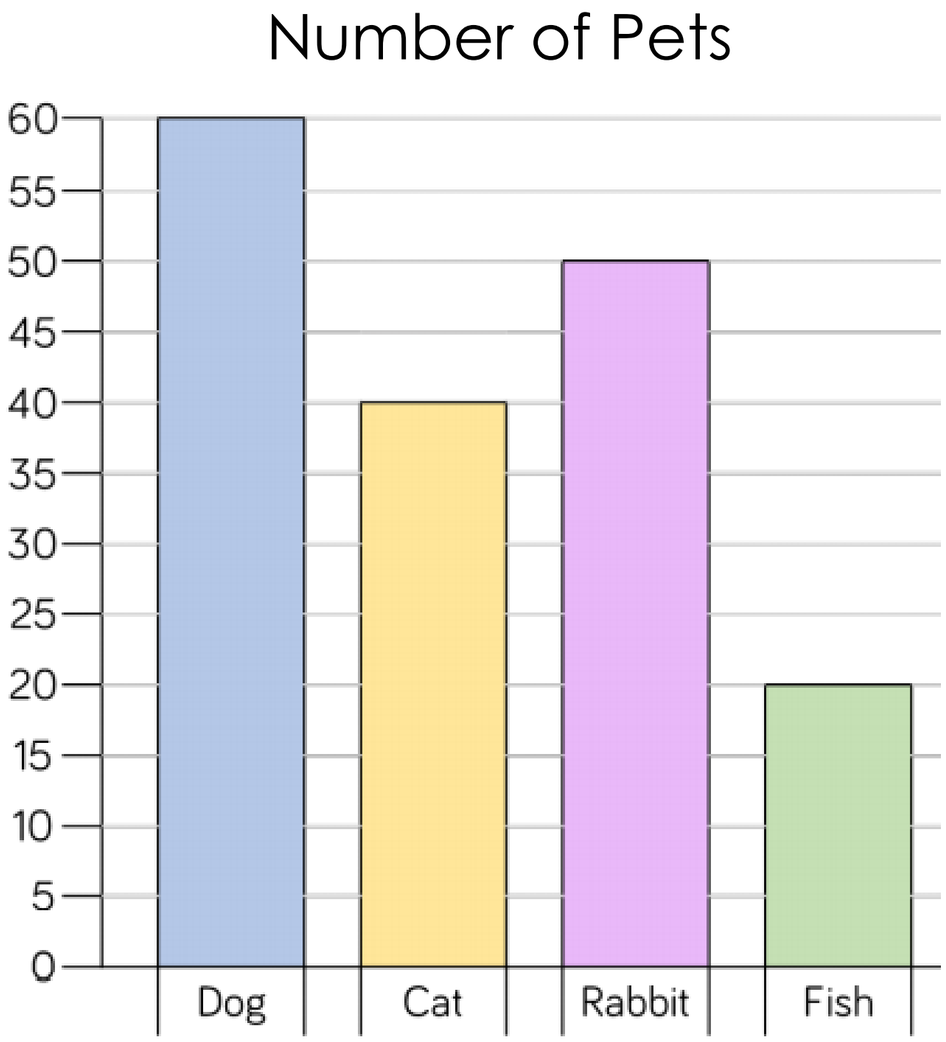
| | |
|---|---|
| School dinners |  |
| Packed lunches |  |

= 5 children


60
55
50
45
40
35
30
25
20
15
10
5
0

# Number of Pets





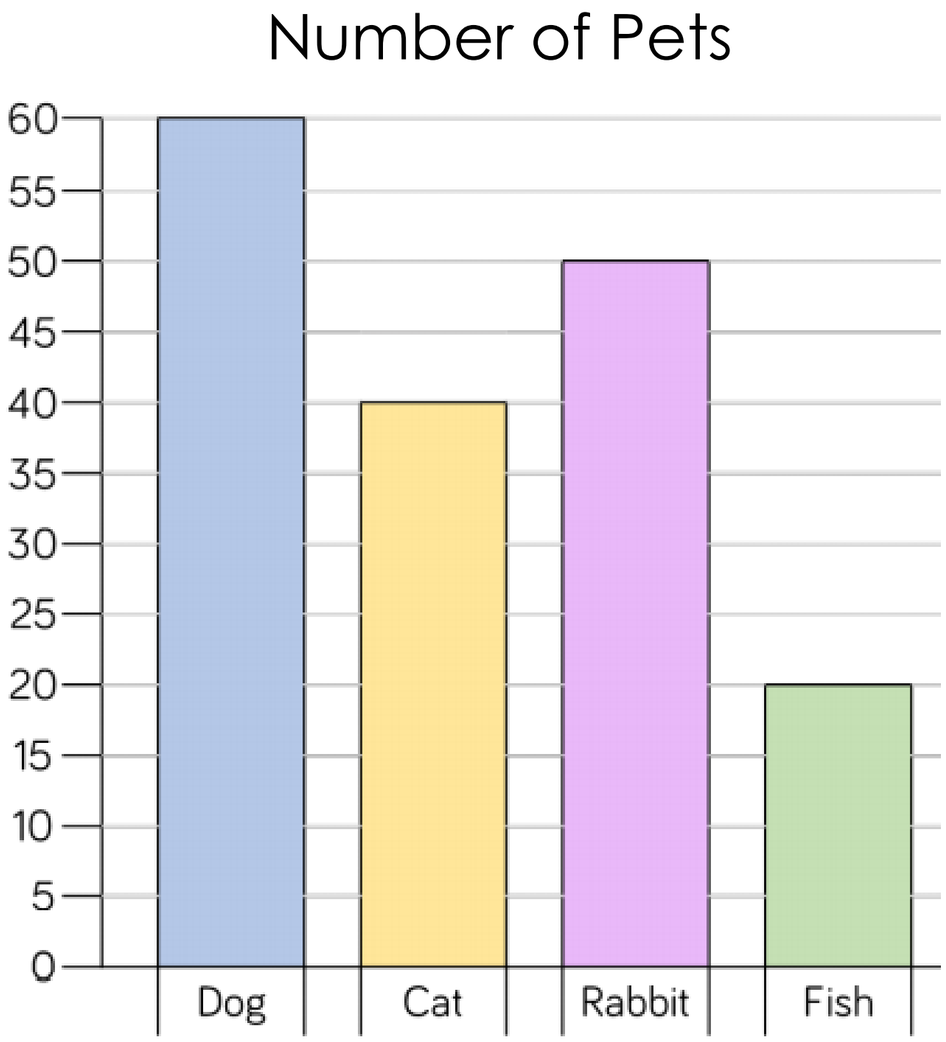

**True or False?**

There are

There are 10 more

Altogether,

Most of




**True or False?**

There are 50 cats in total.

There are 10 more rabbits than cats.

Altogether, there are 180 pets.

Most of the pets are dogs.

I have £

I want to buy a game that costs £

I have £

I want to buy a game that costs £

**How much more money do I need?**

I have £

I want to buy a game that costs £20

**How much more money do I need?**

I have £15

I want to buy a game that costs £20

**How much more money do I need?**

Jen has 10 sweets.

**How many sweets do they have altogether?**

Jen has 10 sweets.

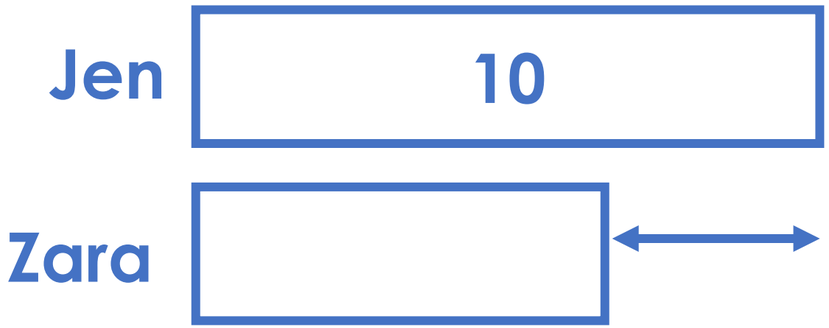
Zara has □ more sweets than Jen.

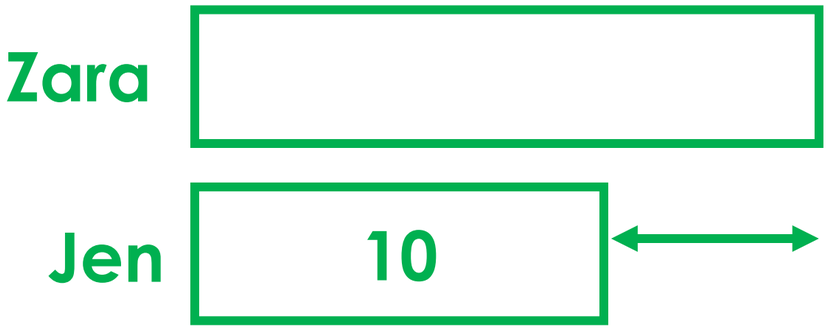
**How many sweets do they have altogether?**

Jen has 10 sweets.

Zara has □ more sweets than Jen.

**How many sweets do they have altogether?**

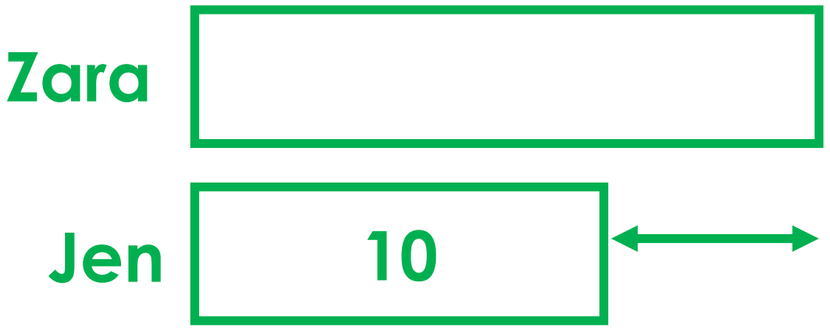


Jen has 10 sweets.

Zara has □ more sweets than Jen.

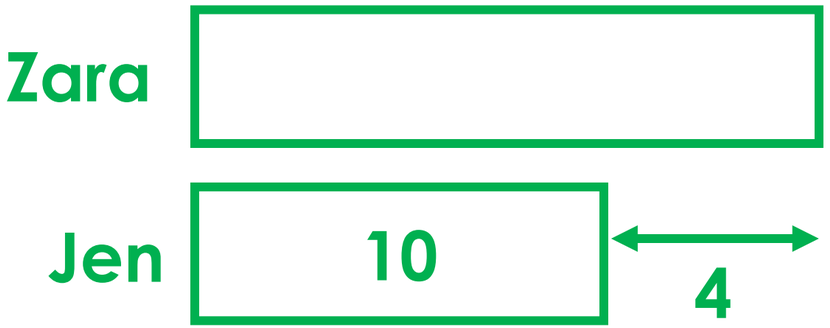
**How many sweets do they have altogether?**



Jen has 10 sweets.

Zara has 4 more sweets than Jen.

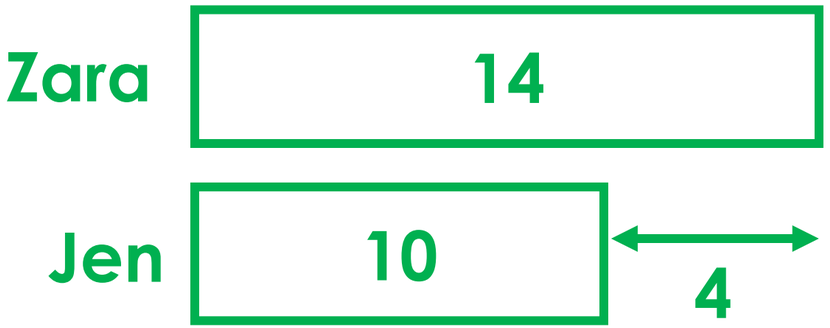
**How many sweets do they have altogether?**



Jen has 10 sweets.

Zara has 4 more sweets than Jen.

**How many sweets do they have altogether?**



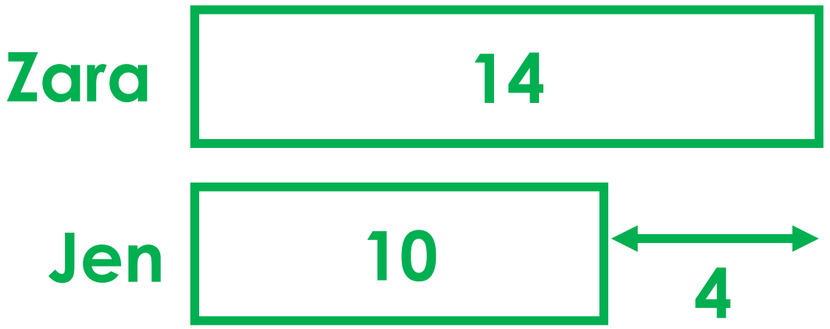
Jen has 10 sweets.

Zara has 4 more sweets than Jen.

**How many sweets do they have altogether?**

14

24

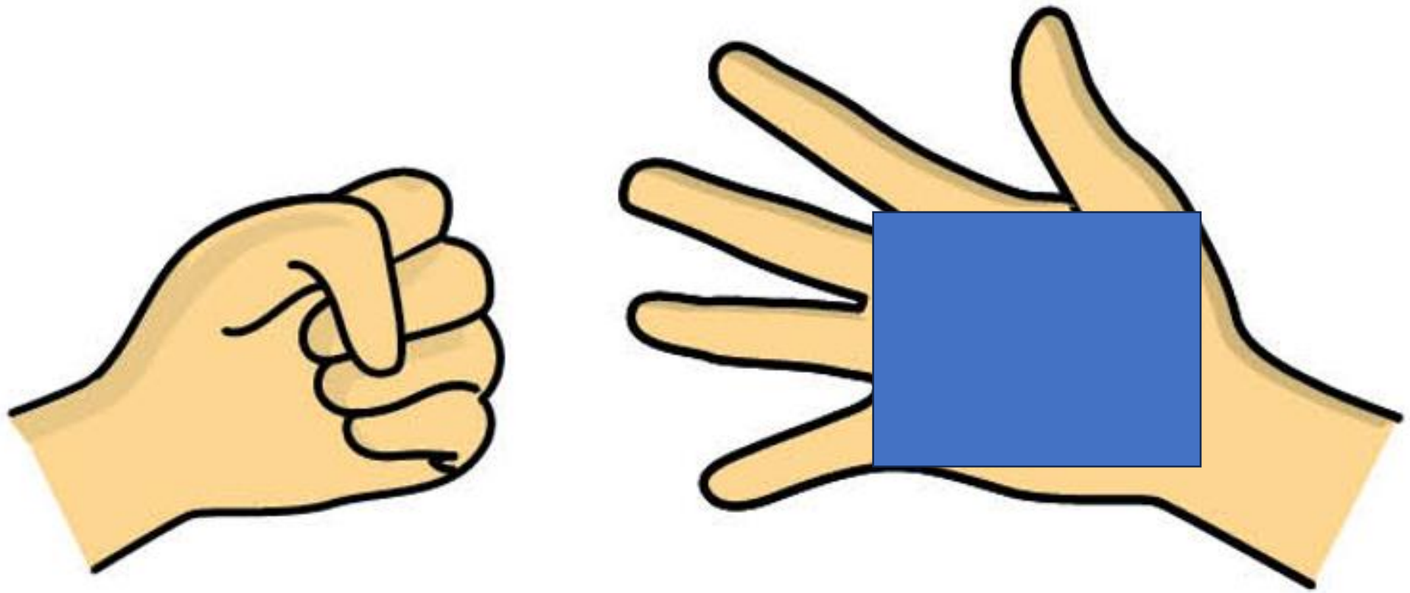


Annie has £1 in total in her hands.

What coins could be in Annie's closed hand?

**Accessibility, depth**

Annie has £1 in total in her hands.



**What coin(s) could be in Annie’s closed hand?**

Annie has £1 in total in her hands.

**What coin(s) could be in Annie’s closed hand?**

Annie has £1 in total in her hands.

**What coin(s) could be in Annie's closed hand?**

*Fewest coins*

*7 coins answer*

## Children's Task:

# Which Picture?

## Task A

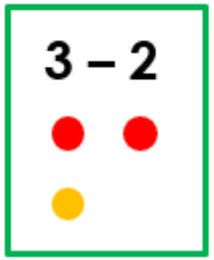
Kate has 3 apples. Tom has 2 apples.

**How many apples in total?**

**3 + 2**

***Which Picture?***

**3 – 2**



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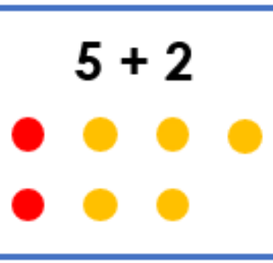
In total, Lee and Ben have 5 sweets. Lee has 2 sweets.

**How many sweets does Ben have?**

**5 + 2**



***Which Picture?***

**5 – 2**

There were 20 people on the bus.

At the bus stop, [redacted]

**How many people on the bus now?**

There were 20 people on the bus.

At the bus stop, 5 people got off the bus and 5 people got on.

**How many people on the bus now?**

There were 20 people on the bus.

At the bus stop, 8 people got off the bus and 6 people got on.

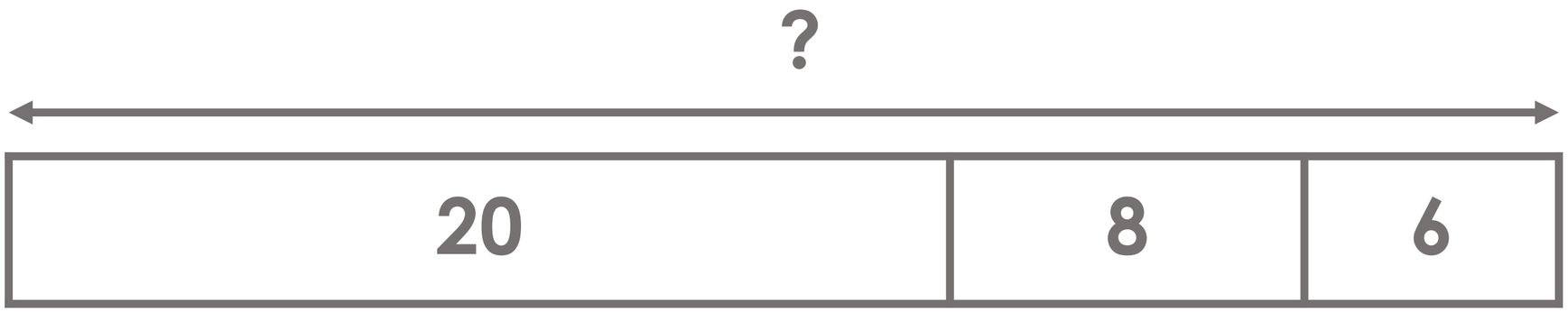
**How many people on the bus now?**

There were 20 people on the bus.

At the bus stop, 8 people got off the bus and 6 people got on.

**How many people on the bus now?**

**Explain why this DOES NOT correctly represent the question:**

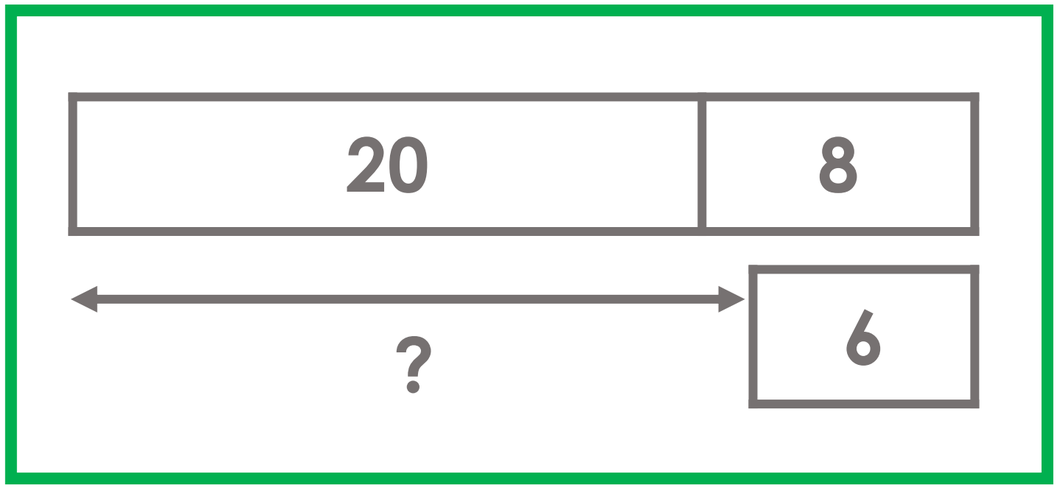


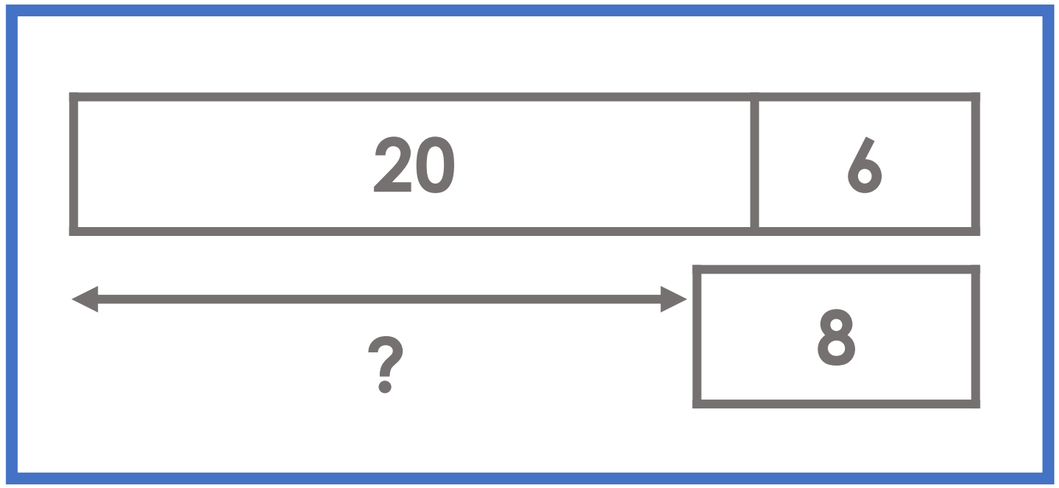
There were 20 people on the bus.

At the bus stop, 8 people got off the bus and 6 people got on.

**How many people on the bus now?**

**Which Picture?**



1. Dan had 10 sweets. He gave 2 sweets to Tom and 3 sweets to Raja.
   **How many sweets does Dan have left?**

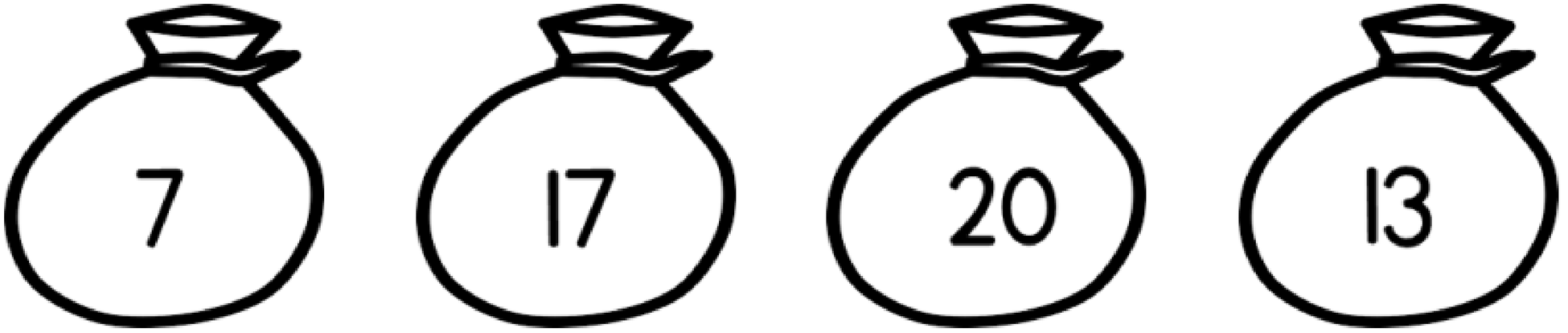
2. Holly had 10 pencil crayons.
   She lost 2 pencil crayons. Then, she bought 3 more pencil crayons.
   **How many pencil crayons does Holly have now?**

3. There were 10 people on the bus.
   At the next stop, 2 people got on the bus and 3 people got off the bus.
   **How many people are on the bus now?**

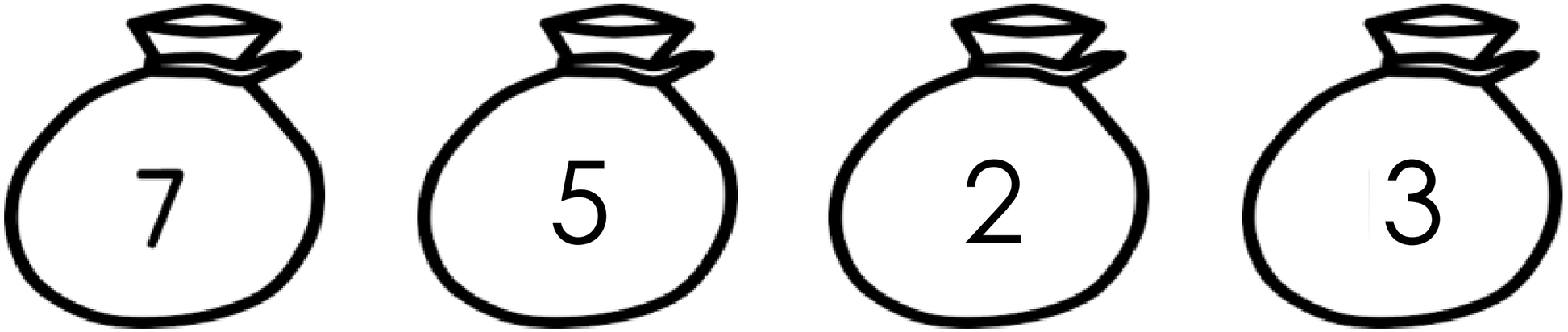
Eva has 2 bags of marbles.

She has 20 marbles altogether.

Circle the bags she has.



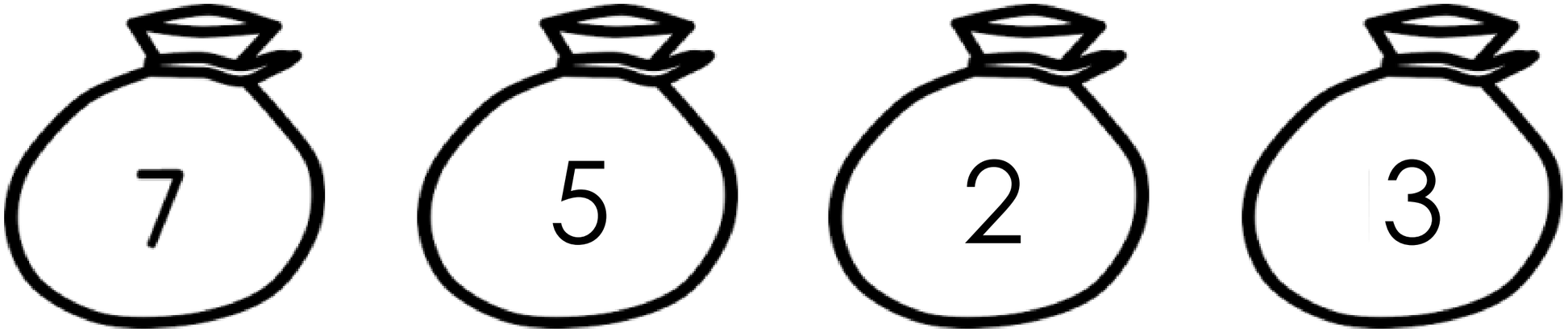
Eva has 2 bags of marbles.



Eva has 2 bags of marbles.

She has 10 marbles altogether.

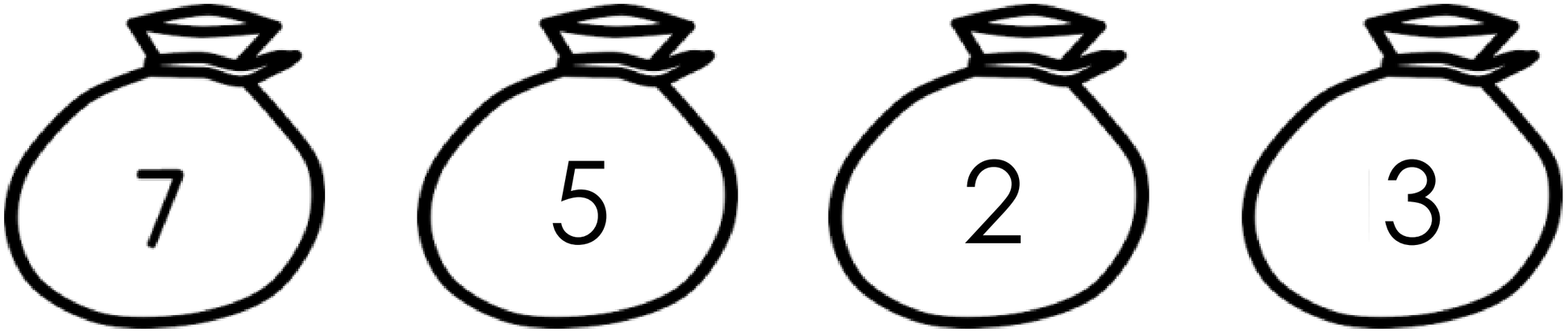
Circle the bags she has.



Eva has 3 bags of marbles.

She has 10 marbles altogether.

Circle the bags she has.



# Explore

Tom has **2** bags of marbles.

**How many marbles could he have?**

*The largest amount is…*

*The smallest amount is…*

# Agree or Disagree?

Jen has **2** bags of marbles.

**How many marbles could she have?**

**Jen could have 6 marbles**

**Jen could have 7 marbles**

# Small Difference Questions

Ben has **2** bags of marbles.
He has **8** marbles altogether.
Circle the bags he has.

Kim has **2** bags of marbles.
She has **10** marbles altogether.
Circle the bags she has.

Mel has **3** bags of marbles.
She has **10** marbles altogether.
Circle the bags she has.

Jen had 10 sweets.

Zara had 4 sweets.

Jen had 10 sweets.

Zara had 4 sweets.

**Who has the most sweets now?**

Jen had 10 sweets.

Zara had 4 sweets.

Jen gave Zara □ sweets.

**Who has the most sweets now?**

Jen had 10 sweets.

Zara had 4 sweets.

Jen gave Zara 2 sweets.

**Who has the most sweets now?**

1. Ben has 8 sweets. Tom had 2 sweets.
**How many sweets do they have altogether?**

2. Kate has 8 sweets. Joy has 2 sweets.
**How many more sweets does Kate have than Joy?**

3. Holly had 8 sweets. Amy had 2 sweets. Holly ate 4 sweets.
**Who has the most sweets now?**

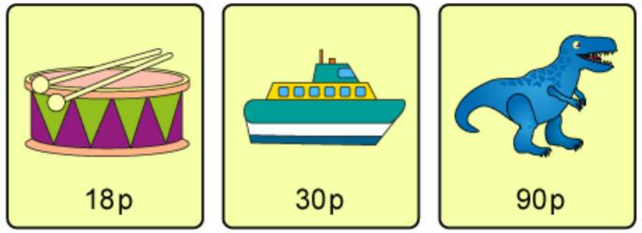
4. Holly had 8 grapes. Amy had 2 grapes. Holly gave Amy 4 grapes.
**Who has the most grapes now?**

Task: Provide each pupil with 2p, 5p and 10p coins (real or otherwise), then ask pupils to show how to pay for:

a. the drum with 2p coins

b. the boat with 5p coins

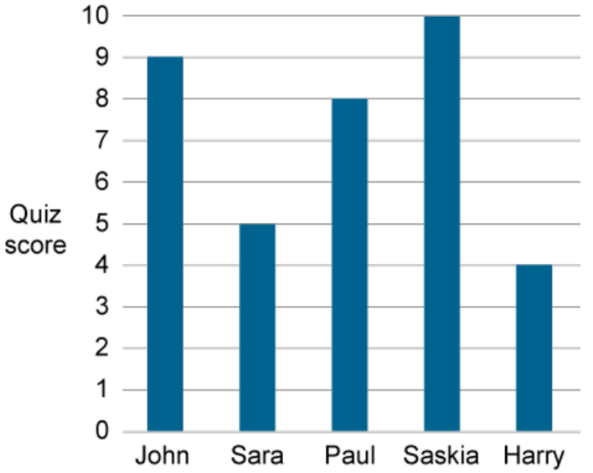
c. the dinosaur with 10p coins




The table shows the results of a survey which asked pupils to choose their favourite sport. Which sports were chosen by between 20 and 30 pupils?

| Favourite sport | Number of pupils |
|---|---|
| netball | 24 |
| basketball | 19 |
| tennis | 12 |
| football | 32 |
| hockey | 6 |
| swimming | 28 |
| gymnastics | 15 |

The bar chart shows how many points some pupils scored in a quiz.




a. How many more points did John score than Sara?

b. How many fewer points did Harry score than Saskia?

c. What is the difference between Saskia's score and Paul's score?

Task: Provide each pupil with 2p, 5p and 10p coins (real or otherwise), then ask pupils to show how to pay for:

a. the drum with 2p coins

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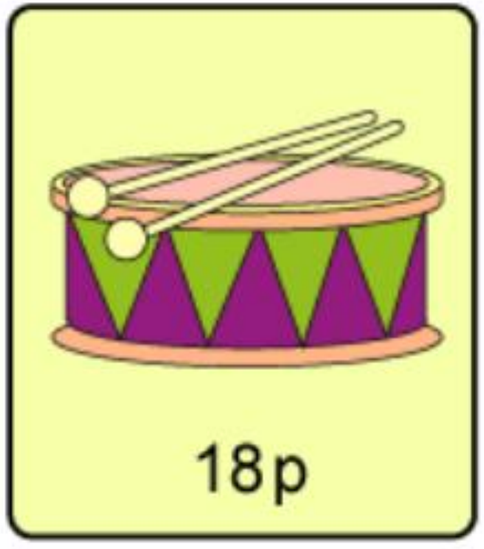
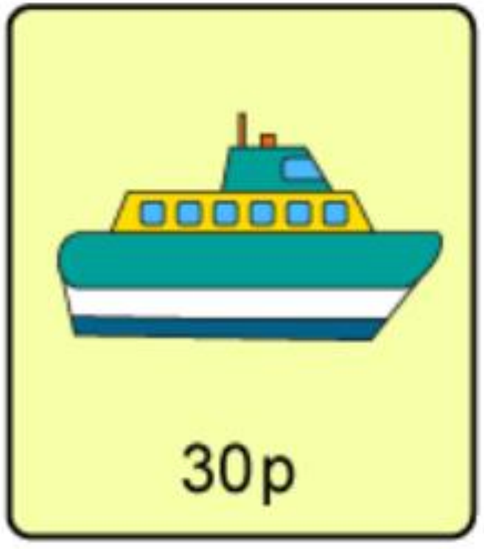
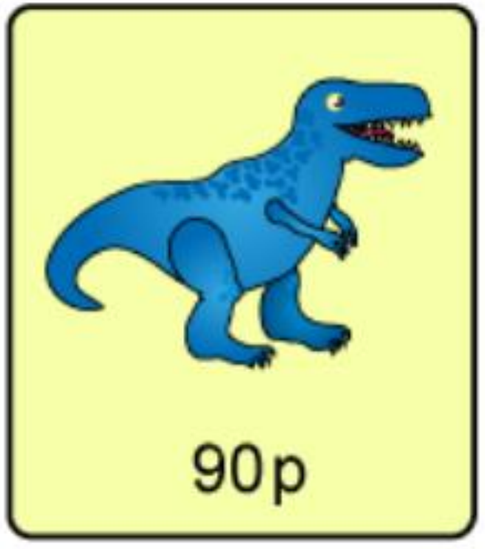
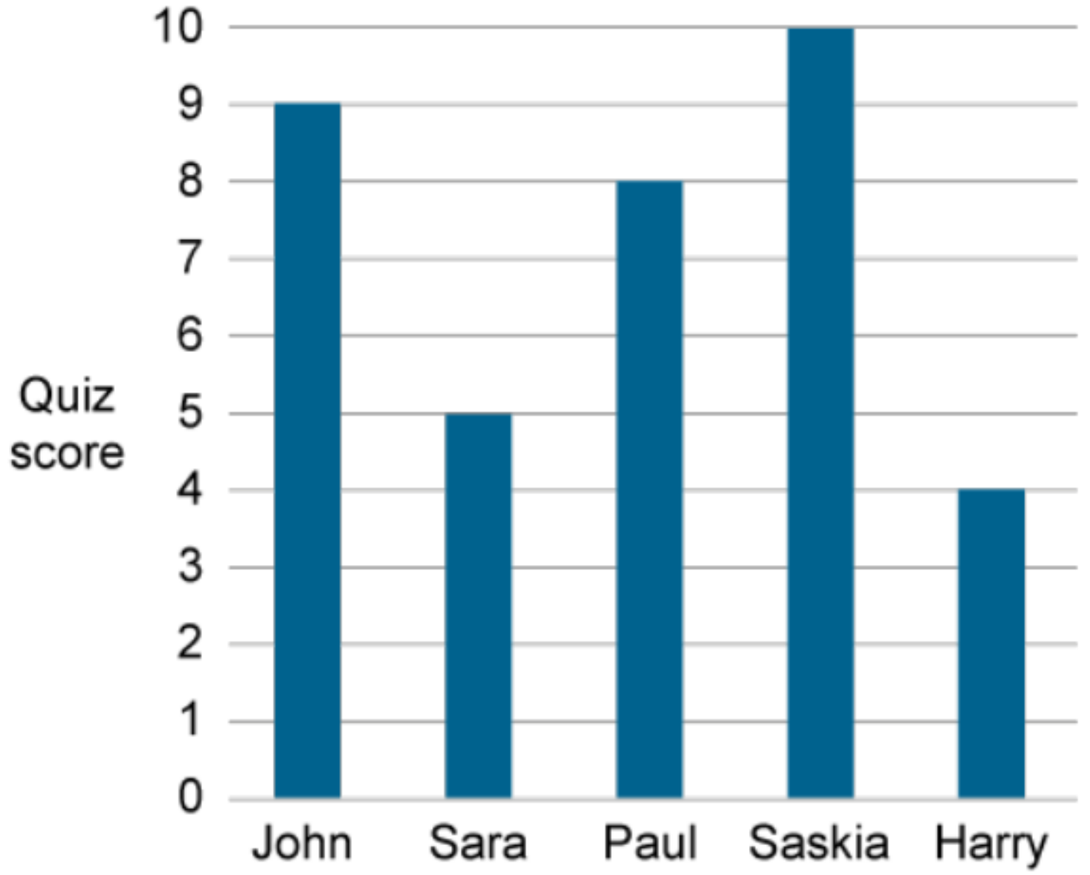


The bar chart shows how many points some pupils scored in a quiz.

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**Which sports were chosen by between 20 and 30 pupils?**

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