Creating Reasoning Routines, Building Problem-Solvers

Session 1

Whole Class Routines

Deconstructing Word Questions

www.iseemaths.com

Y3 & Y4

Content Knowledge

Recall times tables

Place value:

32 = 30 + 2

32 = 20 + 12

Convert the denominators to add fractions

1kg = 1000g

Area = length × width

Learning Dispositions

Derive facts

See connections between real life and mathematics

Follow other perspectives

Persevere through challenge

Explain/demonstrate understanding

Create own examples

Routines Within Interactive Teaching

Raising the internal narrative:

- Gap between question and response/discussion
- Silence in modelling

I already…

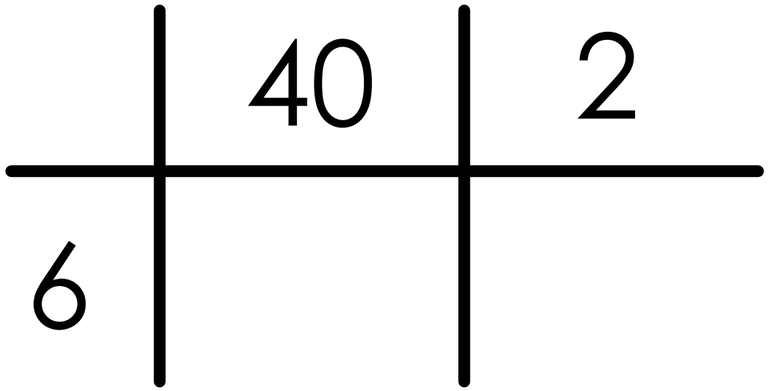
I will try…

A context for…

A sceptic would say…

42×6

42×6



42×6

	40	2
6	240	12

42×6

	40	2
6	240	12

$$
\begin{array}{r}
240 \\
+\ 12 \\
\hline
6 \\
\hline
\\
\hline
\end{array}
$$

Which Answer?

Write the number four hundred and two

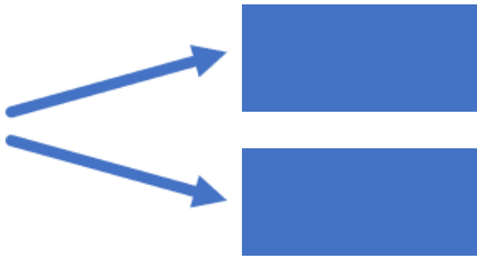
Tim: 4002

Harry: 402

Explain the mistake

Which Answer?

Three hundred and two



605

Which Answer?

Three hundred and two

- **302**
- **3 002**

605

Which Answer?

Three hundred and two

- **302**
- **3 002**

605

- **Sixty-five**
- **Six hundred and five**

There are 8 girls at the party. There are 3 times as many boys as girls at the party. **How many children at the party?**

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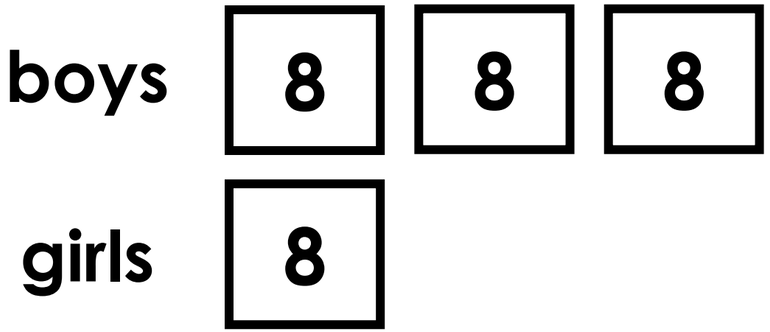
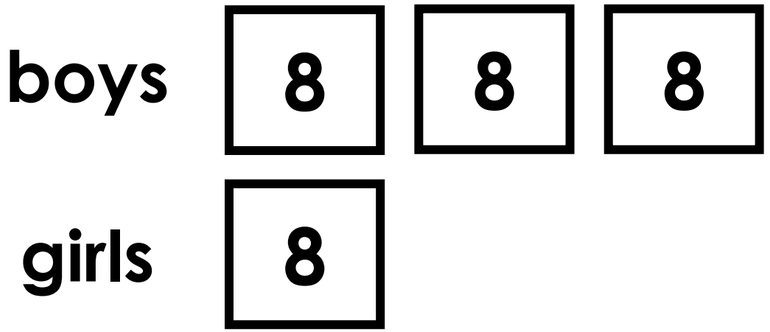


There are 8 girls at the party. There are 3 times as many boys as girls at the party. **How many children at the party?**

Answer: 24



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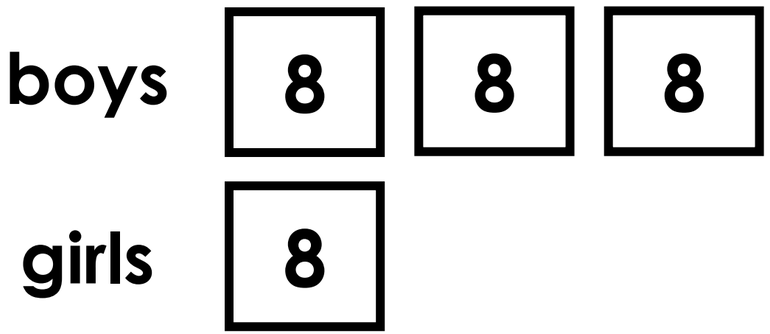

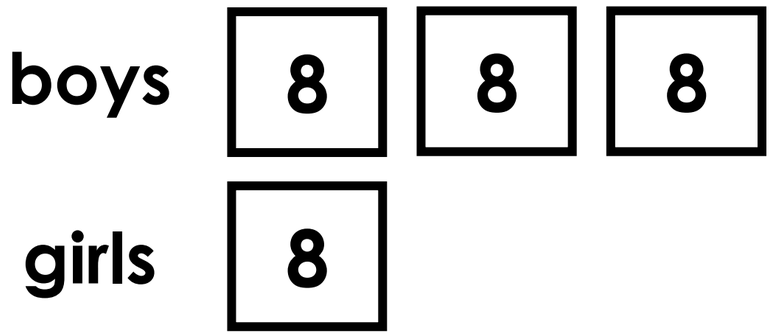

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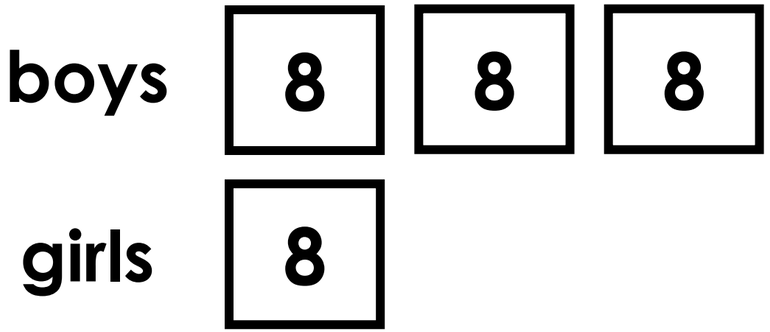
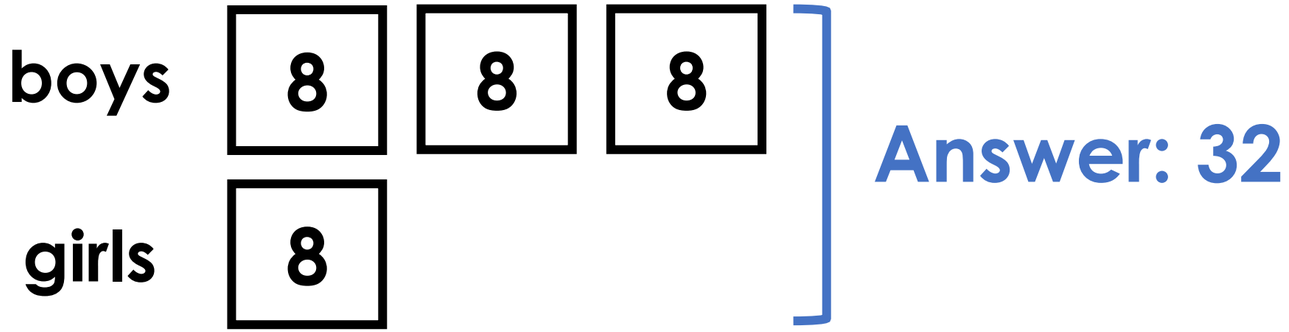




Answer: 32

Jen collected 5 shells.

Jen collected 3 shells fewer than Zara.

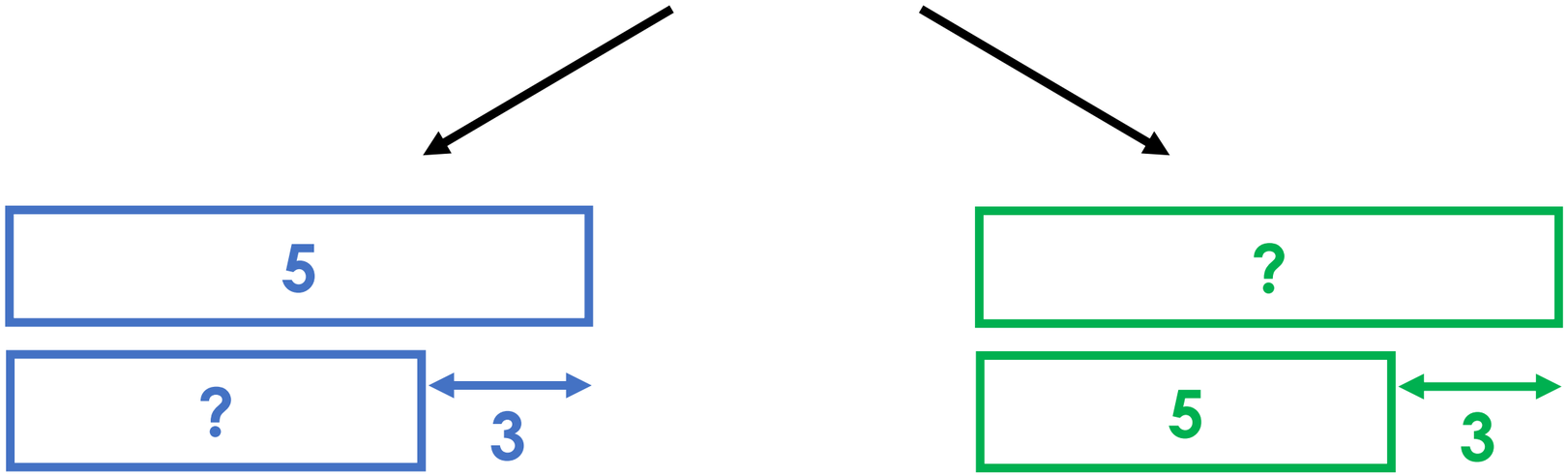
How many shells did Zara collect?

Jen collected 5 shells.

Jen collected 3 shells fewer than Zara.

How many shells did Zara collect?

Which bar model represents the question?



Routines Within Interactive Teaching

Raising the internal narrative:

- Gap between question and response/discussion
- Silence in modelling

Mass participation:

- Form of answer before question
- Explicit and shared routines
- Depth

I already…

I will try…

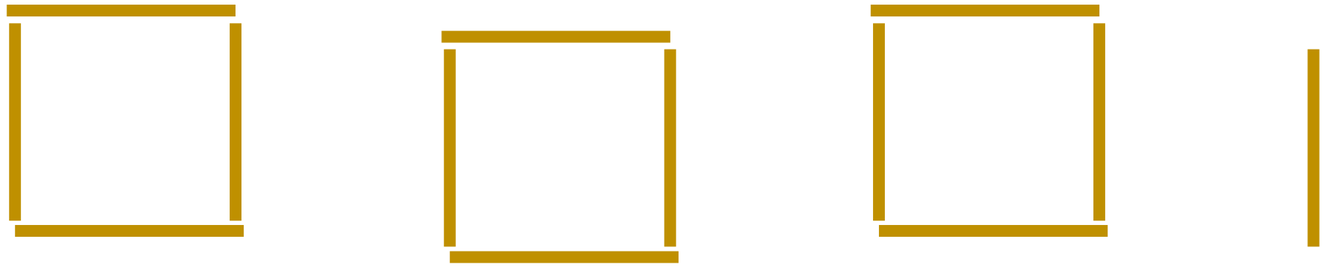
A context for…

A sceptic would say…

13 ÷ 4 =

13 ÷ 4 = 3 r 1

13 ÷ 4 = 3 r 1

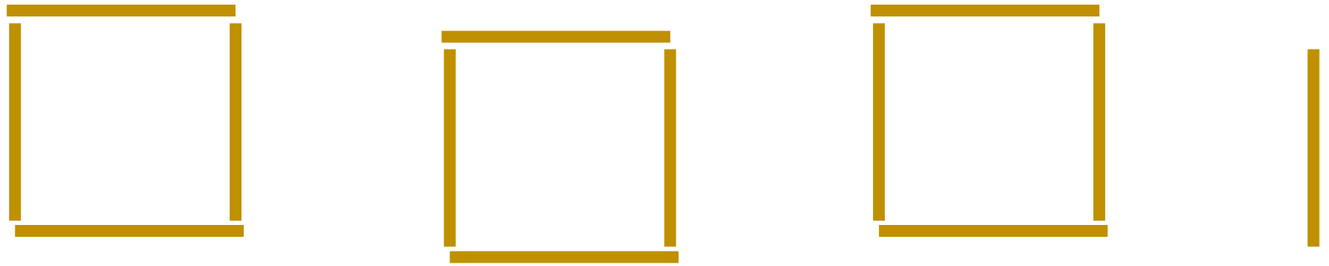


15 ÷ 4 =

13 ÷ 4 = 3 r 1

15 ÷ 4 = 3 r 3

13 ÷ 4 = 3 r 1



15 ÷ 4 = 3 r 3

16 ÷ 4 =

13 ÷ 4 = 3 r 1

15 ÷ 4 = 3 r 3

16 ÷ 4 ≠ 3 r 4

13 ÷ 4 = 3 r 1

15 ÷ 4 = 3 r 3

16 ÷ 4 = 4

13 ÷ 4 = 3 r 1

_____ ÷ ___ = 4 r 3

Rank by Difficulty

62 + 27 =

26 + 27 =

Rank by Difficulty

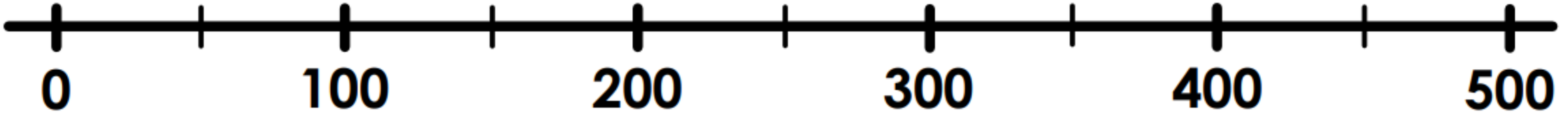
42 ÷ 3 =

27 ÷ 3 =

16 ÷ 3 =

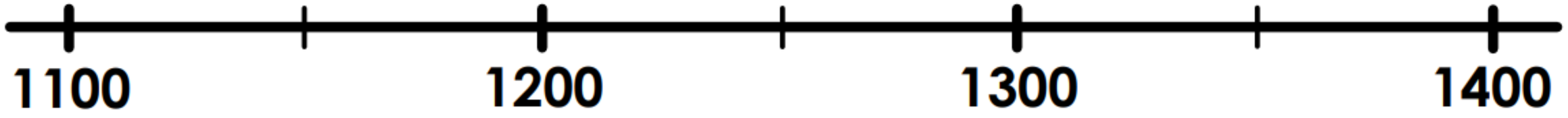
Read the Pictures

Position **205, 253, 46, 382 and 61** on the number line:



For each number, ***which is the nearest 100?***

What is **1238** rounded to the **nearest 100?**



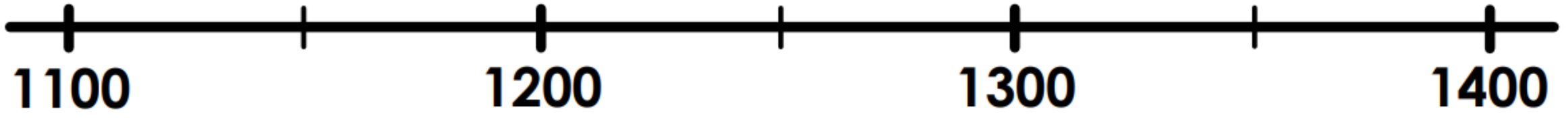
Explain the Mistakes

What is **1238** rounded to the **nearest 100?**

200

1240

1300



Which Answer?

What is **950** rounded to the **nearest 100?**

900

1000

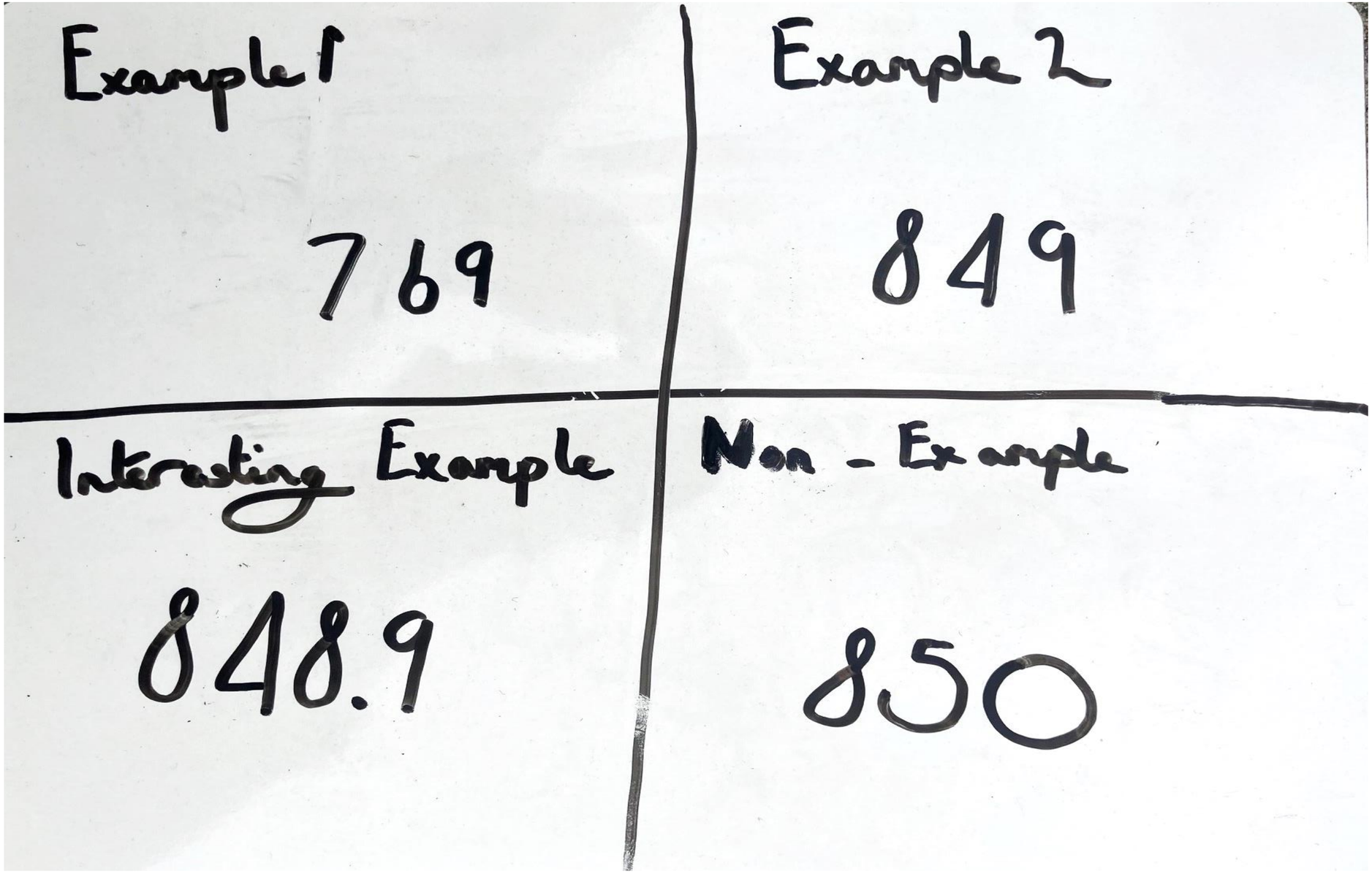
What is **3075** rounded to the **nearest 1000?**

3000

3100

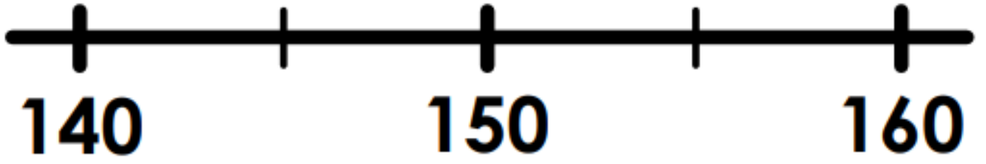
Explain the mistakes.

Which number, when rounded to the nearest 100, is 800?

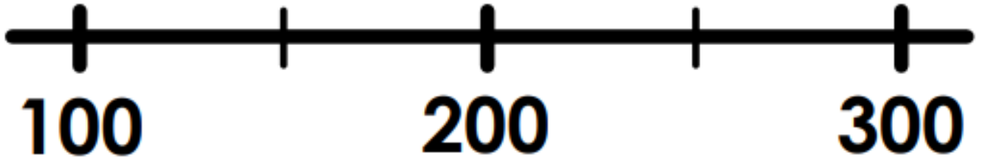


How Many Ways?

Rounded to the nearest 10, my number is 150.



Rounded to the nearest 100, my number is 200.



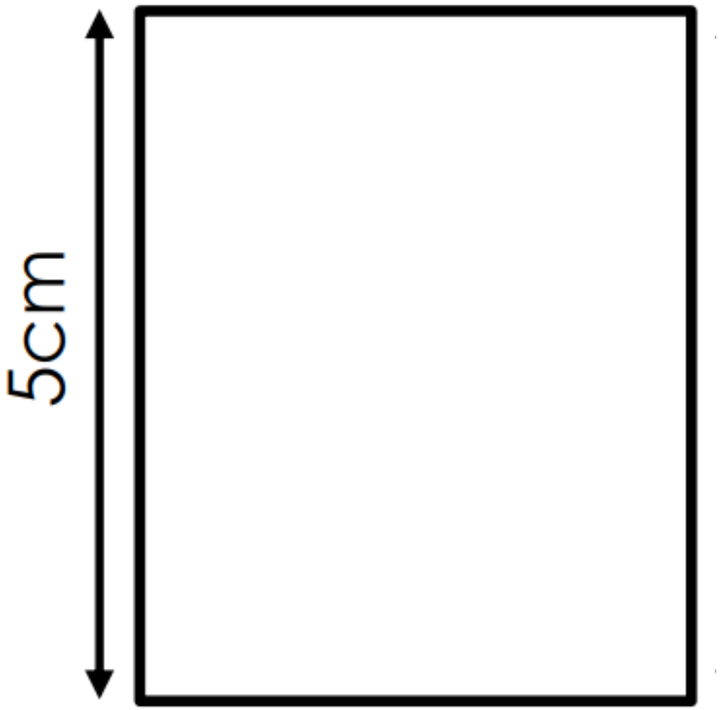
What could my number be?

Level 1: *I can find an answer*

Level 2: *I can find different answers*

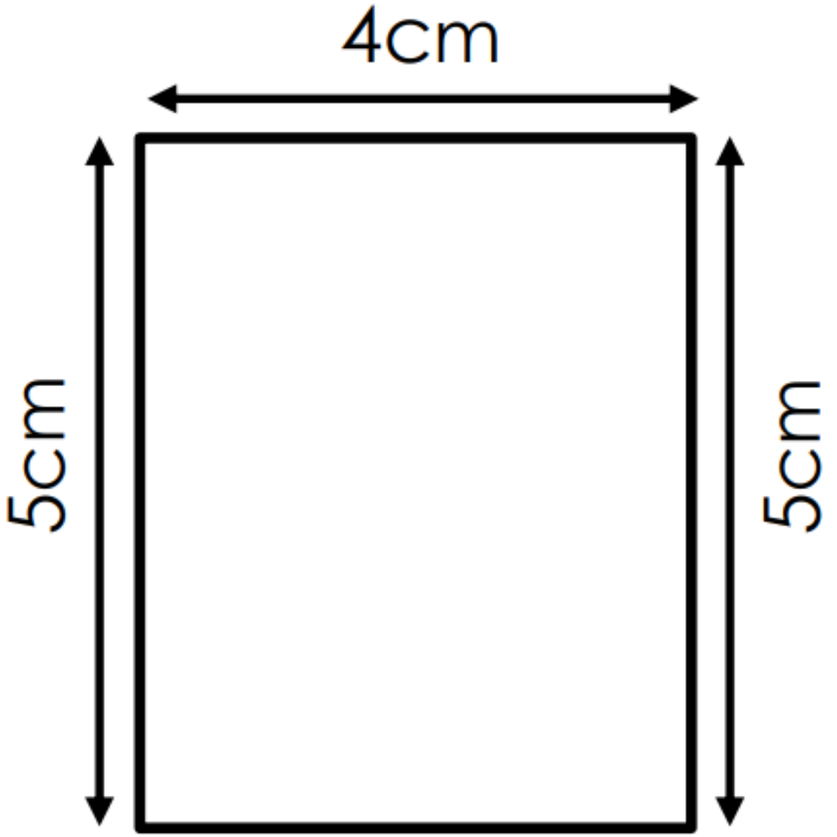
Level 3: *I know how many answers there are*

Estimate the perimeter of the rectangle.



Which Answer?

What is the perimeter of the rectangle?



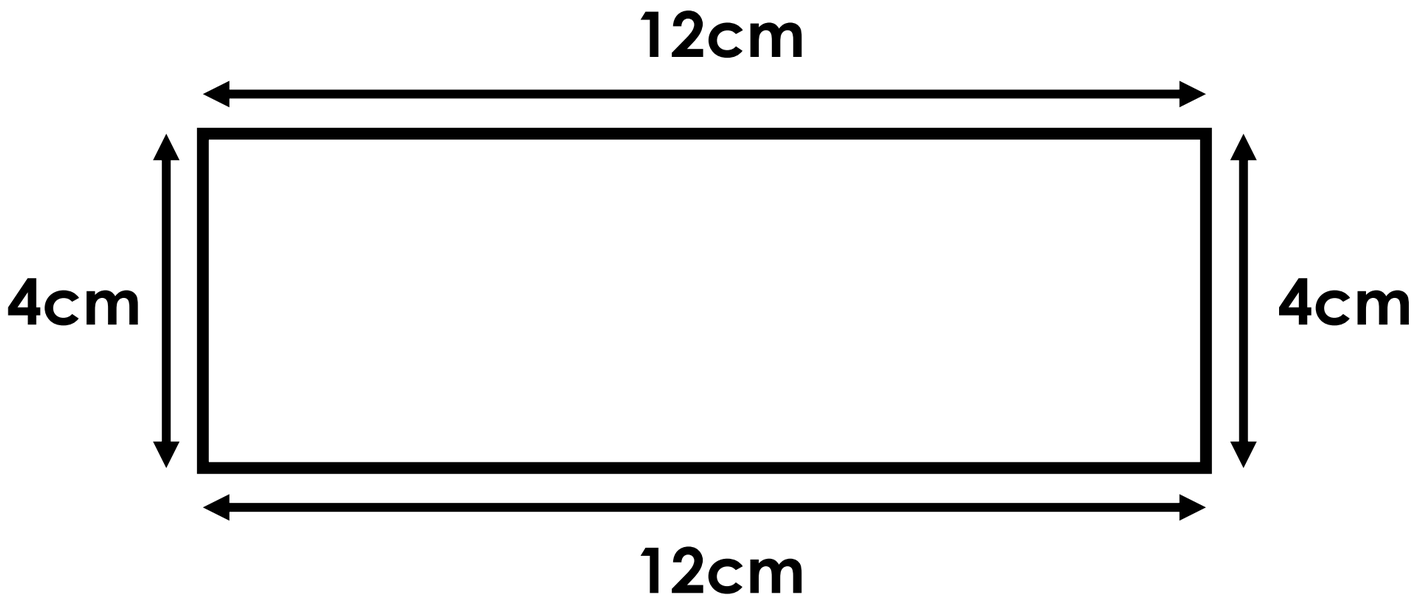
14cm

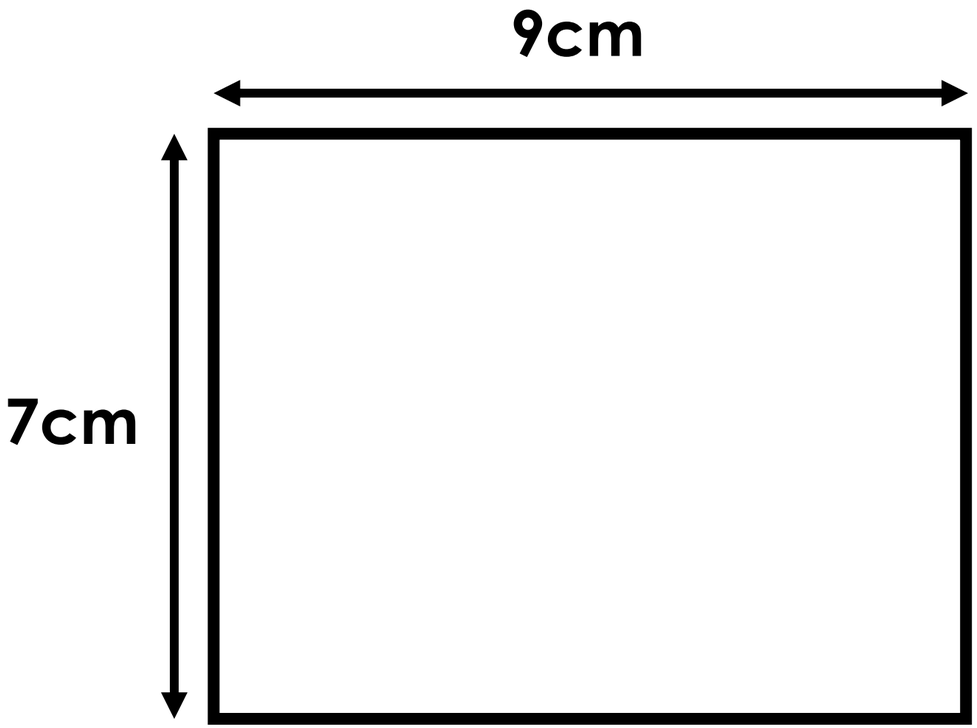
There is not enough information to work out the perimeter

18cm

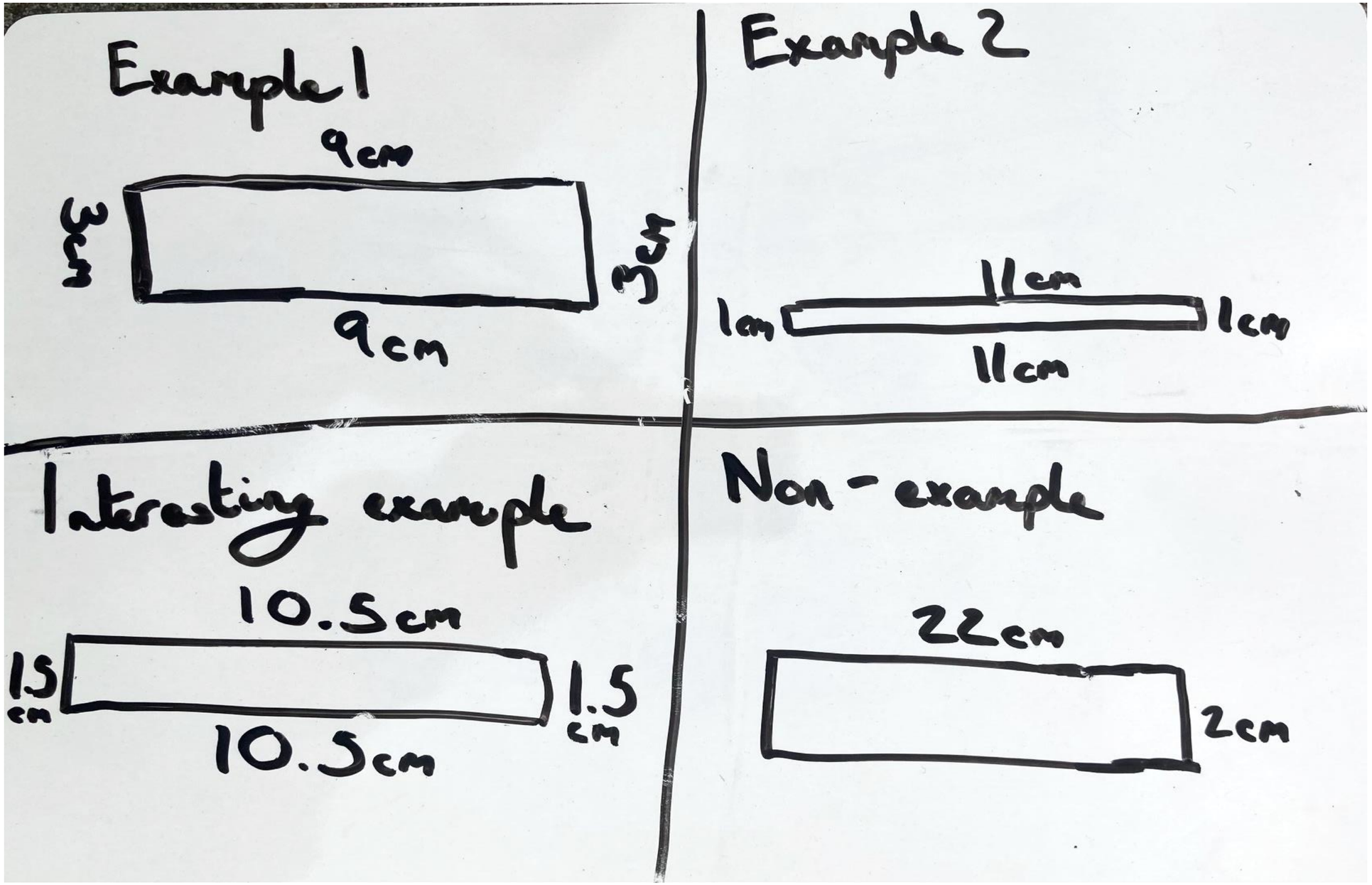
20cm

Explain the mistakes.


12cm
4cm
4cm
12cm


9cm
7cm

A rectangle with a perimeter of 24cm.



Routines Within Interactive Teaching

Raising the internal narrative:

- Gap between question and response/discussion
- Silence in modelling

Mass participation:

- Form of answer before question
- Explicit and shared routines
- Depth

Managing discussions:

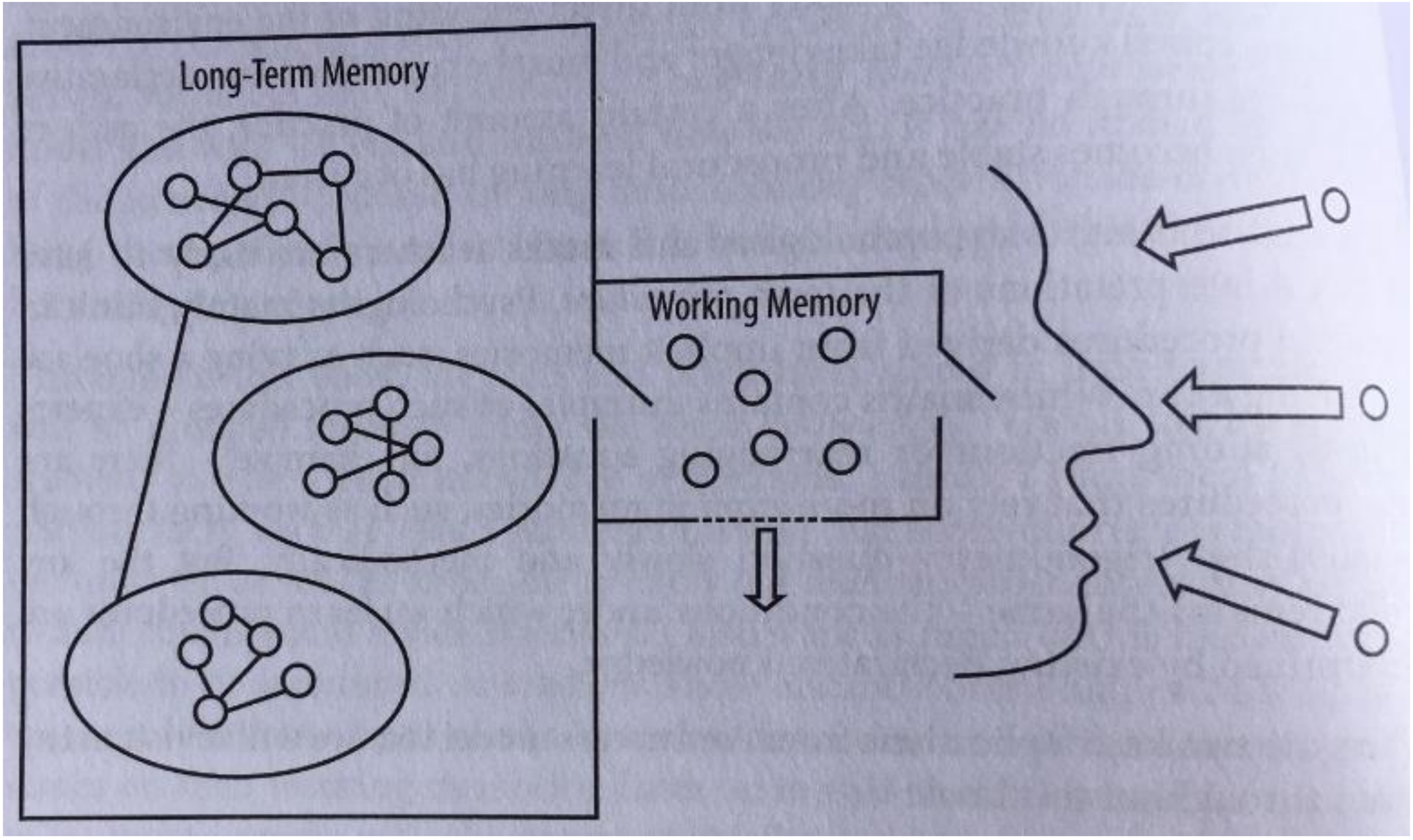
- Selecting and priming responses
- Wait time 2, following perspectives
- ‘Say it again, better’

I already…

I will try…

A context for…

A sceptic would say…


Long-Term Memory
Working Memory

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.

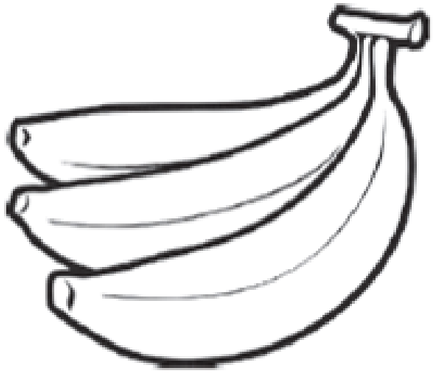
Removing Opportunities to Calculate Improves Students' Performance on Subsequent Word Problems. *Givvin and Stigler (2019)*

A group of tourists planned a 3-day walking trip from Big Rock to Eagles Landing, a total of 66 km. On the first day they walked 22 km. On the second day they walked 20 km.
How far would they have to walk on the third day of their trip?

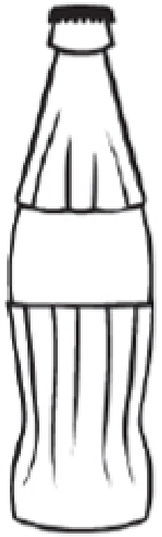
A group of tourists planned a 3-day walking trip from Big Rock to Eagles Landing. On the first day they walked one third of the total distance. On the second day they walked a little less.
How far would they have to walk on the third day of their trip?

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

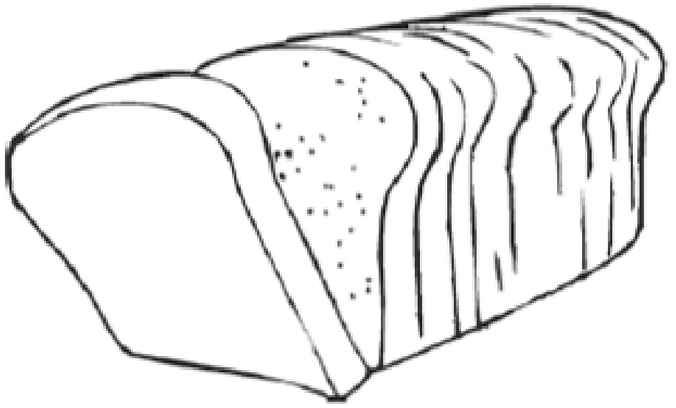
Here is the cost of some items in a shop.



Banana 20p



Drink 50p



Bread 40p

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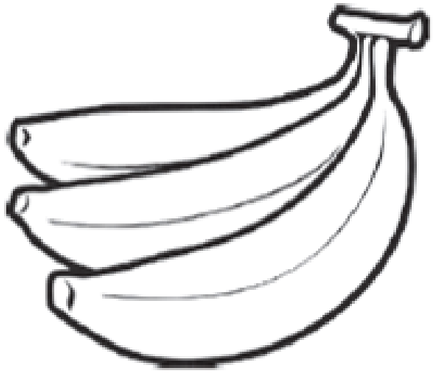
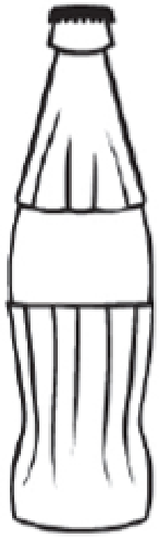


Banana 20p



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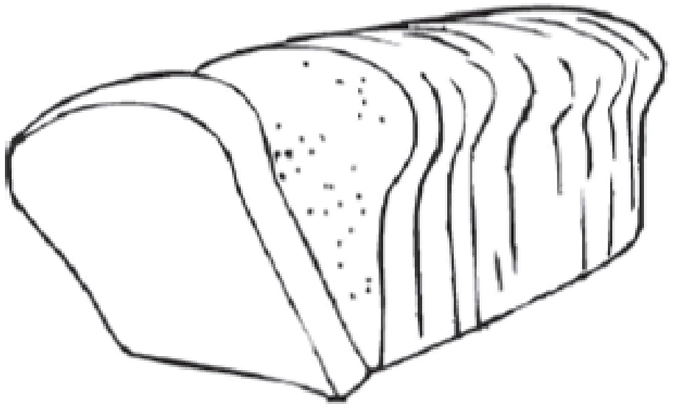
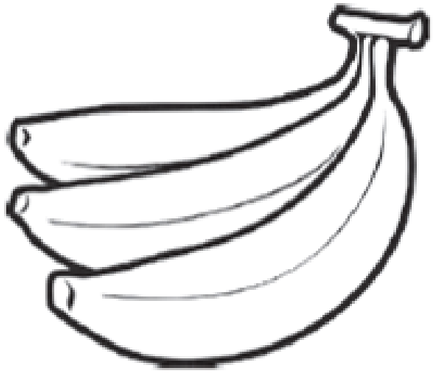


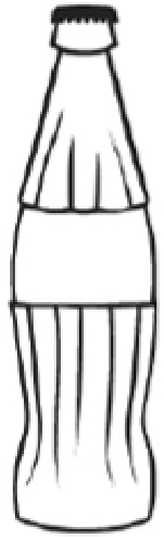
Bread 40p

How many bananas can he buy?

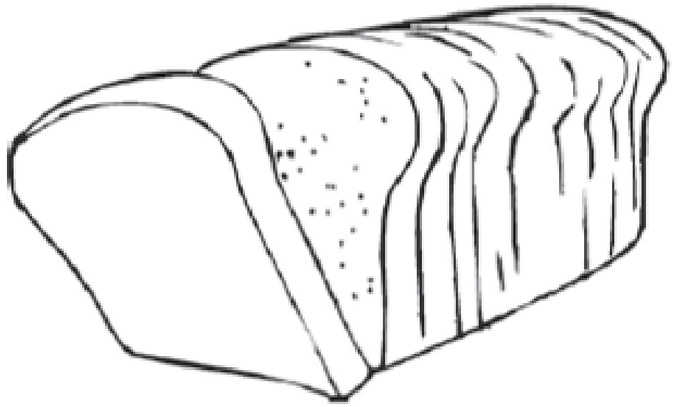
Here is the cost of some items in a shop.



Banana 20p



Drink 50p



Bread 40p

Sam has £1.

How many bananas can he buy?

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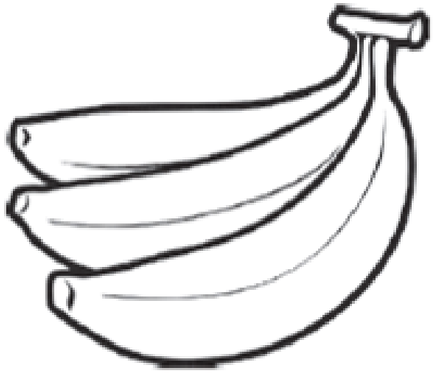
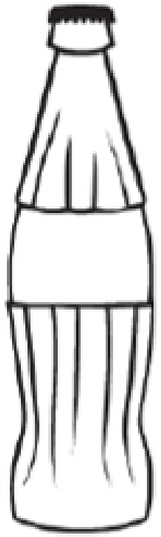


Banana 20p



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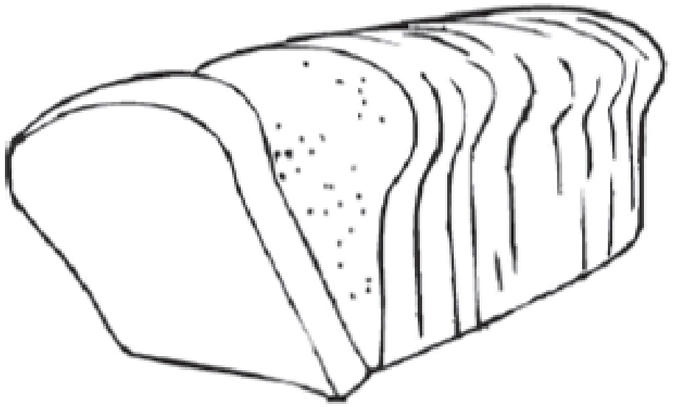
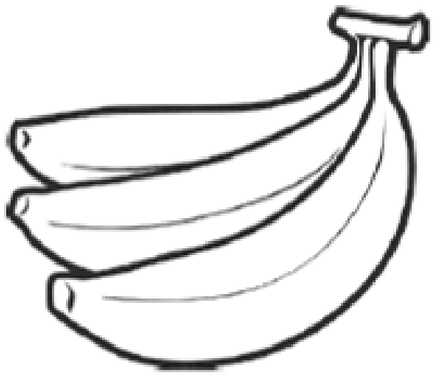


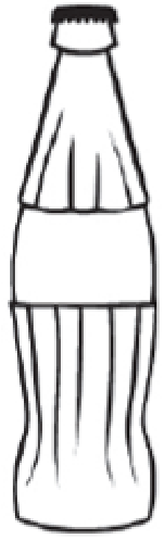
Bread 40p

How much change does she get?

Here is the cost of some items in a shop.



Banana 20p



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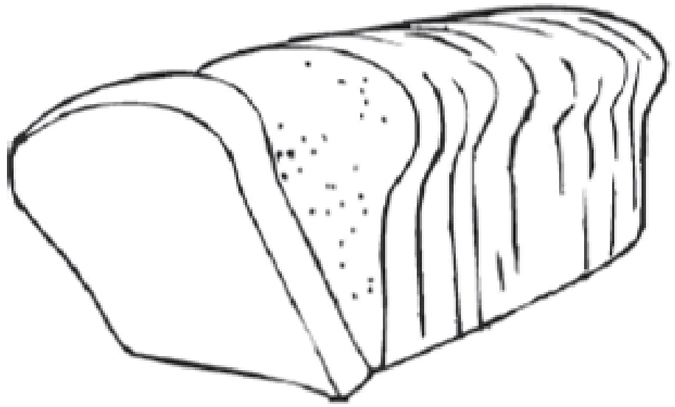

Bread 40p

Jen buys a loaf of bread and two drinks.

How much change does she get?

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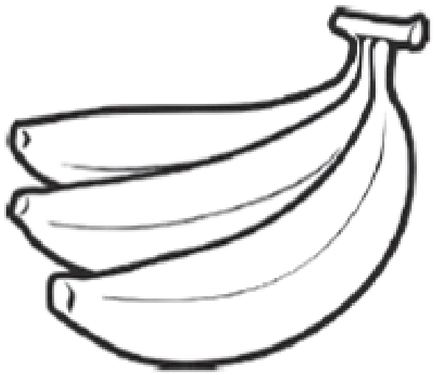

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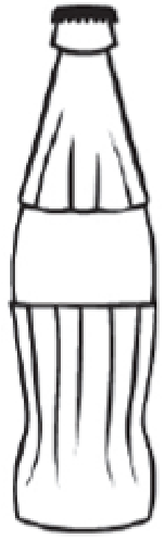
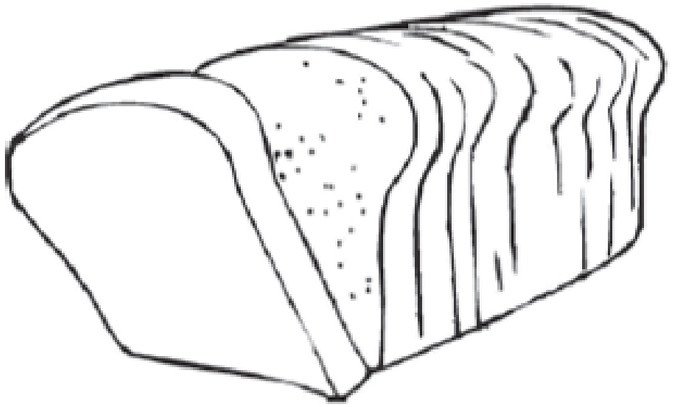


Drink 50p



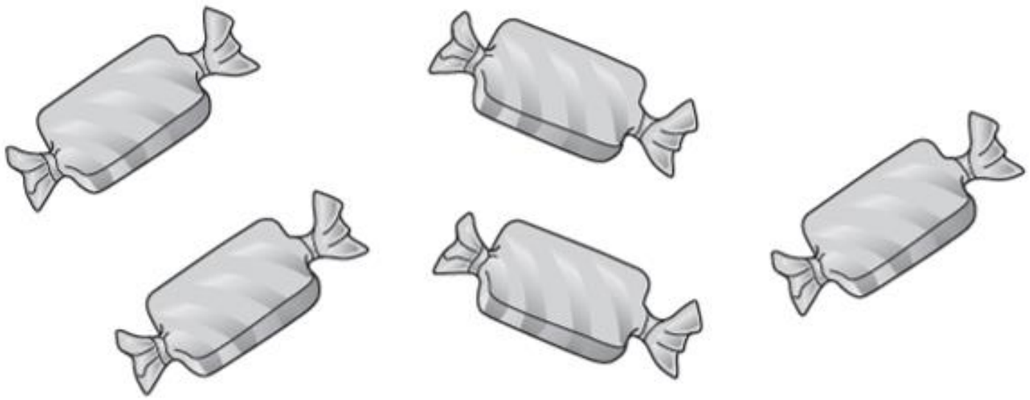
Bread 40p

Jen buys a loaf of bread and two drinks.

She pays with a £2 coin.

How much change does she get?

Bilal spends **25p** on these sweets:



Each sweet costs the same amount.

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

Jen had 10 sweets.

Zara had 4 more sweets than Jen.

How many sweets do they have altogether?

Jen has 10 sweets.

How many sweets do they have altogether?

Jen has 10 sweets.

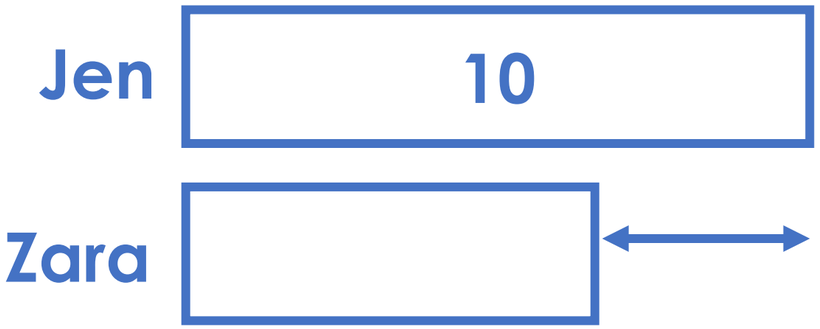
Zara has □ more sweets than Jen.

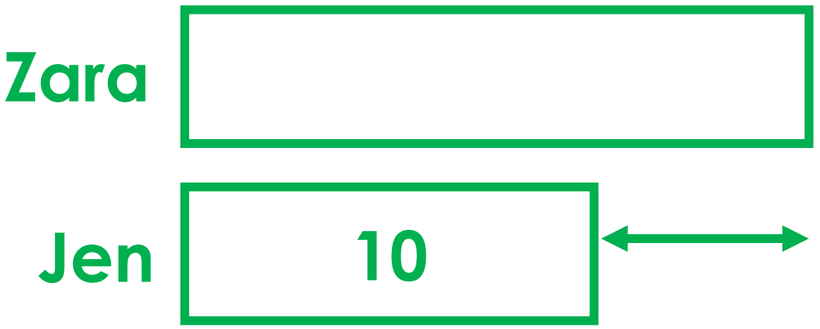
How many sweets do they have altogether?

Jen has 10 sweets.

Zara has □ more sweets than Jen.

How many sweets do they have altogether?

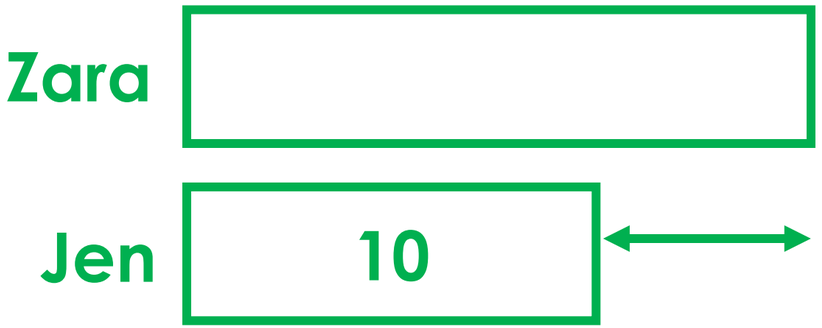




Jen has 10 sweets.

Zara has □ more sweets than Jen.

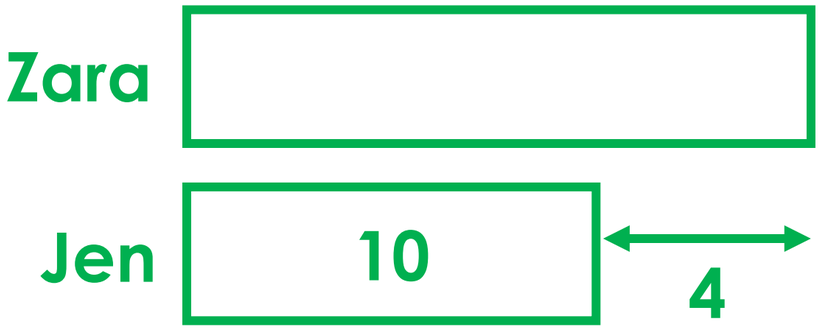
How many sweets do they have altogether?



Jen has 10 sweets.

Zara has 4 more sweets than Jen.

How many sweets do they have altogether?



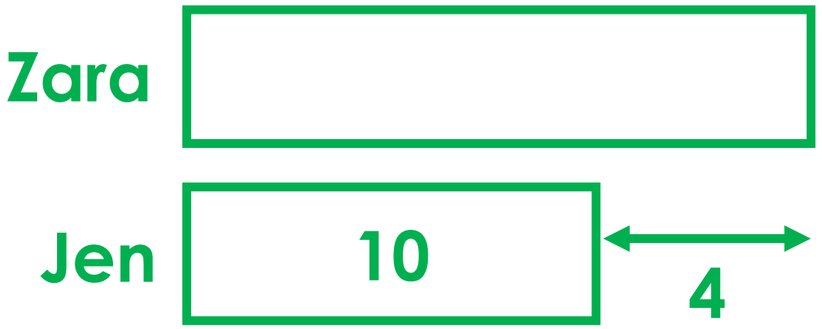
Jen has 10 sweets.

Zara has 4 more sweets than Jen.

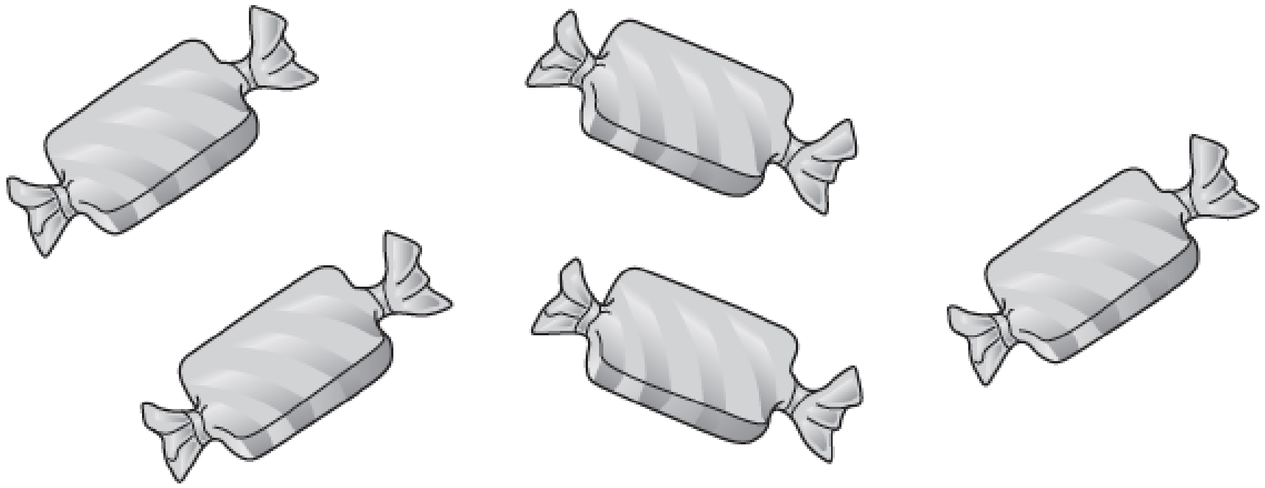
How many sweets do they have altogether?

Explain the mistake:

10 + 4 = 14 sweets

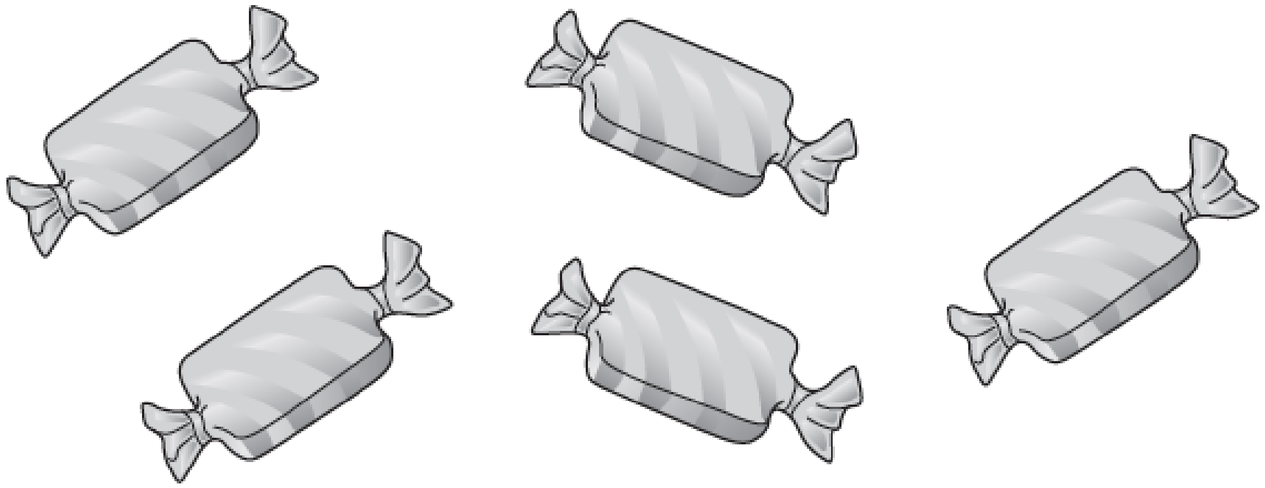


Bilal spends ☐ on these sweets:



Each sweet costs the same amount.

Bilal spends **25p** on these sweets:



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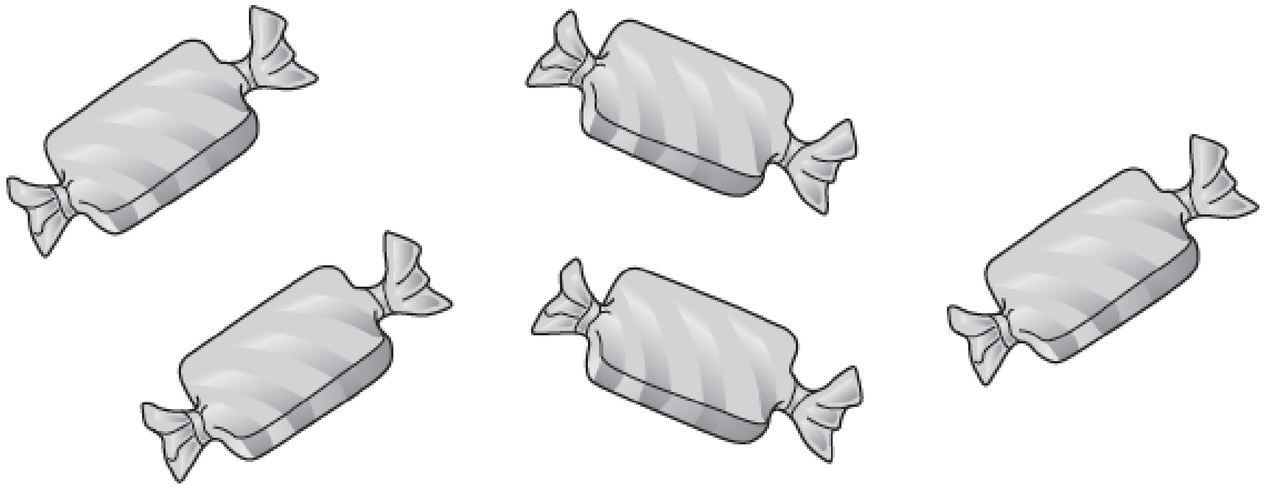
Bilal spends **25p** on these sweets:



Each sweet costs the same amount.

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

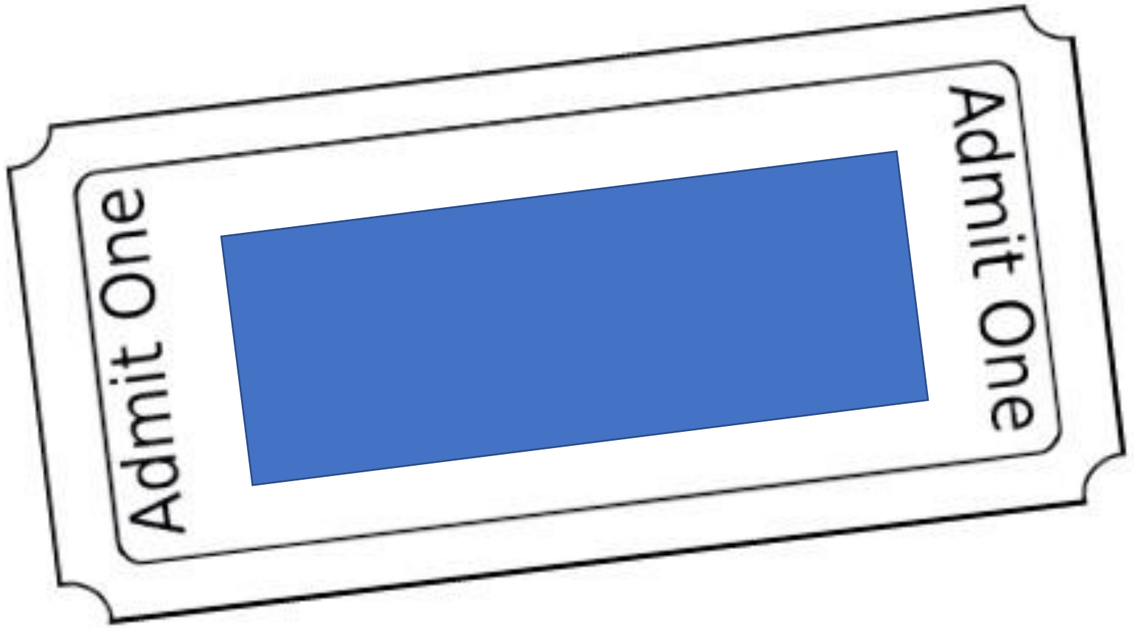
Tony and his 5 friends buy tickets for a musical.

They each pay £17.50

How much do they pay altogether?

Tony and his [redacted] friends buy tickets for a musical.

They each pay [redacted]



How much do they pay altogether?

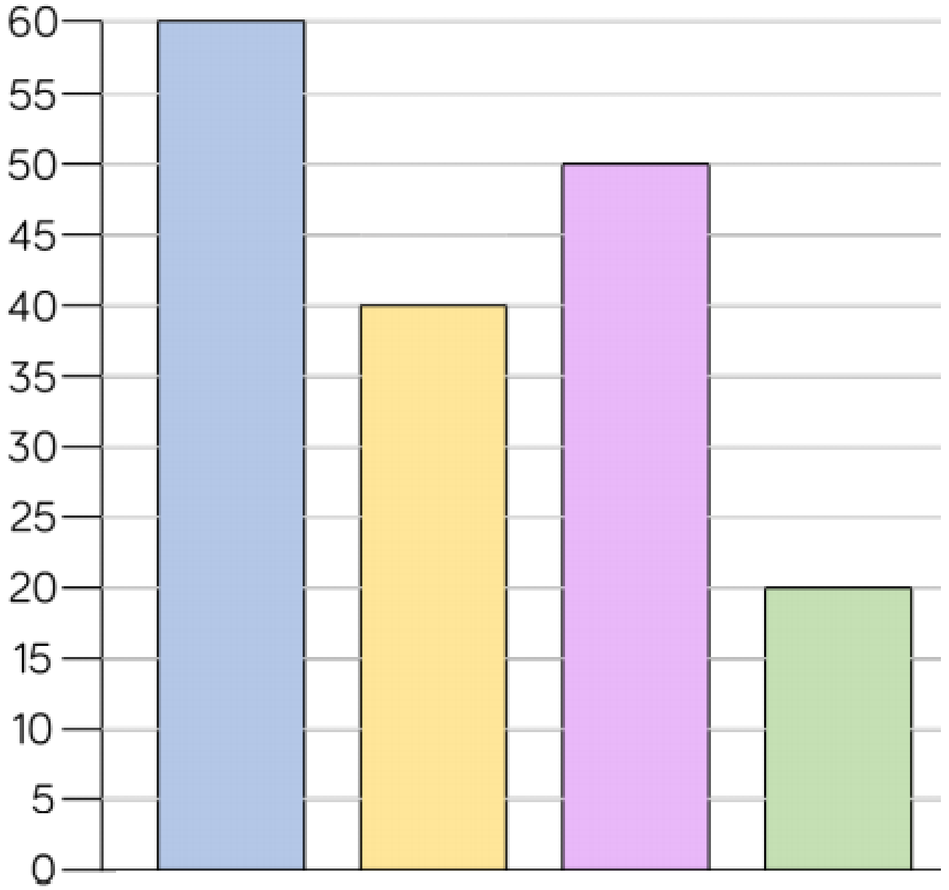
Tony and his **3** friends buy tickets for a musical.

They each pay **£20**

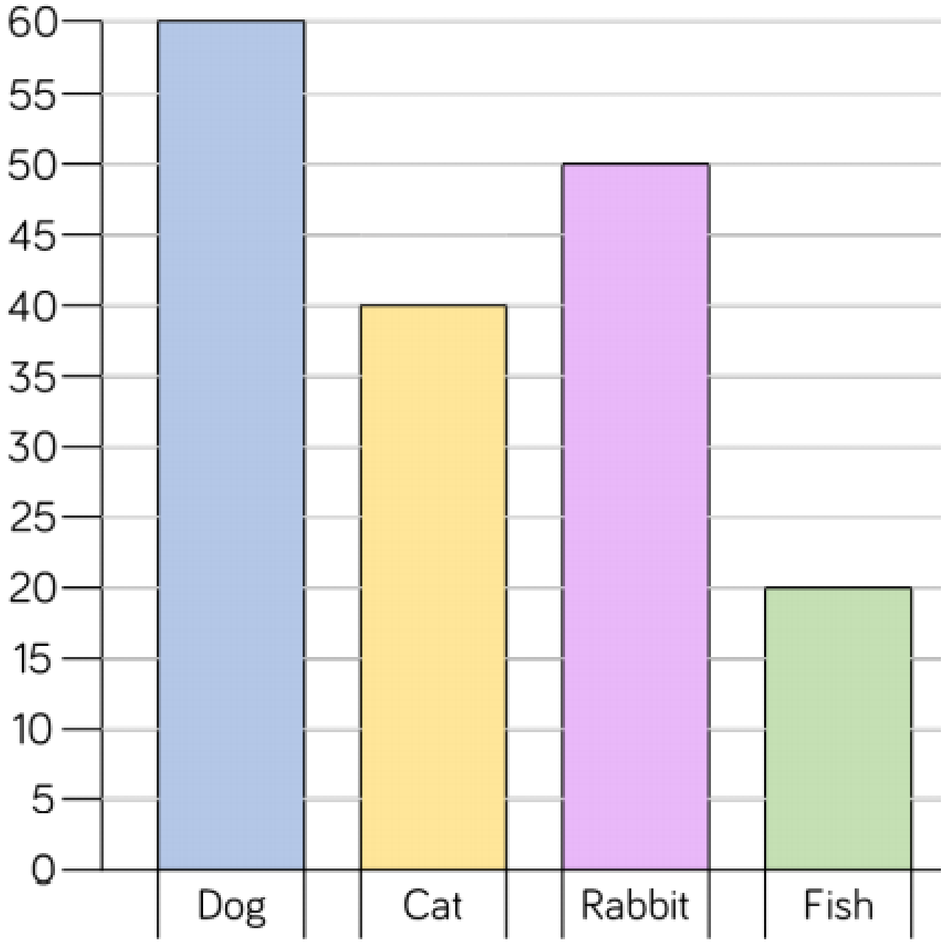
£60

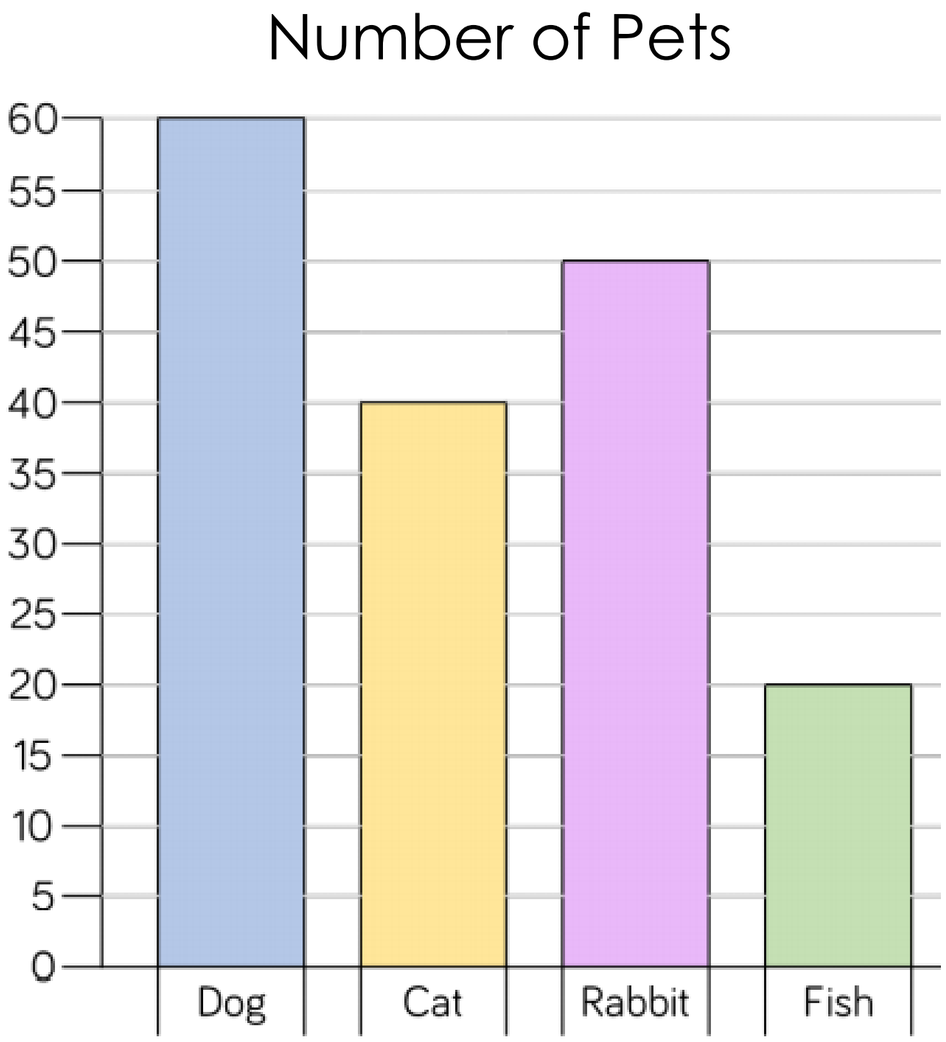
£80

How much do they pay altogether?

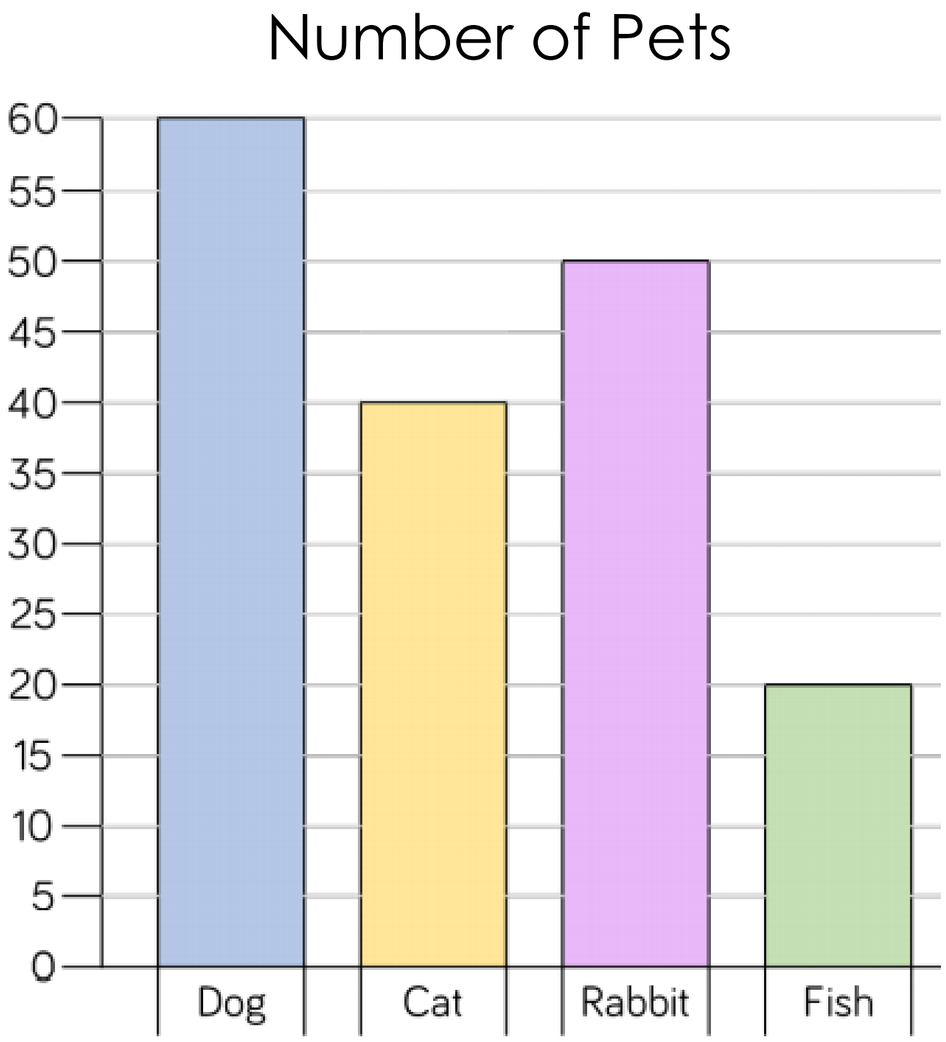

60
55
50
45
40
35
30
25
20
15
10
5
0

Number of Pets





True or False?



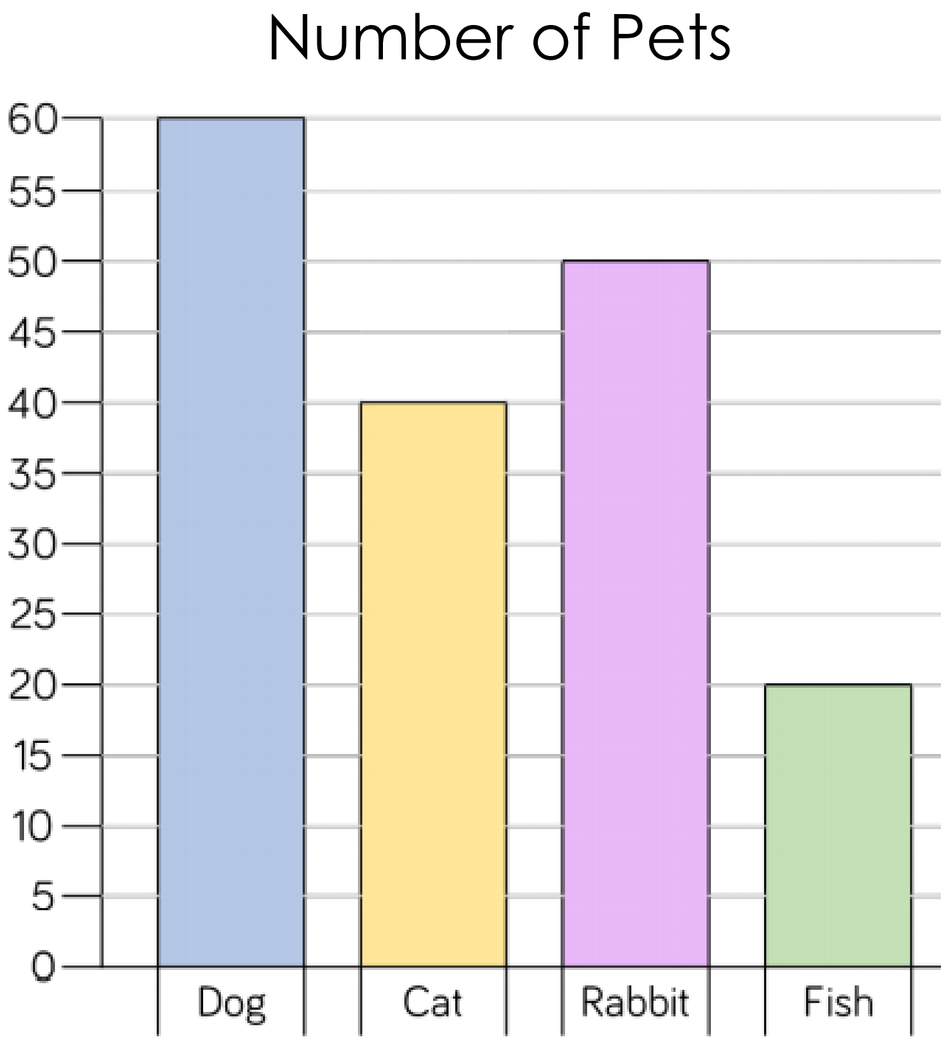
True or False?

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.

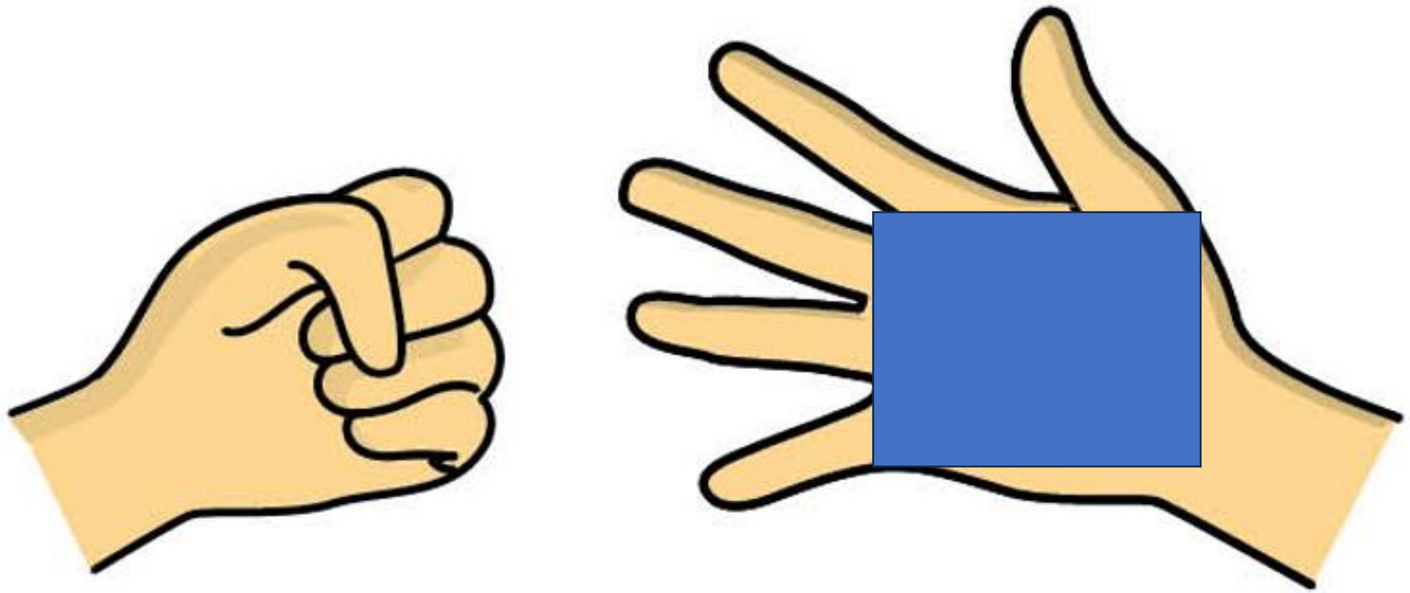
Most of the pets are dogs.

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

Whitney has £30 pocket money.

She buys some of these books and gets £6 change.

How many books does she buy?

A bag costs £11 and a mug costs £7

Annie spends £80 in total on bags and mugs.

She buys 6 bags.

How many mugs does she buy?

A sticker book can fit 6 stickers on each page.

8 out of 20 pages of the book are full.

How many more stickers are needed to complete the sticker book?

A bag costs £11 and a mug costs £7

Annie spends £80 in total on bags and mugs.

She buys 6 bags.

How many mugs does she buy?

Whitney has £30 pocket money.

She buys some of these books and gets £6 change.

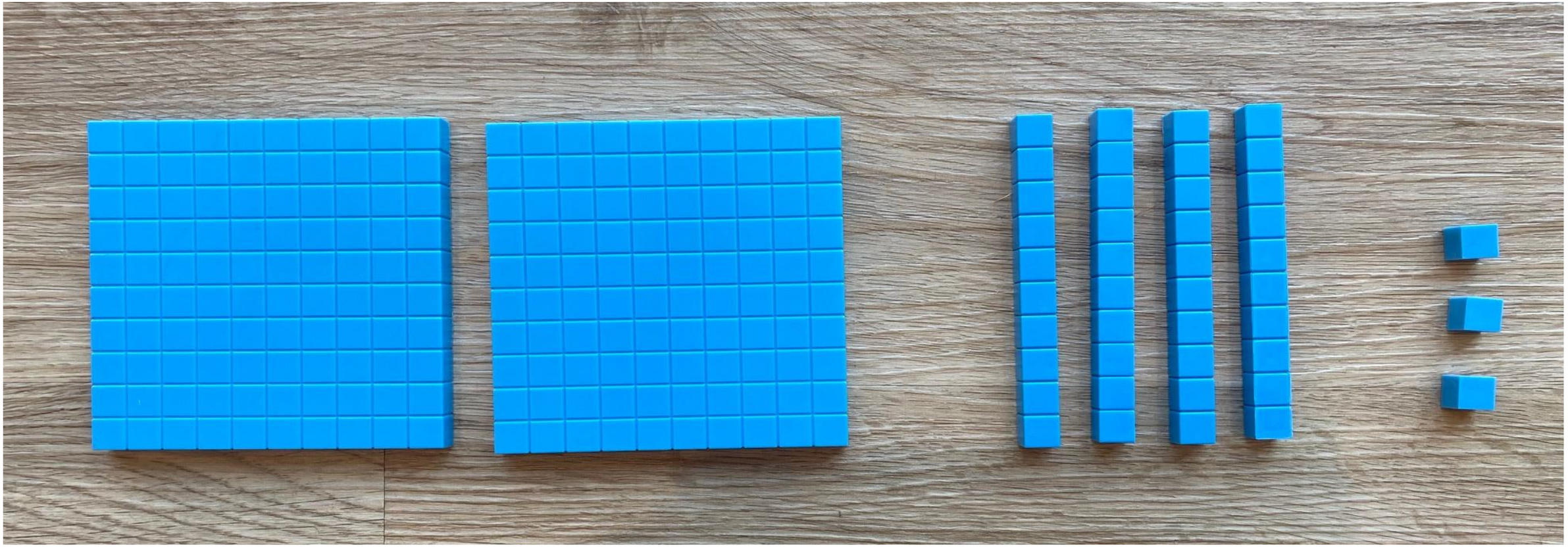
How many books does she buy?

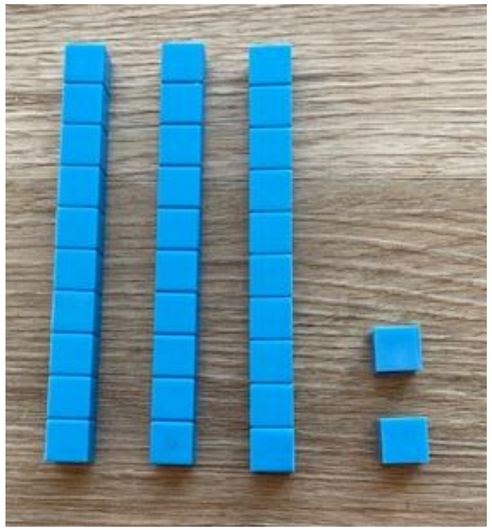
A sticker book can fit 6 stickers on each page.

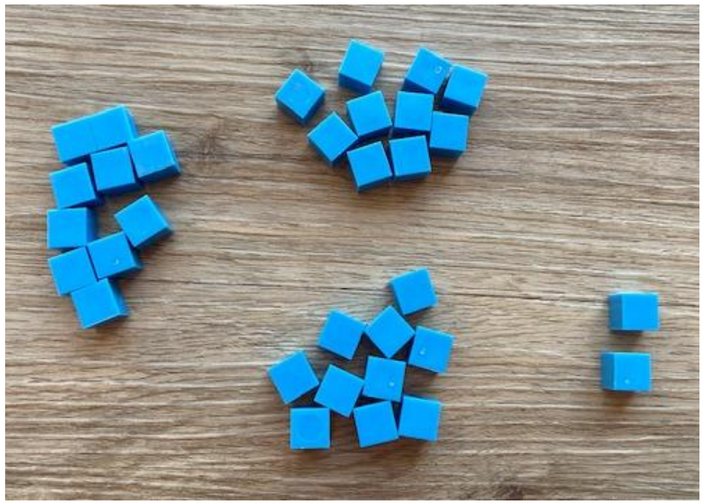
8 out of 20 pages of the book are full.

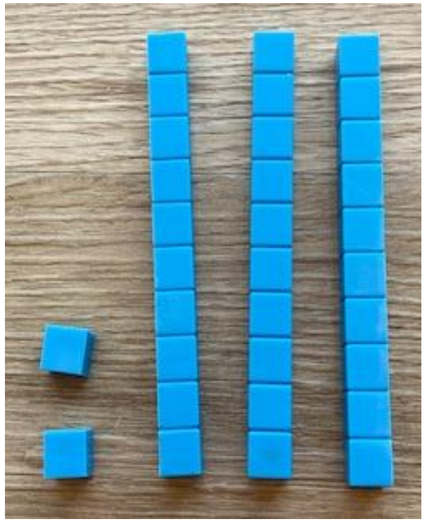
How many more stickers are needed to complete the sticker book?

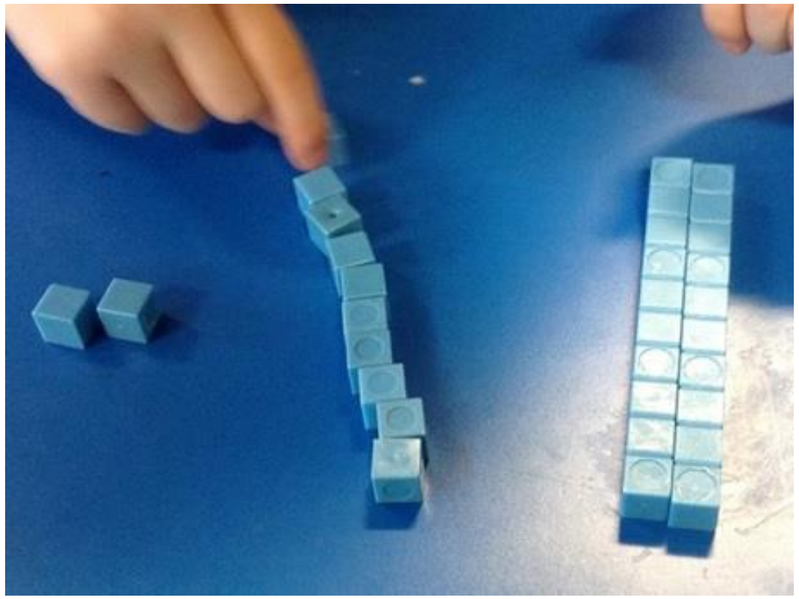
243





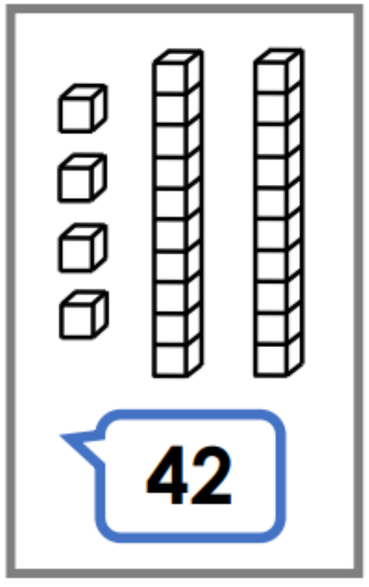


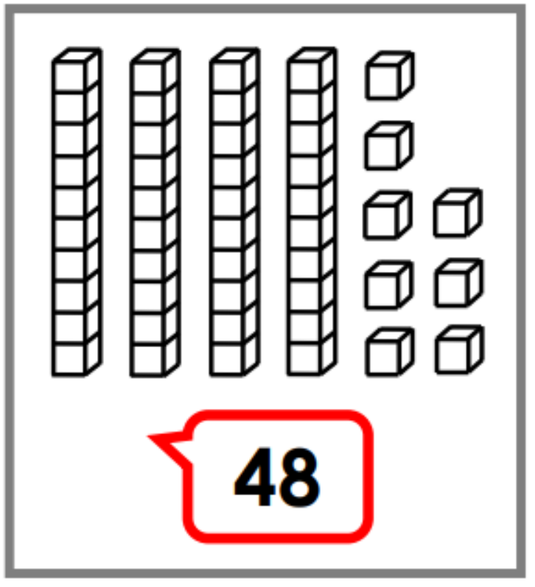


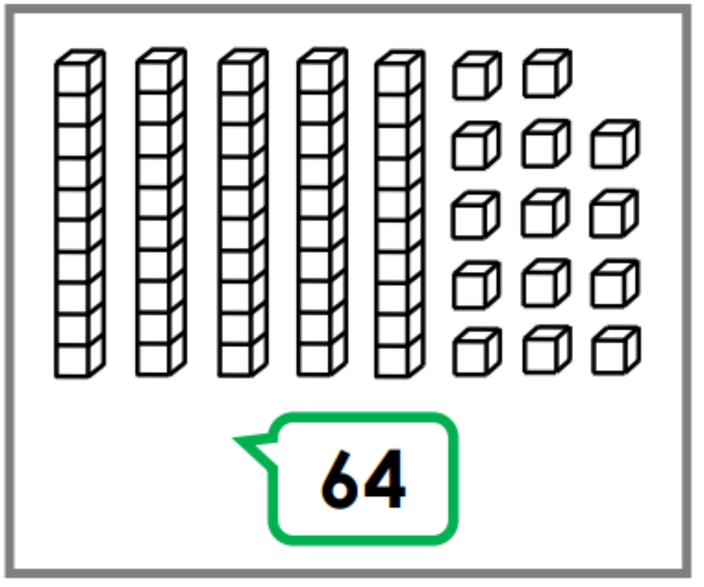


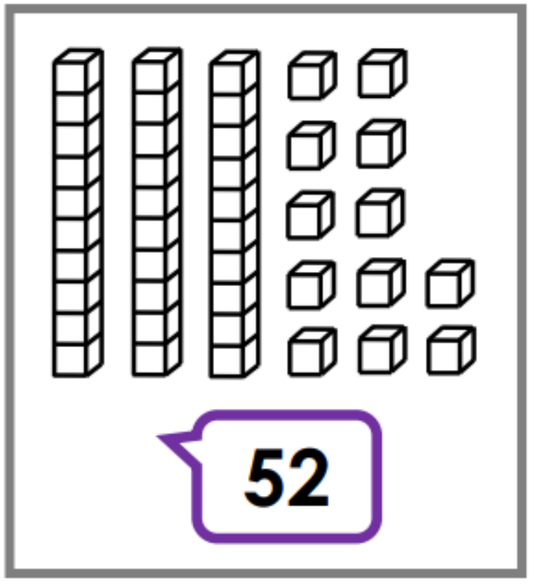
$$\begin{array}{r} {}^{5}\not{6}{}^{1}2 \\ -\ 2\ 7 \\ \hline \\ \hline \end{array}$$

Agree or Disagree? ✓ or ✗









For the incorrect answers, explain the mistakes.

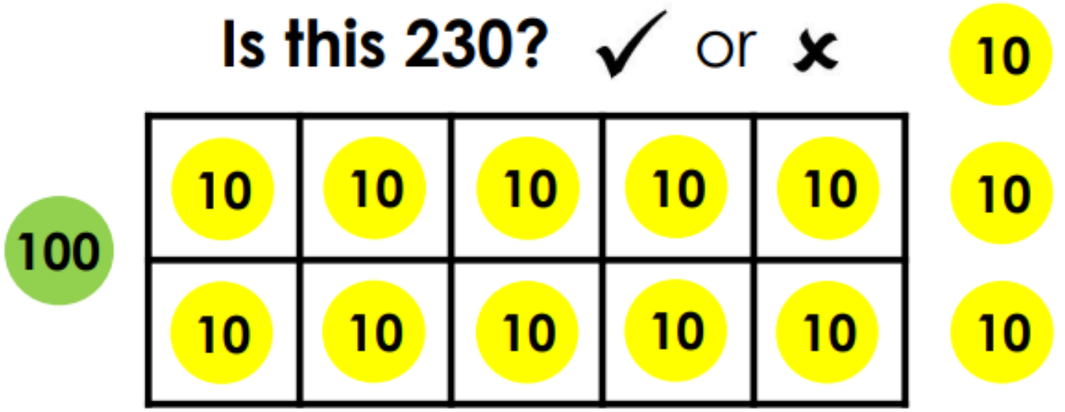
Is this 230? ✓ or ✗

100 100 10 10 10

Is this 203? ✓ or ✗

20 + 3

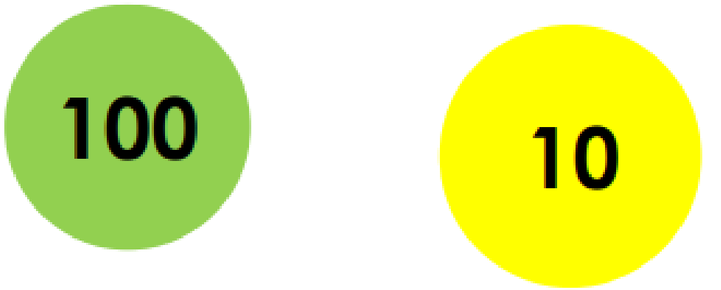
Is this 230? ✓ or ✗



Is this 210? ✓ or ✗

How can 340 be made using 10 and 100 counters?

Level 1: I can find a way
Level 2: I can find different ways
Level 3: I know how many ways there are



460 can be made with ☐ hundreds and **6** tens.

460 can be made with **3** hundreds and ☐ tens.

460 can be made with ☐ tens.

342 can be made with **3** hundreds, **3** tens and ☐ ones.

342 can be made with **2** hundreds, **4** tens and ☐ ones.

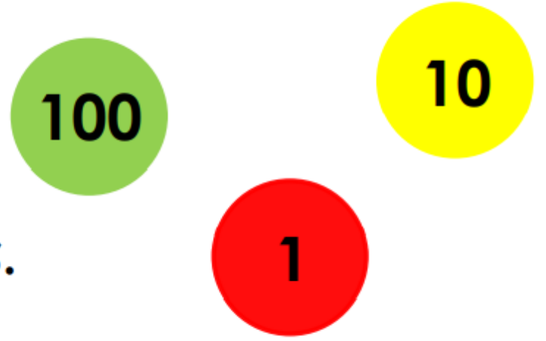
EXTEND

How can 423 be made using 1, 10 and 100 counters?

What are the fewest counters that can be used?

What are the most counters that can be used?

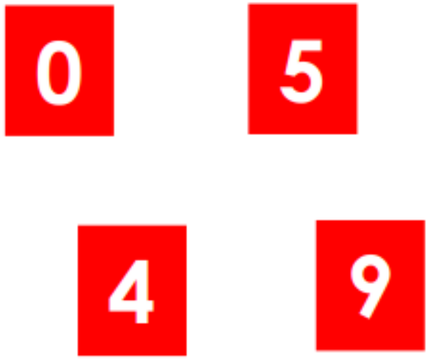
There are two ways to make 423 using 18 counters. Find them.



Explore

Using **three** of the digits **0, 4, 5 and 9** make the number that is **closest to 500.**

Extend: *what is the second closest number to 500 that can be made?*



Using **three** of the digits **0, 5, 6 and 9** make the number that is **closest to 600.**

Extend: *what is the second closest number to 600 that can be made?*