

Introduction to Bar Models

Lesson 2: Subtraction of Whole Numbers

Australian Curriculum: Mathematics (Year 5)

ACMNA291: Use efficient mental and written strategies and apply appropriate digital technologies to solve problems (Year 5).

Lesson abstract

In this lesson, part-whole bar models are used to represent subtraction problems involving whole numbers. Students study various different subtraction situations (e.g. ‘take away’, compare) through five examples. Students then practice with further problems to consolidate this learning.

Mathematical purpose (for students)

Bar models can help us to understand word problems involving subtraction.

Mathematical purpose (for teachers)

This lesson introduces students to the use of the part-whole bar model to solve word problems involving subtraction of whole numbers. The examples provided use simple numbers to show how to construct and use a part-whole model for subtraction. They involve several variations of the situation e.g. where the resulting amount is unknown and where the change is unknown. Several examples demonstrate how bar models need to be used flexibly, for example by placing the constituent bars in a convenient order. The tasks that students complete for consolidation involve larger numbers and more complex relationships.

Two subtraction situations are illustrated through the five examples and the consolidation tasks:

a. Static part-whole situation (Example 1 & 2) - a quantity is made from constituent quantities.

b. Dynamic part-whole situation:

Example 3: One part is ‘taken away’ from the whole - to find the part that remains.

Example 4: One part is ‘taken away’ from the whole - find the part that is taken away.

Example 5: One part is added to another part to form a whole - find the part that is “added”.

Lesson Length 60 minutes approximately

Vocabulary Encountered

- part-whole model
- bar model

Lesson Materials

- Slide show *ST4_BarModelIntro_2a_Subtract.pptx*
- [Student Sheet 1 - Bar Model Examples 2A](#) (1 per student)
- [Student Sheet 2 - Bar Model Examples 2B](#) (1 per student)
- Calculators (optional)

We value your feedback after these lessons via <https://www.surveymonkey.com/r/G6VGPZ8>



Bar Models For Subtraction

This section of the lesson uses the part-whole model to solve word problems involving subtraction of whole numbers. Emphasis is placed on how the part-whole model can be used to help students visualise the relationships between the quantities in the word problems, as an important aspect for students learning to use the models effectively.

The examples and sample solutions are contained in the slide show *ST4_BarModelIntro_2a_Subtract.pptx*, which can be used during initial instruction and class discussion.

Example 1

Hand out [Student Sheet 1 - Bar Model Examples 2A](#). Students should write the solutions to these examples, for future reference.

The first five examples demonstrate a variety of situations in which subtraction occurs. The numbers are very simple, so attention is on drawing the models.

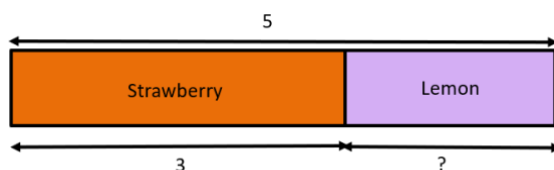
Read Example 1 and discuss how to draw and label the bar model. The slide show *ST4_BarModelIntro_2a_Subtract.pptx* can be used as a prompt.

Jane has 5 tarts. 3 are strawberry tarts. The rest are lemon tarts. How many lemon tarts are there?

Students at lower levels can use interlocking cubes to represent the situation in the word problem.

Sample Solution

$5 - 3 = \underline{2}$
There are 2 lemon tarts.



Example 2

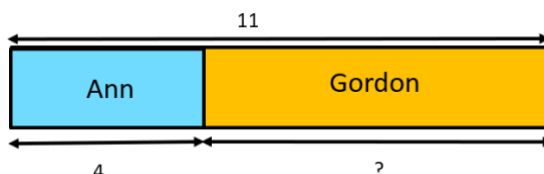
Students could try this example for themselves, before discussing as a group.

Note that the lengths of the bars do not have to be exactly in proportion.

Ann and Gordon have 11 stamps. Ann has 4 stamps. How many stamps does Gordon have?

Sample Solution

$11 - 4 = \underline{7}$
Gordon has 7 stamps.

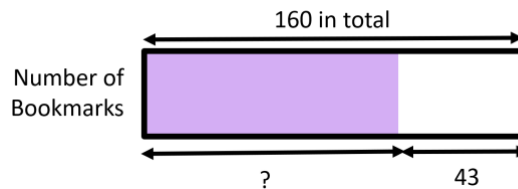


Example 3

Students could try this example themselves, before discussing as a group.

Joanne has 160 bookmarks in her store. She sells 43 bookmarks. How many bookmarks does she have now?

Sample Solution



$$160 - 43 = 117$$

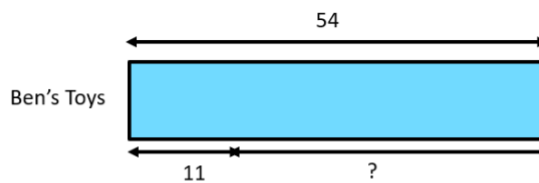
Joanne has 117 bookmarks now.

Example 4

Even though there are three parts drawn in the bar, students only need to find the combined size.

Ben has 54 toys. He gives some toys to Amy and he gives some to Carlos. Ben has 11 toys left. How many toys does Ben give away?

Sample Solution



$$54 - 11 = \underline{43}$$

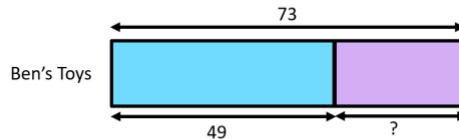
Ben gives 43 toys to Amy and Carlos.

Example 5

Ben has 49 toys. Amy gives him some toys. Ben has 73 toys now. How many toys does Amy give to Ben?

Sample Solution

Ben has 49 toys.
Amy gives him some toys.
Ben has 73 toys now.
How many toys does Amy give to Ben?



$$73 - 49 = \underline{24}$$

Amy gives 24 toys to Ben.

Consolidating and Concluding

Further Practice

Hand out [Student Sheet 2 - Bar Model Examples 2B](#). Students work through tasks selected from the seven provided either individually, in pairs or in groups.

Worked solutions are provided in [Teacher Sheet - Bar Model Solutions 2B](#). Solutions to Tasks 1-4 are included in the slide show *ST4_BarModelIntro_2a_Whole.pptx*.

The problems in the tasks use larger numbers than those in the examples. Calculators could be used. The emphasis needs to be on establishing the mathematical relationships from the problem wording, not on calculation.

Several problems demonstrate choices to make about drawing bar models, such as whether one big bar model is used or several partial models. Another option is making a nice choice about the arrangement of the quantities along a bar (e.g. for Task 2 it is better not to put the days of the week in the normal order).

Discuss solutions as time permits.

Conclusion

Summarise the learning points for the lesson, asking students to add their own observations:

- Constructing a part-whole bar model can help us to understand and solve word problems.
- The length of the bars represent the size of the quantities in the problem, but they do not need to be drawn exactly in proportion. A working bar model is NOT a scale drawing - it is a sketch.
- There is no 'exactly right' way of drawing the bars - draw a model that helps you to solve the problem.
- Sometimes you need to draw more than one model before you get a good arrangement.
- You do not need to put the quantities in the bar model in the same as order as they are in the question.

Example 1

Jane has 5 tarts. 3 are strawberry tarts. The rest are lemon tarts. How many lemon tarts are there?

Example 2

Ann and Gordon have 11 stamps. Ann has 4 stamps. How many stamps does Gordon have?

Example 3

Joanne has 160 bookmarks in her store. She sells 43 bookmarks. How many bookmarks does she have now?

Example 4

Ben has 54 toys. He gives some toys to Amy and he gives some to Carlos. Ben has 11 toys left. How many toys does Ben give away?

Example 5

Ben has 49 toys. Amy gives him some toys. Ben has 73 toys now. How many toys does Amy give to Ben?

Draw bar models to represent the situations below and use them to solve the problems.

Task 1

There were 4896 angelfish, catfish, tigerfish and stingrays in an aquarium.

1960 of them were catfish and stingrays.

426 of them were stingrays.

1254 of them were tigerfish.

- How many catfish were there?
- How many angelfish were there?

Task 2

Jim took Monday, Tuesday, Wednesday and Thursday to tile a swimming pool.

He used 8456 tiles to completely tile the pool.

He laid 1998 tiles on Tuesday and 2003 tiles on Wednesday.

He laid 4228 tiles on Monday and Wednesday combined.

- How many tiles did he lay on Monday?
- How many tiles did he lay on Thursday?

Task 3

4532 adults, 2416 teenagers and 1006 children attended an open-air concert.

812 children, 1478 teenagers and 2968 adults left the concert when it started to rain.

- How many adults remained at the concert when it rained?
- How many children remained at the concert when it rained?
- How many teenagers remained at the concert when it rained?

Task 4

A cruise ship carried 2046 passengers.

After the first group of passengers got off at Hobart (Tasmania), there were 1548 passengers on the cruise.

There were 985 passengers on the cruise after the second group of passengers got off at Adelaide (South Australia).

Finally, 415 passengers got off at Sydney (New South Wales).

- How many passengers got off at Hobart?
- How many passengers got off at Adelaide?
- How many passengers were on the cruise after 415 passengers got off at Sydney?

Task 5

A television show raised \$10 688 for charity.

Global Tour Agency donated some money and the amount raised became \$15 300.

The amount raised increased to \$26 290 after Jay's Kitchen donated another amount of money.

\$13 145 was left after some of the amount raised was given to the Healthy Lifestyle Association.

- a. How much money did Global Tour Agency donate?
- b. What was the amount donated by Jay's Kitchen?
- c. How much did Healthy Lifestyle Association receive?

Task 6

A train carried 8909 passengers. After the first group of passengers got off at Station A, there were 6025 passengers on the train. There were 4300 passengers on the train after the second group of passengers got off at Station B. Finally, 2019 passengers got off at Station C.

- a. How many passengers got off at Station A?
- b. How many passengers got off at Station B?
- c. How many passengers were on the train after 2019 passengers got off at Station C?

Task 7

The teachers at a school raised \$6809 for the School Building Fund.

The boys donated some money, and the amount raised became \$9010.

The amount raised became \$15 560 after the girls donated another amount.

\$8560 was left after some of the money was used to pay the construction company.

- a. How much did the boys donate?
- b. What was the amount donated by the girls?
- c. How much was used to pay the construction company?

Task 1

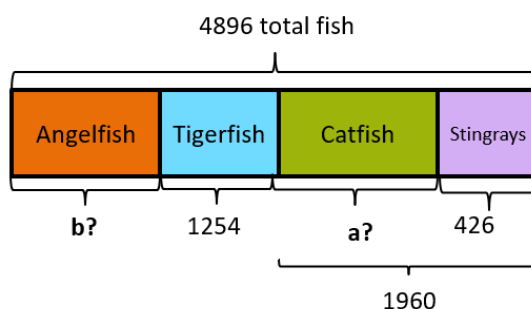
There were 4896 angelfish, catfish, tigerfish and stingray in an aquarium. 1960 of them were catfish and stingray. 426 of them were stingray. 1254 of them were tigerfish.

- How many catfish were there?
- How many angelfish were there?

Solution

- $1960 - 426 = 1534$
There were 1534 catfish.

- $4896 - 1960 - 1254 = 1682$
There were 1682 angelfish



NOTE how it is convenient to change the order of quantities along the bar.

Task 2

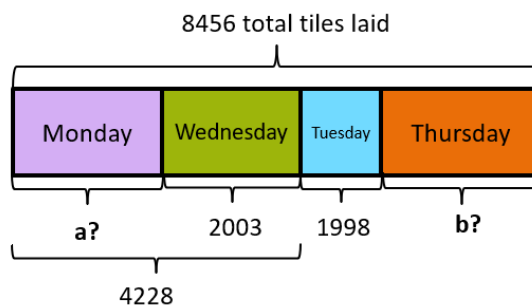
Jim took Monday, Tuesday, Wednesday and Thursday to tile a swimming pool. He used 8456 tiles to completely tile the pool for the four days. He laid 1998 tiles on Tuesday and 2003 tiles on Wednesday. He laid 4228 tiles on Monday and Wednesday.

- How many tiles did he lay on Monday?
- How many tiles did he lay on Thursday?

Solution

- $4228 - 2003 = 2225$
He laid 2225 tiles on Monday.

- $8456 - 4228 - 1998 = 2230$
He laid 2230 tiles on Thursday.



NOTE how it is convenient to change the order of quantities along the bar

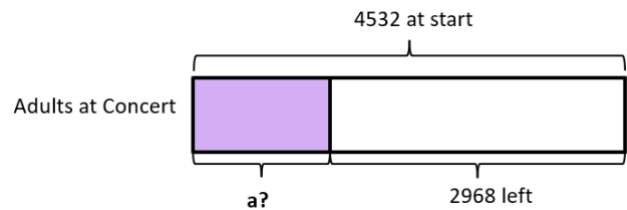
Task 3

4532 adults, 2416 teenagers and 1006 children attended an open-air concert.
812 children, 1478 teenagers and 2968 adults left the concert when it started to rain.

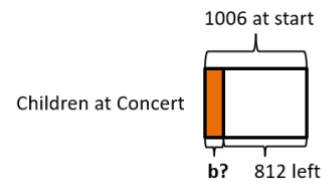
- How many adults remained at the concert when it rained?
- How many children remained at the concert when it rained?
- How many teenagers remained at the concert when it rained?

Solution

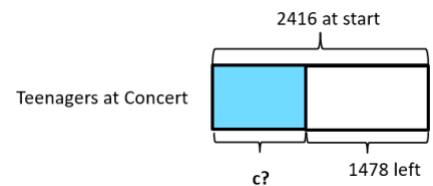
- $4532 - 2968 = 1564$
1564 adults remained at the concert when it rained.



- $1006 - 812 = 194$
194 children remained at the concert when it rained.



- $2416 - 1478 = 938$
938 teenagers remained at the concert when it rained.



NOTE how some students draw combined models and others draw several separate ones. There is no one right way.

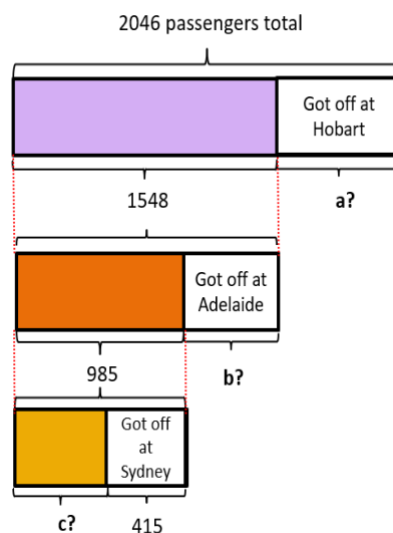
Task 4

A cruise carried 2046 passengers. After the first group of passengers got off at Hobart (Tasmania), there were 1548 passengers on the cruise. There were 985 passengers on the cruise after the second group of passengers got off at Adelaide (South Australia). Finally, 415 passengers got off at Sydney (New South Wales).

- How many passengers got off at Hobart?
- How many passengers got off at Adelaide?
- How many passengers were on the cruise after 415 passengers got off at Sydney?

Solution

- a.
 $2046 - 1548 = 498$
498 passengers got off at Hobart (Tasmania).
- b.
 $1548 - 985 = 563$
563 passengers got off at Adelaide (South Australia).
- c.
 $985 - 415 = 570$
570 passengers were on the cruise after 415 passengers got off at Sydney (New South Wales)



Task 5

A television show raised \$10 688 for charity.

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\$13 145 was left after some of the amount raised was given to the Healthy Lifestyle Association.

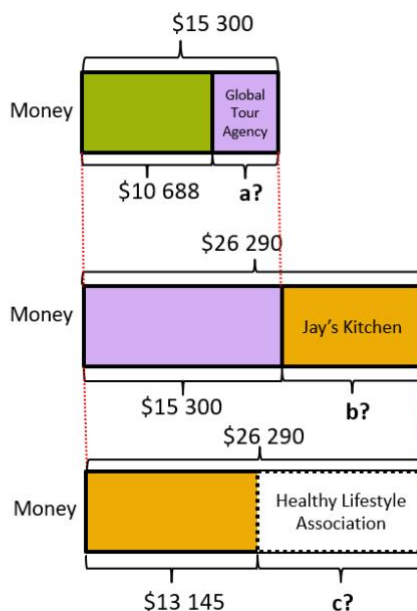
- (a) How much money did Global Tour Agency donate?
 (b) What was the amount donated by Jay's Kitchen?
 (c) How much did Healthy Lifestyle Association receive?

Solution

- a. $\$15\,300 - \$10\,688 = \$4\,612$
 Global Tour Agency donated \$4612.

- b. $\$26\,290 - \$15\,300 = \$10\,990$
 Jay's Kitchen donated \$10 990.

- c. $\$26\,290 - \$13\,145 = \$13\,145$
 Healthy Lifestyle Association received \$13 145.



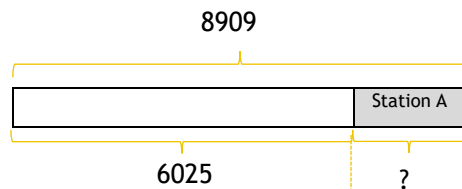
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A train carried 8909 passengers. After the first group of passengers got off at Station A, there were 6025 passengers on the train. There were 4300 passengers on the train after the second group of passengers got off at Station B. Finally, 2019 passengers got off at Station C.

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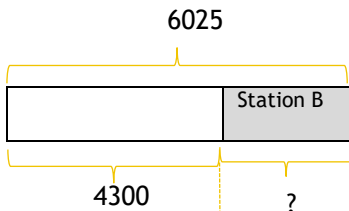
Solution

(a)



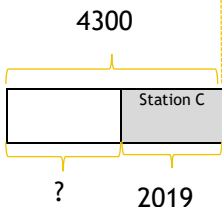
$8909 - 6025 = 2884$
2884 passengers got off at Station A.

(b)



$6025 - 4300 = 1725$
1725 passengers got off at Station B.

(c)



$4300 - 2019 = 2281$
2281 passengers were on the train after 2019 passengers got off at Station C.

Task 7

The teachers raised \$6809 for the School Building Fund.

The boys donated some amount and the amount raised became \$9010.

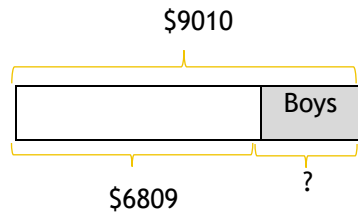
The amount raised became \$ 15 560 after the girls donated another amount.

\$8560 was left after some of the amount was used to pay the construction company.

- (a) How much did the boys donate?
- (b) What was the amount donated by the girls?
- (c) How much was used to pay the construction company?

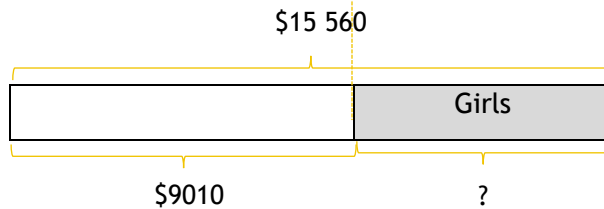
Solution

(a)



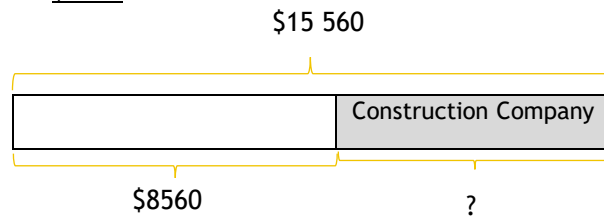
$\$9010 - \$6809 = \$2201$
The boys donated \$2201.

(b)



$\$15\,560 - \$9010 = \$6550$
The girls donated \$6550.

(c)



$\$15\,560 - \$8560 = \$7000$
\$7000 was used to pay the construction company.