



The Chicken-and-Rabbit Problem

A common mathematical problem goes like this:

A farmer had 40 chickens and rabbits altogether. He counted a total of 120 legs. Find the number of chickens and the number of rabbits the farmer had.

There are many variations on problems of this nature. For example,

There are 40 cars and motorcycles altogether in a car park. There are only 120 wheels. Find the number of cars and the number of motorcycles in the car park.

The beauty of this type of problems is its opportunity to explore the problems and a variety of methods to solve the problems. Sometimes, we need to tap into our general knowledge to solve the problems.

EXAMPLES



- 1 A farmer has 30 chickens and rabbits altogether. There are only 100 legs. Find the number of chickens and the number of rabbits that the farmer has.

Method 1: Make a Table

This method is also commonly known as the guess-and-check method. If much analytical thinking is applied, the number of steps can be greatly reduced.

Step 1: Start with half the total for each animal.
(Note that chicken has 2 legs; rabbit has 4 legs)

No. of chickens	No. of legs	No. of rabbits	No. of legs	Total no. of legs
15	30	15	60	90

Step 2: The total number of legs should be 100.

$$100 - 90 = 10 \text{ (difference in total number of legs)}$$

$$4 - 2 = 2 \text{ (difference in the number of legs between the two animals)}$$

$$10 \div 2 = 5 \text{ (add 5 rabbits and subtract 5 chickens to the first guess)}$$

No. of chickens	No. of legs	No. of rabbits	No. of legs	Total no. of legs
15	30	15	60	90
10	20	20	80	100

The farmer has **10** chickens and **20** rabbits.

Method 2: Make an Assumption

This method is tricky and yet fun once you have enough practice.

If we assume all the animals were rabbits,

$$30 \times 4 = 120$$

there would be 120 legs.

As the total number of legs stated in the problem is 100,

$$120 - 100 = 20$$

there is a difference of 20 legs.

$$4 - 2 = 2$$

The difference in the number of legs between a chicken and a rabbit is 2.

$$20 \div 2 = 10$$

The farmer has **10** chickens.

$$30 - 10 = 20$$

The farmer has **20** rabbits.

Alternative Assumption

If we assume all the animals were chickens,

$$30 \times 2 = 60$$

there would be 60 legs.

$$100 - 60 = 40$$

There is a difference of 40 legs.

$$4 - 2 = 2$$

The difference in the number of legs between a chicken and a rabbit is 2.

$$40 \div 2 = 20$$

The farmer has **20** rabbits.

$$30 - 20 = 10$$

The farmer has **10** chickens.

- 2 Samantha has 30 pieces of \$2 and \$5 notes altogether. The total value of the money she has is \$120. Find the number of pieces of \$2 notes and the number of pieces of \$5 notes that Samantha has.

Method 1: Make a Table

Step 1: Start with half the total for \$2 and \$5 notes.

No. of \$5 notes	Value	No. of \$2 notes	Value	Total value
15	\$75	15	\$30	\$105

Step 2: The total value should be \$120.

$$\$120 - \$105 = \$15 \quad (\text{difference in total value})$$

$$\$5 - \$2 = \$3 \quad (\text{difference in value between \$5 and \$2 notes})$$

$$\$15 \div \$3 = 5 \quad (\text{add 5 pieces of \$5 notes and subtract 5 pieces of \$2 to the first guess})$$

No. of \$5 notes	Value	No. of \$2 notes	Value	Total value
15	\$75	15	\$30	\$105
20	\$100	10	\$20	\$120

Samantha has **20** pieces of \$5 notes and **10** pieces of \$2 notes.

Method 2: Make an Assumption

If we assume all were \$5 notes,

$$30 \times \$5 = \$150$$

the total value would be \$150.

$$\$150 - \$120 = \$30$$

There is a difference of \$30 in the total value of money.

$$\$5 - \$2 = \$3$$

$$\$30 \div \$3 = 10$$

Samantha has **10** pieces of \$2 notes.

$$30 - 10 = 20$$

Samantha has **20** pieces of \$5 notes.

Alternative Assumption

If we assume all were \$2 notes,

$$30 \times \$2 = \$60$$

the total value would be \$60.

$$\$120 - \$60 = \$60$$

There is a difference of \$60 in the total value of money.

$$\$5 - \$2 = \$3$$

$$\$60 \div \$3 = 20$$

Samantha has **20** pieces of \$5 notes.

$$30 - 20 = 10$$

Samantha has **10** pieces of \$2 notes.

- 3 There are 24 cars and motorcycles in a car park. There are a total of 76 wheels. How many motorcycles are there? How many cars are there?

Method 1: Make a Table

Step 1: Start with half the total for each vehicle.

No. of cars	No. of wheels	No. of motorcycles	No. of wheels	Total no. of wheels
12	48	12	24	72

Step 2: The total number of wheels should be 76.

$$76 - 72 = 4 \quad (\text{difference in total number of wheels})$$

$$4 - 2 = 2 \quad (\text{difference in number of wheels between a car and a motorcycle})$$

$$4 \div 2 = 2 \quad (\text{add 2 cars and subtract 2 motorcycles to the first guess})$$

No. of cars	No. of wheels	No. of motorcycles	No. of wheels	Total no. of wheels
12	48	12	24	72
14	56	10	20	76

There are **14** cars and **10** motorcycles.

Method 2: Make an Assumption

If we assume all were cars,

$$24 \times 4 = 96$$

the total number of wheels would be 96.

$$96 - 76 = 20$$

There is a difference of 20 in the total number of wheels.

$$4 - 2 = 2$$

$$20 \div 2 = 10$$

There are **10** motorcycles.

$$24 - 10 = 14$$

There are **14** cars.

Alternative Assumption

If we assume all were motorcycles,

$$24 \times 2 = 48$$

the total number of wheels would be 48.

$$76 - 48 = 28$$

There is a difference of 28 in the total number of wheels.

$$4 - 2 = 2$$

$$28 \div 2 = 14$$

There are **14** cars.

$$24 - 14 = 10$$

There are **10** motorcycles.

- 4 There were 6 questions in a mathematics competition. 5 marks would be awarded for every correct answer. 2 marks would be deducted for a wrong answer. If Valerie scored 23 marks in the mathematics competition, how many questions did she answer correctly?

If we assume Valerie had answered all 6 questions correctly,

$$6 \times 5 = 30$$

she would be awarded 30 marks.

$$30 - 23 = 7$$

There is a difference of 7 marks between the full marks and her score.

If Valerie had answered one question incorrectly,

$$5 + 2 = 7$$

she would lose 7 marks.

$$6 - 1 = 5$$

She answered **5** questions correctly.

- 5 There were 25 questions in a mathematics quiz. If a question was answered correctly, 4 marks would be given, otherwise 1 mark would be deducted. If John scored 85 marks in the mathematics quiz, how many questions had he answered correctly?

If we assume John had answered all questions correctly,

$$25 \times 4 = 100$$

he would be given 100 marks.

$$100 - 85 = 15$$

There is a difference of 15 marks between the full marks and John's score.

$$4 + 1 = 5$$

5 marks would be deducted for a wrong answer.

$$15 \div 5 = 3$$

John answered 3 questions wrongly.

$$25 - 3 = 22$$

He had answered **22** questions correctly.

PRACTICE



- 1 There were a total of 30 cars and motorcycles at a car park. There were 100 wheels in all. How many cars were there at the car park?

Method 1: Make a Table

No. of cars	No. of wheels	No. of motorcycles	No. of wheels	Total no. of wheels

Method 2: Make an Assumption (Assume either all cars or all motorcycles.)

- 2 Each adult movie ticket costs \$8. Each child movie ticket costs \$5. Sean buys 10 movie tickets altogether. He pays \$74 in all. Find the number of adult movie tickets and the number of child movie tickets Sean buys.

Method 1: Make a Table

No. of adult tickets	Value	No. of child tickets	Value	Total value

Method 2: Make an Assumption (Assume either all adult tickets or all child tickets.)

- 3 Clifford has 30 pieces of 50¢ and 20¢ stamps. The total value of all his stamps is \$12. Find the number of 50¢ and 20¢ stamps Clifford has.

Method 1: Make a Table

No. of 50¢ stamps	Value	No. of 20¢ stamps	Value	Total value

Method 2: Make an Assumption (Assume either all 50¢ stamps or all 20¢ stamps.)

- 4 A spider has 8 legs and a dragonfly has 6 legs. There are 20 spiders and dragonflies altogether. There are 144 legs in all. Find the number of spiders and the number of dragonflies.

Method 1: Make a Table

No. of spiders	No. of legs	No. of dragonflies	No. of legs	Total no. of legs

Method 2: Make an Assumption (Assume either all spiders or all dragonflies.)

- 5 Natalie saves 30 pieces of \$5 and \$10 notes. Her total savings is \$220. How many pieces of \$10 notes does Natalie save?

Method 1: Make a Table

No. of \$5 notes	Value	No. of \$10 notes	Value	Total value

Method 2: Make an Assumption (Assume either all \$5 notes or all \$10 notes.)

- 6 There are 30 questions in a mathematics competition. All questions must be answered. 5 marks are awarded for every correct answer. 2 marks will be deducted for a wrong answer. If Amy scores 122 marks, how many questions does she answer correctly?

- 7 There were 45 questions in a science contest. 4 marks would be awarded for every correct answer. 2 marks would be deducted for every wrong answer. All questions had to be answered. If Henry scored 150 marks, how many questions had he answered wrongly?
- 8 For every slice of bread a child takes, an adult takes 2 slices of bread. If there are 66 adults and children in all and 99 slices of bread are taken,
- (a) how many adults are there?
 - (b) how many children are there?
- 9 There were 100 adults and children altogether. An adult could consume 3 buns while 3 children could only finish one bun. If 100 buns were consumed, how many adults were there?

- 10** 56 teachers and pupils went for a river cruise. The seating capacity of a big boat was 8 people and the seating capacity of a small boat was 6 people. Find the number of big boats and the number of small boats.

Method 1: Make a Table

No. of big boats	No. of people	No. of small boats	No. of people	Total no. of people

Method 2: Make an Assumption (Assume either all big boats or all small boats.)

- 11** There are 20 questions in a mathematics contest. 8 marks will be awarded for each correct answer. 4 marks will be deducted for each wrong answer. All the questions must be answered. If Isabelle scores 100 marks in the mathematics contest, how many questions does she answer correctly?
- 12** A PE teacher bought 4 identical basketballs and 5 identical volleyballs for \$230. Each basketball was \$8 more expensive than a volleyball. Find the cost of each basketball and each volleyball.

- 13 A pen cost \$4 and a book cost \$7. Samuel paid \$64 for 10 such pens and books. Find the number of pens and the number of books he had bought.

Method 1: Make a Table

No. of pens	Cost	No. of books	Cost	Total cost

Method 2: Make an Assumption (Assume either all pens or all books.)

- 14 A whiteboard marker cost \$3. A paintbrush cost \$1. A teacher paid \$28 in all for 12 paintbrushes and whiteboard markers. How many whiteboard markers and how many paintbrushes did the teacher buy?

Method 1: Make a Table

No. of whiteboard markers	Value	No. of paintbrushes	Value	Total value

Method 2: Make an Assumption (Assume either all whiteboard markers or all paintbrushes.)