Chapter 14
Algebraic equations 1

14.1 Solving by inspection

number puzzles

Solve these number puzzles.

1. I am thinking of a certain number. If I add 3 to that number, the answer is 13. What is the number?

2. I am thinking of a certain number. If I multiply that number by 5, the answer is 30. What is the number?

3. I am thinking of a certain number. If I multiply that number by 3 and then add 4 to the result, the answer is 19.
    (a) Is the number 3? Give a reason for your answer.
    (b) Is the number 4? Give a reason for your answer.
    (c) Is the number 5? Give a reason for your answer.
    (d) Is the number 6? Give a reason for your answer.

Number puzzles like those above can be shortened by using letter symbols as placeholders for unknown numbers. In the case of question 1 we can write the following number sentence: $x + 3 = 13$.

   In the case of a number sentence such as $x + 3 = 13$ we cannot say whether it is true or false until we have determined the value of the unknown. The value of the unknown that makes the number sentence (an **equation**) true is called the **solution** of the number sentence.

   For the number sentence $x + 3 = 13$, the solution is $x = 10$ because it makes the number sentence true.

A mathematical statement such as $x + 3 = 13$ that could be true or false depending on the value of x, is called an **open number sentence** or an **equation**.

To make a number sentence **true** means to find its **solution**.

the solution is there to see

The solution to the number sentence $x + 4 = 20$ can be seen at once. The value of x is 16 simply because $16 + 4 = 20$. In this case, we say we solve the number sentence **by inspection**.

Solve these number sentences (equations) by inspection.

1. (a) $x - 8 = 8$ (b) $x + 7 = 20$

   (c) $\dfrac{16}{x} = 8$ (d) $\dfrac{x}{16} = 2$

   (e) $5 \times x = 40$ (f) $8 \times x = 40$

2. (a) $84 \div x = 7$ (b) $36 \div x = 4$

   (c) $x + 56 = 100$ (d) $100 - x = 56$

14.2 Solving by the trial and improvement method

Sometimes you cannot see the solution of a number sentence (an equation) at once. Look at the following number puzzle or equation, for example:

I am thinking of a number. $6 \times$ *the number* $- 11 = 43$. What is the number?

In this case, you will have to try many different possible solutions until you identify the correct one. Here we can use a method known as **trial and improvement** to determine the solution. It is shown in the table below.

Possible solution	Test	Conclusion
Try 5	$6 \times 5 - 11 = 30 - 11 = 19$	5 is too small
Try 10	$6 \times 10 - 11 = 60 - 11 = 49$	10 is too big
Try 8	$6 \times 8 - 11 = 48 - 11 = 37$	8 is too small
Try 9	$6 \times 9 - 11 = 54 - 11 = 43$	9 is the solution

Copy the tables below. Solve the following equations by means of the trial and improvement method. In each case, the solution is a number between 1 and 20.

1. $2 \times x + 13 = 37$

Possible solution	Test	Conclusion

2. $14 \times x - 21 = 77$

Possible solution	Test	Conclusion

3. $7 \times x + 8 = 71$

Possible solution	Test	Conclusion

4. $4 \times x + 7 = 31$

Possible solution	Test	Conclusion

5. $10 \times x + 11 = 141$

Possible solution	Test	Conclusion

solving by inspection or trial and improvement

Solve the following equations by inspection or by the trial and improvement method:

1. (a) $x + 5 = 2 \times x$ (b) $k \times 5 = 20 + k$
   (c) $2 \times q = 18 - q$ (d) $3 \times t = t + 22$

2. (a) $y + 6 = 4 \times y$ (b) $5 \times p = 18 + 2 \times p$
   (c) $4 \times z = 18 + z$ (d) $x \times 5 = 20$
   (e) $42 \div m = 35 - 29$ (f) $3 \times x - 2 = x + 6$

14.3 Describing problem situations with equations

from words to equations

Write an equation using a letter symbol as a placeholder for the unknown number to describe the problem in each of the situations below.

1. There are 30 learners in a class. x learners are absent and 19 are present.

2. There are 70 passengers on a bus. At a bus stop m passengers get off. There are now 23 passengers on the bus.

3. A boy buys a bicycle for R1 260 on lay-by. How many payments of R90 each must he make to pay for the bicycle? Let x be the number of payments to be made.

4. Five people share a total cost of R240 equally amongst themselves. Let c be the cost per person.

5. A school charges R100 a day for the use of its training facilities for athletes plus R30 per athlete per day for food and use of equipment. A team of athletes paid R400 for a day's practice. Let x be the number of athletes attending the training.

6. Bennie has R54 with which to buy chocolates for his friends. Each chocolate costs R6. How many chocolates can he buy for that amount? Let x be the number of chocolates that Bennie can buy.

7. Write an equation to calculate the area of a rectangle with length 2,5 cm and breadth 2 cm. Let A represent the area of the rectangle.

8. There are 38 girls in Grade 7. This is 6 more than double the number of boys.

9. Janine is 12 years old. Her father's age is 7 years plus three times Janine's age.

making sense of equations

1. Rajbansi Taxi Service charges R10 per kilometre travelled and a standard charge of R30 per trip. Consider the equation below about a taxi trip:
   $10 \times t + 30 = 80$
   (a) Explain what each number and letter symbol stands for in the equation.
   (b) Why is t multiplied by 10 in the equation?

2. The cost of an adult's ticket for a music concert is four times the cost of a child's ticket. An adult's ticket costs R240. The equation below represents this problem:
   $4 \times x = 240$
   (a) What does x represent?
   (b) Why is x multiplied by 4?
   (c) Solve the equation by inspection.
   (d) How much does a child's ticket cost?

3. There are 12 eggs in a carton. Consider the equation below:
   $12 \times c = 72$
   (a) What does the letter symbol c represent in the equation?
   (b) What value of c makes the equation true?
   (c) What does the number 72 represent?