

Grade 7 – Book B **(Revised CAPS edition)**

CONTENTS:

	<u>Page:</u>
B1. Number patterns	3
B2. Algebraic expressions and equations	21
B3. Integers	51
B4. Statistics	75
B5. Probability	111

This book was compiled and processed by E.J. Du Toit in 2013.
Revised edition 2020. Newest version 2022

Contact: info@abcbooks.co.za

Copyright© 2013. All copyrights are reserved. No part of this publication may be reproduced in any form unless written consent is obtained.

ISBN 978-1-919957-18-0

Also visit www.abcmathsandscience.co.za for extra exercise, tests and exam papers.

Chapter B2

Numeric sentences (Equations)

B2.1 Introduction to Algebra:

B2.1.1 Inspection:

E.g.1 If $3 + \square = 7$, we must find a number that can replace \square to make this numeric sentence true. Here we can see that \square can be replaced with **4**, because $3 + 4 = 7$.

Exercise 1:

Date: _____

(1) Determine which number must replace \square to make the numeric sentence true:

(a) $15 + \square = 13$

(b) $38 - \square = 30$

(c) $\square + 16 = 24$

(d) $2 \times \square = 22$

(e) $14 \div \square = 2$

(f) $\square - 13 = 6$

(g) $\square \div 6 = 5$

(h) $\square \times 24 = 48$

(i) $122 + \square = 98$

(j) $13 + 2 \times \square = 19$

(k) $15 \div \square - 1 = 4$

(l) $\square - 2 \times 3 = 8$

(2) Insert a suitable operation (e.g. $+$, $-$, \times or \div) in place of \square to make the numeric sentence true:

(a) $6 \square 4 = 2$

(b) $6 \square 4 = 24$

(c) $13 \square 12 = 1$

(d) $16 \square 4 = 4$

(e) $4 \square 3 = 7$

(f) $3 \square 0 = 0$

B2.1.2 Algebraic language:

In exercise 1 the symbol \square is used as a placeholder for an unknown number or operation. Instead of the symbol \square we can use any letter of the alphabet to represent a number.

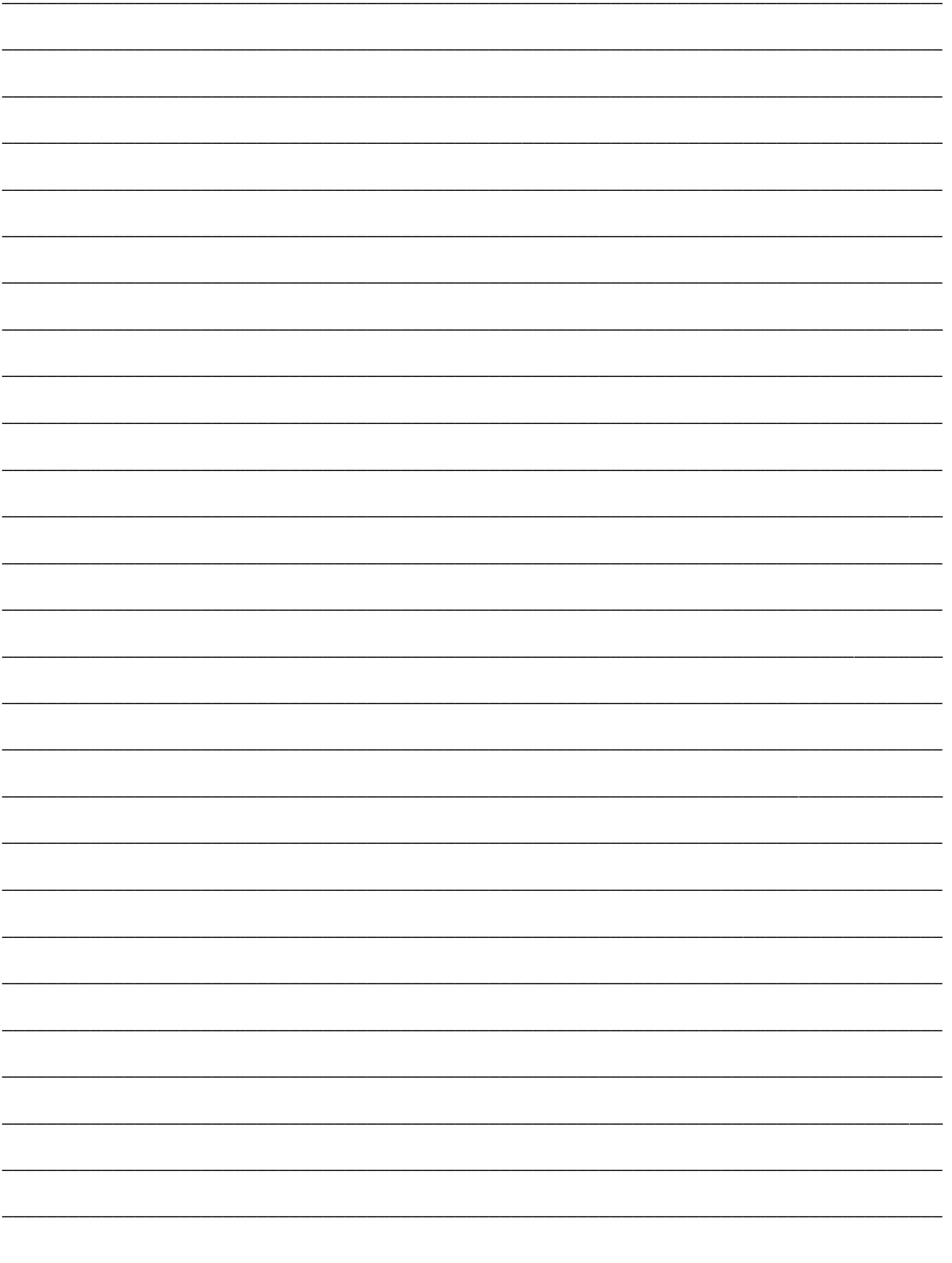
E.g.2 Translate the following sentences into mathematical language:
(Any letter of the alphabet can be used.)

(a) The sum of 8 and a number. $\therefore 8 + x$

(b) The difference between y and 6. $\therefore y - 6$

(c) Carla is x years old at present. What was her age 3 years ago? $\therefore x - 3$

(d) One cooldrink costs p cent. How much will 10 cooldrinks cost? $\therefore p \times 10$



Exercise 2:

Date: _____

Translate the following sentences into mathematical language:

- (1) The sum of x and y : _____
- (2) 26 reduced with t : _____
- (3) The product of m and n : _____
- (4) 12 more than y : _____
- (5) The halve of k : _____
- (6) How much is 9 less than p ? _____
- (7) Increase 4 with k : _____
- (8) The difference between t and q : _____
- (9) Arno is x years old and Peter is y years old. What is their joint age? _____
- (10) One book costs p rand. How much will 3 books cost? _____
- (11) Subtract 17 from k : _____
- (12) A father is 28 years older than his son.
His son is t years old. What is the age of the father? _____
- (13) Double x : _____
- (14) Samuel buys a car for y rand and sells it for k rand. Calculate his profit: _____
- (15) Seven toffees cost x rand. How much will one toffee cost? _____
- (16) Three times y : _____
- (17) Rafael is currently 13 years old. What will his age be in p years time? _____
- (18) Halve the sum of p and q : _____
- (19) The square of x : _____
- (20) There are 28 learners in a class, of which t are girls. How many are boys? _____

B2.2 Equations:**B2.2.1 Word sentences:**Exercise 3:

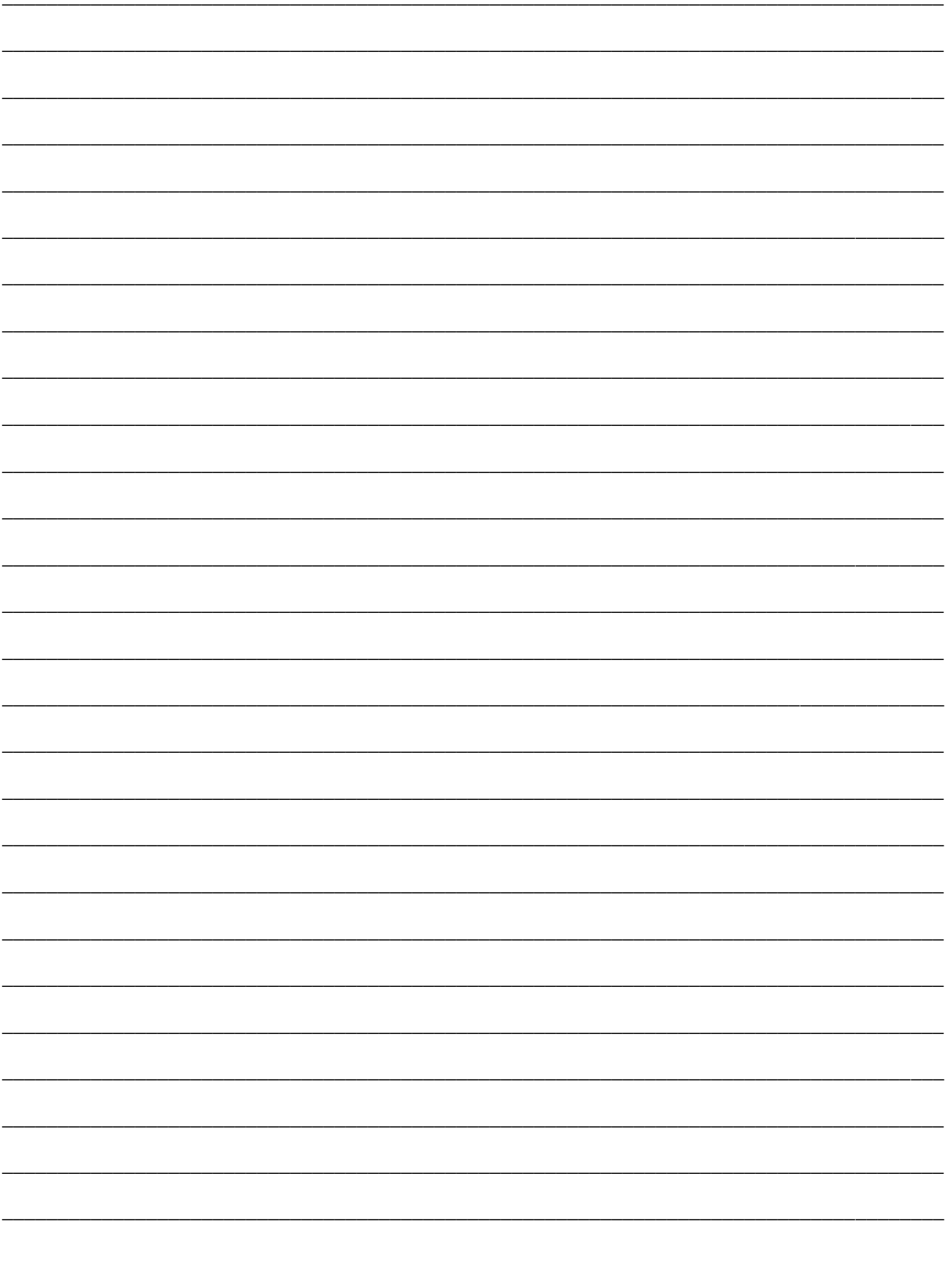
Date: _____

- (1) In which of the following numeric sentences can you **immediately determine** whether the sentence is true or false?

- | | |
|-------------------------|-----------------------------|
| (a) $4 + 7 = 11$ _____ | (b) $0 + 7 = 3$ _____ |
| (c) $y + 6 = 8$ _____ | (d) $4 - x = 21$ _____ |
| (e) $13 - 1 = 12$ _____ | (f) $m \times -3 = 9$ _____ |

- (2) How many possible values can x be in each of the following mathematical sentences:

- | | |
|-----------------------|----------------------------|
| (a) $x + 4 = 7$ _____ | (b) $x = 2 \times y$ _____ |
| (c) $5 - x = 1$ _____ | (d) $x + y = 7$ _____ |



In exercise 3 number (1) we saw that with numeric sentences (a), (b) and (e) we could immediately determine whether the sentence was true or not. We then call these **closed numeric sentences!** In numeric sentences (c), (d) and (f), however, the answer is dependent on the variable (y , x and m or any letter of the alphabet that is used). We then call these open numeric sentences, which are also known as **equations!**

In exercise 3 number (2) we saw that in (a) and (c) the numeric sentences have only one possible answer, while in (b) and (d) there are more than one possible answer; the value(s) of x in (b) and (d) is actually dependent on the value(s) of y .

E.g.3 Write down an open numeric sentence or equation for the following word sentence:

The sum of 5 and x is 9.

\therefore Numeric sentence: $5 + x = 9$

E.g.4 Write down a word sentence to describe the following numeric sentence: $y - 6 = 3$

The difference between a number and 6 is 3.

Exercise 4:

Date: _____

(1) Write down an open numeric sentence or equation for the following word sentences:

- (a) The sum of 3 and x is 7: _____
- (b) The product of x and 2 is 18: _____
- (c) The difference between 3 and x is 1: _____
- (d) The quotient of 7 and x is 14: _____
- (e) A certain number increased by 12 is 17: _____
- (f) Half of a certain number is 4. What is the number? _____
- (g) Eight less than a certain number is 11. Determine the number: _____
- (h) Six times a certain number is 30. Determine the number: _____
- (i) A quarter of a number and 4 is 9. What is the number? _____
- (j) Six more than a certain number is 25. What is the number? _____
- (k) The difference between a number and 1 is 5. What is the number? _____
- (l) My age multiplied by three is 72. How old am I? _____
- (m) A certain number doubled and then increased by 6 is 8. What is the number? _____
- (n) If the quotient of a certain number and 8 is reduced by 3 the answer is 4: _____
- (o) Kas thinks of a number. He divides the number by 2 and then adds 2. His answer is 12. What is the number? _____

(2) Write down a word sentence to describe the following numeric sentences:

(a) $3 + x = 7$ _____

(b) $y - 1 = 14$ _____

(c) $14 \times m = 52$ _____

(d) $6 \div x = 1$ _____

(e) $2x - 5 = 13$ _____

(f) $3p + 4 = 45$ _____

(g) $\frac{y}{3} - 7 = 2$ _____

(h) $8 + y = 12$ _____

(i) $9 + 2x = 11$ _____

(j) $x = \frac{1}{2}x + 3$ _____

(3) Choose the correct numeric sentence(s) for each of the following word sentences:

(a) I had R20 spending money and spent x rand. I have R6 left. How much money did I spend?

A. $20 \times x = 6$ B. $x - 20 = 6$ C. $x + 20 = 6$ D. $20 - x = 6$

(b) Jack is 24 years old at present. Three years ago, he was x years old. How old was he 3 years ago?

A. $24 - x = 3$ B. $x = 24 - 3$ C. $3x = 24$ D. $x + 3 = 24$

(c) There are 66 oranges in x bags. If there are 6 oranges in each bag, determine how many bags there are.

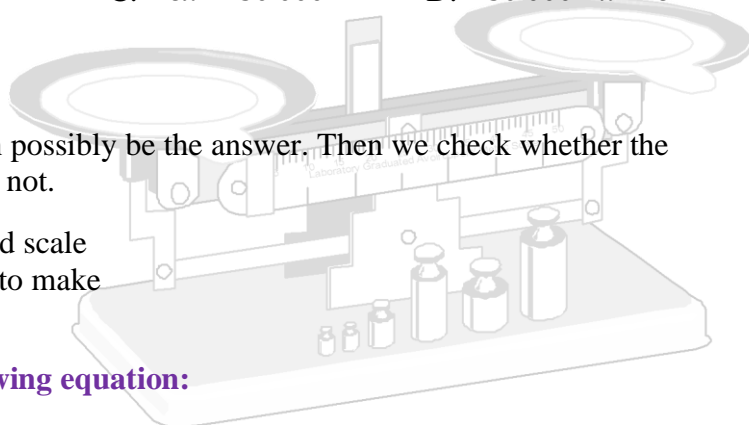
A. $x + 6 = 66$ B. $6 \times x = 66$ C. $66 \div x = 6$ D. $66 - x = 6$

- (d) I buy 3 cool drinks at x rand each. I pay with a R20 and get two-rand change. How much did each cool drink cost?
- A. $3 \times x = 20$ B. $x - 2 = 20$ C. $20 - 3x = 2$ D. $3x - 2 = 20$
- (e) Five times a number, increased by two multiplied by the same number equals 49. Determine the number.
- A. $5x + 2x = 49$ B. $5x + 2 = 49$ C. $5 + 2x = 49$ D. $49 - x = 7$
- (f) Four boys have 63 marbles together. Three marbles get lost. If each boy had x marbles, calculate how many marbles each boy originally had.
- A. $4 \times x = 63$ B. $4x + 3 = 63$ C. $63 + 4x = 3$ D. $63 - 3 = 4x$
- (g) There are 45 sweets in a packet. Two boys each eat x sweets and four girls each eat three sweets. If only one sweet is left in the packet, calculate how many sweets each boy ate.
- A. $45 - 2x - 4 = 1$ B. $45 + 2x + 1 = 4$ C. $45 - 2x - 3 \times 4 = 1$ D. $45 - 5x = 1$
- (h) Emma saves x rand and then uses R60. Then she saves another two times x rand. Now she has R300 altogether in her purse. How much money did she save initially?
- A. $x + 2x - 60 = 300$ B. $x - 60 - 2x = 300$ C. $300 - x - 2x = 60$ D. $x + x - 60 = 300$
- (i) The sum of a number and half of the number is 12. Determine the number.
- A. $x + 0,5x = 12$ B. $x \times \frac{1}{2}x = 12$ C. $x + 2x = 12$ D. $2x - 0,5x = 12$
- (j) Six cows cost x rand each. Together the cows cost R30 000. How much does one cow cost?
- A. $30\,000 \times x = 6$ B. $30\,000 \div 6 = x + 1$ C. $6x = 30\,000$ D. $30\,000 - x = 6$

B2.2.2 Trial and error method:

With this method we choose a number that can possibly be the answer. Then we check whether the chosen number does make the equation true or not.

Remember: an equation is like an old-fashioned scale
the two sides need to be balanced to make
the equation true.



E.g.5 Determine the value of x in the following equation:

$$3x - 2 = 16$$

\therefore Left-hand-side (LHS) = $3x - 2$ and Right-hand-side (RHS) = 16

For e.g. choose $x = 7$,

then LHS = $3 \times 7 - 2 = 21 - 2 = 19 \neq$ RHS = 16 $\therefore x \neq 7$

Because the LHS (19) is bigger than the RHS (16), choose another number smaller than 7!

Now choose $x = 6$,

then LHS = $3 \times 6 - 2 = 18 - 2 = 16 =$ RHS

$\therefore x = 6$, because if x is replaced by 6, the value of the LHS will be the same as the value of the RHS!

Exercise 5:

Date: _____

Determine the value of x in each of the following equations by using the trial and error method.
Show all calculations!

(1) $4 + 3x = 19$

(2) $2x + 5 = 21$

(3) $\frac{x}{2} + 3 = 7$

(4) $4x + 3 = 11$

(5) $2 + 2x = 3 + x$

(6) $\frac{2x}{3} - 2 = 4$

☺ Which of the following values will make each of the equations below true:

$$x \in \{-4 ; -1 ; 0 ; \frac{1}{2} ; 1 ; 7\}$$

(1) $4x - 1 = 6x - 3$

(2) $\frac{8x}{3} + 2 = 3\frac{1}{3}$

B2.2.3 Mathematical manipulation:

As already seen in B2.2.2, an equation is like an old-fashioned balancing scale. If the scale is balanced and any weight is added or taken away on the one side and then the same weight must be added or taken away from the other side. Then the scale will still balance!

Remember: the left- and right-hand-sides of any equation always must be the same value!

Therefore, the same is true for an equation as for the balancing scale – what is done on the left- side of an equation also must be done on the right side! For instance, if you add a number to the LHS, the same number must be added to the RHS. Or if you multiply by a certain number on the LHS, you must multiply the same number on the RHS. This rule applies to all the other calculations.

E.g.6 Solve the following equations. Check your answers!

(a) $x + 4 = 29$

$$\therefore x + 4 - 4 = 29 - 4$$

$$\therefore x + 0 = 25$$

$$\therefore x = 25$$

Therefore, subtract 4 on both sides, because $4 - 4 = 0$

4 and -4 are each other's addition inverses and

therefore, when added together, the answer is 0

CHECK: LHS = $x + 4$
 $= 25 + 4$
 $= 29$

RHS = 29

\therefore LHS = RHS

(b) $m - 3 = 2$

$$\therefore m - 3 + 3 = 2 + 3$$

$$\therefore m = 5$$

Add 3 on both sides

CHECK: LHS = $m - 3$
 $= 5 - 3$
 $= 2$

RHS = 2

\therefore LHS = RHS

Exercise 6:

Date: _____

Solve the following equations. Check your answers!

(1) $a + 7 = 11$

(2) $b - 5 = 7$

(3) $4 + y = 8,5$

(4) $k - \frac{1}{2} = 3\frac{1}{2}$

(5) $x - 13 = 4$

(6) $2 + m = 6$

E.g.7 Solve the following equations. Check your answers.

(a) $3y = 15$

$$\therefore 3 \times y = 15$$

$$\therefore \frac{3 \times y}{3} = \frac{15}{3}$$

$$\therefore \frac{\cancel{3} \times y}{\cancel{3}} = \frac{15}{3^1}$$

$$\therefore y = 5$$

The opposite calculation of \times is \div

Divide both sides with 3

Simplify left and right through division

CHECK: **LHS = $3y$** **RHS = 15**
 = 3×5
 = 15 **\(\therefore\) LHS = RHS**

(b) $4x - 1 = 11$

$$\therefore 4x - 1 + 1 = 11 + 1$$

$$\therefore 4x = 12$$

$$\therefore \frac{4x}{4} = \frac{12}{4}$$

$$\therefore \frac{\cancel{4}x}{\cancel{4}} = \frac{12}{4^1}$$

$$\therefore x = 3$$

First add 1 to both sides

Simplify left and right

Divide by 4 on both sides

Simplify left and right

CHECK: **LHS = $4x - 1$** **RHS = 11**
 = $4 \times 3 - 1$
 = $12 - 1 = 11$ **\(\therefore\) LHS = RHS**

Exercise 7:

Date: _____

Solve the following equations. Check your answers!

(1) $3m + 8 = 14$

(2) $17g + 17 = 17$

(3) $4k + 3 = 7$

(4) $5 + 6y = 17$

(5) $3 + 8x = 11$

(6) $0,5b - 3 = 2$

E.g.8 Solve the following equations. Check your answers.

$$\frac{k}{5} - 1 = 5$$

$$\frac{k}{5} - 1 + 1 = 5 + 1$$

Add 1 on both sides

$$\frac{k}{5} = 6$$

The opposite calculation of \div is \times

$$\therefore \frac{k}{5} \times \frac{5}{1} = \frac{6}{1} \times \frac{5}{1}$$

Then multiply on both sides by 5

$$\therefore \frac{k}{\cancel{5}} \times \frac{\cancel{5}}{1} = \frac{6}{1} \times \frac{5}{1}$$

Simplify by dividing on the left

$$\therefore k = 30$$

CHECK:

$$\begin{aligned} \text{LHS} &= \frac{k}{5} - 1 \\ &= \frac{30}{5} - 1 \\ &= 6 - 1 \\ &= 5 \end{aligned}$$

$$\text{RHS} = 5$$

$$\therefore \text{LHS} = \text{RHS}$$

(5) $\frac{x}{4} + 2 = 4$

(6) $\frac{5t}{7} + 6 = 11$

☺ Determine x if $x \in \mathbb{N}$, where $3x - \frac{x}{2} = 7$

B2.3 REVISION EXERCISE:

Date: _____

(1) Determine which number must replace \square to make the numeric sentence true:

(a) $8 \times \square = 16$

(b) $2 + \square = 5$

(c) $\square - 11 = 33$

(2) Insert a suitable operation (e.g. $+$; $-$; \times or \div) in place of \square to make the numeric sentence true:

(a) $7 \square 2 = 9$

(b) $40 \square 5 = 8$

(c) $11 \square 0 = 0$

(3) Write an open numeric sentence or equation for the following word sentences:

- (a) 16 increased by a certain number are 30. Determine the number. _____
- (b) The quotient of a certain number and 7 is 3. Determine the number. _____
- (c) Rick's age divided by 6 is 3. If Rick is currently x years old, determine the value of x . _____
- (d) The total price of four shirts is R240. If one shirt costs y rand, determine the price of one shirt. _____

(4) Write down a word sentence to describe the following numeric sentences:

(a) $2x - 1 = 3$

(b) $\frac{m}{7} + 2 = 19$

(5) Choose the correct numeric sentence for each of the following word sentences:

- (a) Renaldo thinks of a number. He multiplies the number by 7 and reduces the result by 4. His answer is 12. Which number was he thinking of?

A. $4x - 7 = 12$ B. $7x + 4 = 12$ C. $7x - 4 = 12$ D. $7x - 4x = 12$

- (b) Five toffees cost x cent each. I pay with a R2 coin and get 25^c change. What does one toffee cost?

A. $2 - 5x = 25$ B. $5x + 25 = 200$ C. $200 + x = 25$ D. $5x \times 25 = 200$

(6) Determine the value of the following variables through inspection:

(a) $5 \times p = 35$	_____	(b) $2 + t = 6$	_____
(c) $k \div 4 = 12$	_____	(d) $y \times y = 36$	_____
(e) $a + 13 = 22$	_____	(f) $m + m = 6$	_____

(7) Determine the value of x in each of the following equations by using the trial-and-error method. Show all calculations!

(a) $12 \div x - 3 = 1$

(b) $2 + 3x = 5$

(e) $4x - 7 = 17$

(f) $5x \times 25 = 200$

(g) $12 + 2x = 11 + 1$

(h) $3 + 4x = 63$

(i) $7 = \frac{1}{2}x + 3$

(j) $2x - 5 = 13$
