

MATHEMATICS GRADE 9

DATE:
1. TOPIC: ALGEBRAIC EQUATIONS - 3



2. CONCEPTS & SKILLS TO BE ACHIEVED:

- By the end of the lesson learners should know and be able to solve equations by using laws of exponents

3. RESOURCES:	DBE Workbook 1, Sasol-Inzalo book 1, Textbooks,
ONLINE RESOURCES	https://drive.google.com/open?id=1Qw6gZzmSxQ-ypsHmqx1LHnVbA2HsKX79 https://www.thelearningtrust.org/asp-treasure-box

4. INTRODUCTION

Laws of exponents



- The laws of exponents should be introduced through a range of numeric examples first, then variables can be used.
- The following laws of exponents should be known and used in solving equations involving exponents. In the table below, *m* and *n* are integers and *a* and *t* are not equal to 0:

$a^m \times a^n = a^{m+n}$	$a^m \div a^n = a^{m-n}$
Examples	
a) $2^3 \times 2^4 = 2^{3+4} = 2^7 = 128$	a) $3^5 \div 3^2 = 3^3 = 27$
b) $x^3 \times x^4 = 3^{3+4} = x^7$	b) $x^5 \div x^3 = x^2$



$(a^m)^n = a^{m \times n}$	$(a \times t)^n = a^n \times t^n$
Examples	
$(2^3)^2 = 2^6 = 64$	$(3x^2)^3 = 3^3 x^6 = 27x^6$
$a^0 = 1$	$a^{-m} = \frac{1}{a^m}$
Examples	
$(37)^0 = 1$	$5^{-3} = \frac{1}{5^3} = \frac{1}{125}$
$(4x^2)^0 = 1$	$7^3 \div 7^5 = 7^{-2} = \frac{1}{7^2} = \frac{1}{49}$

- Make sure learners understand these laws reading from both sides of the equal sign i.e. if the LHS = RHS, then the RHS = LHS



Activity 1

a) Complete the following table. (Calculators may not be used)

x	2	3	4	5
x^2				$5^2 = 25$
x^3	$2^3 = 8$			
x^4		$3^4 = 81$		
x^5			$4^5 = 1024$	

b) Solve for x and give a reason

a) $x^3 = 8$
 $x = 2$ because $2^3 = 8$

b) $x^2 = 324$
 $x = 18$ because $18^2 = 324$

Activity 2

Solve for x :

a) $2^x = 16$
 $2^x = 2^4$ write the constant in the same base as the term with exponent
 $x = 4$ equate the exponents (only if the bases are the same)

b) $5^{x-1} = 125$
 $5^{x-1} = 5^3$
 $x - 1 = 3$
 $x - 1 + 1 = 3 + 1$
 $x = 4$

c) $7^x = \frac{1}{49}$
 $7^x = 49^{-1}$
 $7^x = 7^{-2}$
 $x = -2$

a^{-m}
$= \frac{1}{a^m}$

Note:

- In the examples above, we can equate the exponents because the two numbers are equal only when they are raised to the same power.

Solve for x :

- complete the table working in pairs



- respond to probing questions from the teacher
- work individually solving equations involving exponents
- use laws of exponents to solve the equations involving exponents
- share and discuss their responses in pairs



- a) $2^{x+3} = 8$
- b) $7^{x+1} = 1$
- c) $x^0 = 1$
- d) $10^x = 0,001$
- e) $4^{-x} = \frac{1}{16}$

5. CLASSWORK & Homework

1. For what value of x is:

- (a) $x^3 = 64$ (b) $x^5 = 32$ (c) $x^4 = 256$
(d) $x^3 = 8$ (e) $x^4 = 16$ (f) $x^5 = 3\ 125$

2. Solve for x and give a reason:

- (a) $x^3 = 216$ (b) $x^2 = 324$
(c) $x^4 = 10\ 000$ (d) $8^x = 512$
e) $18^x = 324$ (f) $6^x = 216$



6. CONSOLIDATION / CONCLUSION

Emphasise the following:

- a) learners must know the exponent laws and be able to apply it,
- b) to solve an equation where the variable is in the exponent position, the basis must be made the same so that the exponents can be equated.





ANSWERS

Activity 1

x	2	3	4	5
x^2	$2^2 = 4$	$3^2 = 9$	$4^2 = 16$	$5^2 = 25$
x^3	$2^3 = 8$	$3^3 = 27$	$4^3 = 64$	$5^3 = 125$
x^4	$2^4 = 16$	$3^4 = 81$	$4^4 = 256$	$5^4 = 625$
x^5	$2^5 = 32$	$3^5 = 243$	$4^5 = 1024$	$5^5 = 3125$

Activity 2

Solve for x ;

a) $2^{x+3} = 8$
 $2^{x+3} = 2^3$
 $\therefore x + 3 = 3$
 $x = 3 - 3$
 $x = 0$

b) $7^{x+1} = 1$
 $7^{x+1} = 7^0$
 $\therefore x + 1 = 0$
 $x = 0 - 1$
 $x = -1$

c) $x^0 = 1$
 $x^0 = x^0$
 $x \in R$

d) $10^x = 0,001$
 $10^x = 10^{-3}$
 $\therefore x = -3$

e) $4^{-x} = \frac{1}{16}$
 $4^{-x} = 4^{-2}$
 $\therefore -x = -2$
 $x = 2$

HOMEWORK

1a) $x = 4$

b) $x = 2$

c) $x = 4$

d) $x = 2$

e) $x = 2$

f) $x = 5$

2a) $x = 6$ because $6^3 = 216$

b) $x = 18$ because $18^2 = 324$

c) $x = 10$ because $10^4 = 10\,000$

d) $x = 3$ because $8^3 = 512$

e) $x = 2$ because $18^2 = 324$

f) $x = 3$ because $6^3 = 216$