**Foundation of Mathematics and Pre-Calculus 10**

**Chapter 1**

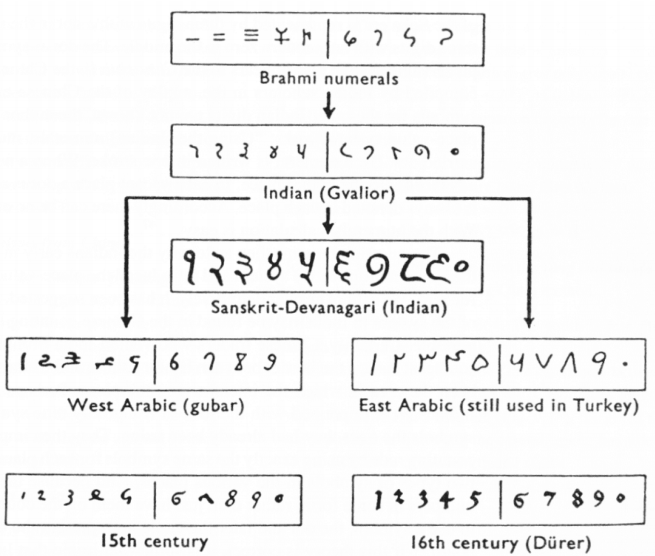
**Real Numbers**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Mr. Formaran**

**1.1 Number Systems**

Number: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Numeral: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Hindu—Arabic Number System Roman Numerals**



1 = \_\_\_\_\_\_\_\_



2 = \_\_\_\_\_\_\_\_



3 = \_\_\_\_\_\_\_\_



4 = \_\_\_\_\_\_\_\_



5 = \_\_\_\_\_\_\_\_



6 = \_\_\_\_\_\_\_\_



7 = \_\_\_\_\_\_\_\_



8 = \_\_\_\_\_\_\_\_



9 = \_\_\_\_\_\_\_\_

10 = \_\_\_\_\_\_\_\_



100 = \_\_\_\_\_\_\_\_



500 = \_\_\_\_\_\_\_\_



1000 = \_\_\_\_\_\_\_\_

Try these:

Numerals Brahmi Numerals Roman Numerals

\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_

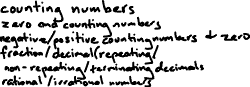
Natural Numbers ( ) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Whole Numbers ( ) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Integers ( ) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Rational Numbers ( ) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Irrational Numbers ( ) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Real Numbers ( ) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Try these:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Numerals | Natural | Whole | Integers | Rational | Irrational | Real |
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**1.2 Greatest Common Factor and Least Common Multiple**

Review:

Divisibility Properties

|  |  |
| --- | --- |
| By 2 | A whole number is divisible by 2 if its last digit is even number:  0, 2, 4, 6, 8. |
| Examples: | |
| By 3 | A whole number is divisible by 3 if the sum of its digits are multiple of 3, or divisible by 3. |
| Examples: | |
| By 4 | A whole number is divisible by 4 if the last two digits are multiple of 4 or divisible by 4.  A whole number is divisible by 4 if the last two digits are zeros. |
| Examples: | |
| By 5 | A whole number is divisible by 5 if the last digit is 0 or 5. |
| Examples: | |
| By 6 | A whole number is divisible by 6 if it is an even number that is multiple of 3, or divisible by 3.  A whole number is divisible by 6 if it is divisible by 2 and 3. |
| Examples: | |
| By 9 | A whole number is divisible by 9 if the sum of its digit is multiple of 9, or divisible by 9. |
| Examples: | |
| By 10 | A whole number is divisible by 10 if it ends in a 0. |
| Examples: | |

Try these:

Put a check mark for each set that the number is divisible;

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Numerals | By 2 | By 3 | By 4 | By 5 | By 6 | By 9 | By 10 |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
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Prime Number : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

List of Prime Numbers Less Than 100

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Composite Number : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

List of Composite Numbers Less Than 100

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Zero ( 0 ) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



One ( 1 ) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Try these:

Put a check mark for each set that the numeral is;

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Numeral | Prime | Composite |  | Numeral | Prime | Composite |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |



Greatest Common Factor (**GCF**) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Least Common Multiple (**LCM**) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Finding the Greatest Common Factor (**GCF**) and Least Common Multiple (**LCM**)



|  |  |
| --- | --- |
| Methods | |
| Factor Tree | Inverse Division |
| 1. |  |
| 2. |  |
| Factor Tree | Inverse Division |
| 3. |  |
| 4. |  |

Try these:

Finding the Greatest Common Factor (**GCF**) and Least Common Multiple (**LCM**)

|  |  |
| --- | --- |
| Factor Tree | Inverse Division |
|  |  |

**1.3 Squares and Square Roots**

Perfect Squares (a2) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_

A picture containing text, clipart

Description automatically generatedSquare root ( a ) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Numeral | Squares | Computation | Square Numeral | Square root | Numeral |
| 1 | 12 | 1 x 1 | 1 | A picture containing text, clipart  Description automatically generatedA picture containing text, clipart  Description automatically generated1 | 1 |
| 2 | 22 | 2 x 2 | 4 | A picture containing text, clipart  Description automatically generated4 | 2 |
| 3 | 32 | 3 x 3 | 9 | 9 | 3 |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |
| 6 |  |  |  |  |  |
| 7 |  |  |  |  |  |
| 8 |  |  |  |  |  |
| 9 |  |  |  |  |  |
| 10 |  |  |  |  |  |
| 11 |  |  |  |  |  |
| 12 |  |  |  |  |  |
| 13 |  |  |  |  |  |
| 14 |  |  |  |  |  |
| 15 |  |  |  |  |  |
| 16 |  |  |  |  |  |
| 17 |  |  |  |  |  |
| 18 |  |  |  |  |  |
| 19 |  |  |  |  |  |
| 20 |  |  |  |  |  |

Finding Square Roots Without a Calculator or Table

|  |  |
| --- | --- |
| Methods | |
| Factor Tree | Inverse Division |
|  |  |
|  |  |
|  |  |

Cubes and Cube Roots

Perfect Cubes (a3) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

A picture containing text, clipart

Description automatically generatedCube root (3. a ) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Numeral | Cubes | Computation | Cube Numeral | Cube root | Numeral |
| 1 | 13 | 1 x 1 x 1 | 1 | A picture containing text, clipart  Description automatically generatedA picture containing text, clipart  Description automatically generated 3 1 | 1 |
| 2 | 23 | 2 x 2 x 2 | 8 | A picture containing text, clipart  Description automatically generated 3 8 | 2 |
| 3 | 33 | 3 x 3 x 3 | 27 | 3 27 | 3 |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |
| 6 |  |  |  |  |  |
| 7 |  |  |  |  |  |
| 8 |  |  |  |  |  |
| 9 |  |  |  |  |  |
| 10 |  |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Numeral | 4th Power | Computation | Numeral to the 4th Power | Fourth root | Numeral |
| 1 | 14 | 1 x 1 x 1 x 1 | 1 | A picture containing text, clipart  Description automatically generatedA picture containing text, clipart  Description automatically generated 4.  1 | 1 |
| 2 | 24 | 2 x 2 x 2 x 2 | 16 | A picture containing text, clipart  Description automatically generated 4 16 | 2 |
| 3 | 34 | 3 x 3 x 3 x 3 | 81 | 4 81 | 3 |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |
| 6 |  |  |  |  |  |
| 7 |  |  |  |  |  |
| 8 |  |  |  |  |  |
| 9 |  |  |  |  |  |
| 10 |  |  |  |  |  |
| Numeral | 5th Power | Computation | Numeral to the 5th Power | Fifth root | Numeral |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |
| 3 |  |  |  |  |  |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |
| 6 |  |  |  |  |  |
| 7 |  |  |  |  |  |
| 8 |  |  |  |  |  |
| 9 |  |  |  |  |  |
| 10 |  |  |  |  |  |

Finding Roots Without a Calculator or Table

|  |  |
| --- | --- |
| Methods | |
| Factor Tree | Inverse Division |
|  |  |
|  |  |
|  |  |
|  |  |

Try these:

Find Roots Without a Calculator or Table

|  |  |
| --- | --- |
| Factor Tree | Inverse Division |
|  |  |

**1.4 Rational and Irrational Numbers**

Review:

Rational: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Ex. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Irrational: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Ex. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Approximating Irrational Numbers.



Estimating the location of irrational numbers on number line.



Ordering irrational Numbers on number line.



**1.5 Exponential Notation**

Review: 33 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



(3a)2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



(-a)3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



10w3  = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Exponents of 0 and 1

a1 = a, for any number of a.



*any number raised to the power of 1 the answer is \_\_\_\_.*



a0 =1, for any non-zero number a.



*any number raised to the power of 0 the answer is \_\_\_\_.*



Examples:



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Product Rule

am x an = am + n , a = 0

For any number a with exponents m and n

*Multiplying expression by another expression with the same*

*base, the exponents will be added up.*

Examples:



a2 x a3 = (a1 x a1) (a1 x a1 x a1) = a1+1+1+1+1 = a5



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



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Quotient Rule

am

= am – n , a = 0

an

For any number a with exponents m and n

*Dividing expression by another expression with the same base,*

*the exponents will be subtracted.*

Examples:

= = a4

a9 a x a x a x a x a x a x a x a x a

a5 a x a x a x a x a



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Power Rule

(am)n = a(m)(n)



For any number a with exponents m and n

Examples:



(43)4 = 4(3)(4) = 420



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A Product to a Power Rule



(ab)n = an xbn

For any numbers a and b with exponent n

Examples:



(3a)2 = 32 x a2 = 9a2



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A Fraction to a Power Rule

a n an



=

b bn

For any numbers a and b, b = 0, with exponent n

Examples:



=

=

3 2 32 9



b b2 b2



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



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Negative Exponent Rule

1



a-n =

an



For any number a, a = 0, with exponent n

Examples:

1

8

1

23

2-3 = =



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



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Changing from Negative to Positive Exponents Rule

a-m bn a -m b m



= and =

b-n am b a

For any numbers a and b, b = 0, with exponent n

Examples:



=

=

2-2 33 27



3-3 22 4



=

=

4 -2 52 25



5 42 16



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Shape

Description automatically generated

Rational Exponent Rule (a1/n)

Shape

Description automatically generated



a1/n = n a1



For any non-negative real number a, and any positive integer n.



Shape

Description automatically generated Examples:

x1/2  = x



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



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Rational Exponent Rule (am/n)

Shape

Description automatically generated

m

n

a = n am

For any non-negative real number a, and any positive integer n.

Examples:



6

2

3

2

3

2

4  = (22) = 2(2)( ) = 2 23 = 8



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



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**1.6 Irrational Numbers**

Shape

Description automatically generatedShape

Description automatically generatedShape

Description automatically generatedShape

Description automatically generatedShape

Description automatically generatedThe Product Rule for Square Roots

For any real numbers *A*  and *B*  :  *A* x *B* = *A* x *B*

Examples:

|  |  |  |  |
| --- | --- | --- | --- |
| Shape  Description automatically generatedMethod 1 | Method 2 | Shape  Description automatically generatedMethod 3 | Method 4 |
| 72 | Shape  Description automatically generated72 | 72 | Shape  Description automatically generated72 |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

Shape

Description automatically generatedShape

Description automatically generatedAn expression such as 2 7 is called a **mixed root**,

and an expression 28 is called an **entire root**.

Examples:

Shape

Description automatically generatedShape

Description automatically generatedShape

Description automatically generatedShape

Description automatically generated

9 3 = 92 x 3 or 9 x 9 x 3

Shape

Description automatically generated

= 81 x 3

Shape

Description automatically generated

= 243

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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