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CSN341
R Programming

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R for Basic Math

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R

All common arithmetic operations and mathematical functionality are ready to use at the console prompt.

(+, -, *, /, ^)

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R for arithmetic

In R, standard mathematical rules apply throughout and follow the usual **left-to-right** order of operations: **parentheses, exponents, multiplication, division, addition, subtraction (PEMDAS).**

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R for arithmetic

Except, **exponent (^).**

In R, the exponentiation operator ^ exhibits **right-to-left** associativity.

E.g.: 2^3^2

R

Examples

```
R> 2+3
[1] 5
R> 14/6
[1] 2.333333
R> 14/6+5
[1] 7.333333
R> 14/(6+5)
[1] 1.272727
R> 3^2
[1] 9
R> 2^3
[1] 8
```

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R for arithmetic

You can find the square root of any non-negative number with the **sqrt function**.

```
R> sqrt(x=9)
[1] 3
R> sqrt(x=5.311)
[1] 2.304561
```

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R for arithmetic

$$10^2 + \frac{3 \times 60}{8} - 3$$

$$\frac{5^3 \times (6 - 2)}{61 - 3 + 4}$$

$$2^{2+1} - 4 + 64^{-2^{2.25-\frac{1}{4}}}$$

$$\left(\frac{0.44 \times (1 - 0.44)}{34}\right)^{\frac{1}{2}}$$

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R for arithmetic

$$10^2 + \frac{3 \times 60}{8} - 3$$

```
R> 10^2+3*60/8-3
[1] 119.5
```

$$\frac{5^3 \times (6-2)}{61-3+4}$$

```
R> 5^3*(6-2)/(61-3+4)
[1] 8.064516
```

$$2^{2+1} - 4 + 64^{-2^{2.25-\frac{1}{4}}}$$

```
R> 2^(2+1)-4+64^((-2)^(2.25-1/4))
[1] 16777220
```

$$\left(\frac{0.44 \times (1-0.44)}{34}\right)^{\frac{1}{2}}$$

```
R> (0.44*(1-0.44)/34)^(1/2)
[1] 0.08512966
```

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R for arithmetic

In R, the log transformation is achieved with the **log function.**

```
R> log(x=243,base=3)
[1] 5
```

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R for arithmetic

Points to consider:

- Both x and the base must be positive.
- The log of any number x when the base is equal to x is 1.
- The log of x = 1 is always 0, regardless of the base.

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E-Notation in R

When R prints large or small numbers beyond a certain threshold of significant figures, the numbers are displayed using the classic scientific e-notation.

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E-Notation in R

In e-notation, any number x can be expressed as *xey*, which represents exactly $x * 10^y$.

```
R> 2342151012900
[1] 2.342151e+12
R> 0.0000002533
[1] 2.533e-07
```

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Exercise 2.1

a. Using R, verify that

$$\frac{6a + 42}{3^{4.2-3.62}} = 29.50556$$

when $a = 2.3$.

b. Which of the following squares negative 4 and adds 2 to the result?
   i. `(-4)^2+2`
   ii. `-4^2+2`
   iii. `(-4)^(2+2)`
   iv. `-4^(2+2)`

c. Using R, how would you calculate the square root of half of the average of the numbers 25.2, 15, 16.44, 15.3, and 18.6?

d. Find $\log_e 0.3$.

e. Compute the exponential transform of your answer to (d).

f. Identify R's representation of –0.000000000423546322 when printing this number to the console.

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Operators in R

Arithmetic Operators

Operator	Description	Example	Output
+	Addition	5 + 3	8
-	Subtraction	5 - 3	2
*	Multiplication	5 * 3	15
/	Division	5 / 2	2.5
^ or **	Exponentiation	2 ^ 3	8
%%	Modulus (remainder)	5 %% 2	1
%/%	Integer division (quotient)	5 %/% 2	2

Relational Operators

Operator	Description	Example	Output
==	Equal to	5 == 3	FALSE
!=	Not equal to	5 != 3	TRUE
>	Greater than	5 > 3	TRUE
<	Less than	5 < 3	FALSE
>=	Greater than or equal to	5 >= 5	TRUE
<=	Less than or equal to	3 <= 5	TRUE

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Logical Operators

Operator	Description	Example	Output
&	**Element-wise AND** – TRUE if **both** elements are TRUE	c (TRUE, FALSE) & c (TRUE, TRUE)	TRUE FALSE
|	**Element-wise OR** – TRUE if **at least one** element is TRUE	c(TRUE, FALSE) | c (TRUE, TRUE)	TRUE TRUE
!	**NOT** – Negates the logical value	!c(TRUE, FALSE)	FALSE TRUE

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Assigning Objects in R

If you want to **save the results** and **perform further operations**, you need to be able to **assign** the results of a given computation to an object.

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Assigning Objects in R

You can specify an assignment in R in two ways:

- Using arrow notation (<-)
- Using a single equal sign (=)

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Assigning Objects in R

You can specify an assignment in R in two ways:

- Using arrow notation (<-)
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Exercise 2.2

a. Create an object that stores the value $3^2 \times 4^{1/8}$.

b. Overwrite your object in (a) by itself divided by 2.33. Print the result to the console.

c. Create a new object with the value -8.2×10^{-13}.

d. Print directly to the console the result of multiplying (b) by (c).

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Thank You