Manual of „alfacentrum” library:
mathematical functions for sobieszewo language

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MATHEMATICAL FUNCTIONS

1. **ac_FACTORIAL**
   Returns a factorial of the given value. **Important:** value will always be set as integer: $int(5.4) = 5$.
   Example: Calculate $5!$

```
SET X
ADD 5
ac_FACTORIAL X
PRT X
```

   Answer: 125

2. **ac_xPI**
   Returns a multiple of the π.
   Example: Calculate $2 \times \pi$

```
SET X
ADD 2
ac_xPI X
PRT X
```

   Answer: 6.283185307179586

3. **ac_xe**
   Returns a multiple of the e (Euler’s number). Same usage as ac_xPI.

4. **ac_ex**
   Returns a power of the e.
   Example: Calculate e^5

```
SET X
ADD 5
ac_ex X
PRT X
```

   Answer: 148.41315910257657

5. **ac_POW**
   Calculates a power of given value.
   Example: Calculate $3^{4.55}$

```
SET X
ADD 3
ac_POW 4.55
PRT X
```

   Answer: 148.21825945041095

6. **ac_ROOT**
   Calculates a root of given value.
   Example: Calculate $\sqrt{25}$

```
SET X
ADD 25
ac_ROOT 2
PRT X
```

   Answer: 5

7. **ac_RAD2DEG**
   Converts radians to degrees.
   Example: Convert $\pi/2$ rad to degrees.

```
SET X
ADD 1
ac_xPI X
DIV 2
ac_RAD2DEG X
PRT X
```

   Answer: 90.0

8. **ac_DEG2RAD**
   Converts degrees to radians.
   ac_DEG2GRA
   Converts degrees to gradians.
   ac_RAD2GRA
   Converts radians to gradians.
   ac_GRA2DEG
   Converts gradians to degrees.
   ac_GRA2RAD
   Converts gradians to radians. Same usage as ac_RAD2DEG.

9. **ac_SIN**
   Calculates a sine of the given angle. **Important:** angle must be in degrees.
   Example: Calculate $\sin(30°)$

```
SET X
ADD 30
ac_SIN X
PRT X
```

   Answer: 0.49999999999999994

10. **ac_COS**
    Calculates a cosine of the given angle.
    ac_TAN
    Calculates a tangent of the given angle.
    ac_COT
    Calculates a cotangent of the given angle. Same usage as ac_SIN.

11. **ac_ASIN**
    Calculates an angle for the given sine proportion. **Important:** the answer is in degrees.
    Example: Calculate $\text{asin}(\sqrt{3}/2)$

```
SET X
ADD 3
ac_ROOT 2
DIV 2
ac_ASIN X
PRT X
```

    Answer: 60.0

12. **ac_ACOS**
    Calculates an angle for the given cosine proportion.

ac_ATAN
Calculates an angle for the given tangent proportion.
ac_ACOT
Calculates an angle for the given cotangent proportion. Same usage as ac_ASIN.

13. **ac_CRD**
    Calculates a length of a chord of the given angle. Chord is the predecessor of trigonometry, used by ancient mathematicians. **Important:** the answer is the length of a chord when the radius of a cirle is equal to 1. To get the correct chord length, multiply it by correct radius.
    Example: The radius of the Earth is approximately equal to 6371 km. How long would be a hypothetical straight-line tunnel from the equator to the North Pole?

```
SET X
ADD 90 //angular difference between equator and pole
ac_CRD X
MUL 6371
PRT X
```

    Answer: 9009.954605878987

14. **ac_ACRD**
    Calculates an angle of the given length of the chord. **Important:** to get the correct answer, chord must be divided by the length of the radius of a concidered circle.
    Example: An isosceles figure is inscribed in a circle with a radius of 2 meters. The length of one side of the figure is approximately 1.7349 meters. How many sides does this figure have?

```
SET X
ADD 1.7349
DIV 2
ac_ACRD X
DIV 360
ac_POW -1
PRT X
```

    Answer: 7.002748985713219 (It has seven sides)

15. ac_LOGe

Calculates a natural logarytm of given value.
Example: Calculate $\ln(2137)$

```
SET X
ADD 2137
ac_LOGe X
PRT X
```

Answer: 7.6671582553191495

16. ac_LOG10

Calculates a common logarithm of given value. Same usage as ac_LOGe.

17. ac_LOGx

Calculates a logarithm of given value and base.
Example: Calculate $\log_5(125)$

```
SET X
ADD 125
ac_LOGx 5
PRT X
```

Answer: 2.9999999999999982

18. ac_SINH

Calculates hyperbolic sine of given value.

ac_COSH

Calculates hyperbolic cosine of given value.

ac_TANH

Calculates hyperbolic tangent of given value.

ac_COTH

Calculates hyperbolic cotangent of given value. Same usage as ac_SIN.

19. ac_ARSINH

Calculates area hyperbolic sine of given value.

ac_ARCOSH

Calculates area hyperbolic cosine of given value.

ac_ARTANH

Calculates area hyperbolic tangent of given value.

ac_ARCOTH

Calculates area hyperbolic cotangent of given value. Same usage as ac_ASIN.

FORMULAS AND CALCULUS

1. **ac_CALC**
   Calculates the answer of given formula with respect to given single value, but does not exceed the functionality of all above formulas when using „by hand". CALC function must be written right away after the variable for the formula has been choosed (as in functions of two variables in **MATHEMATICAL FUNCTIONS** section). Formulas use same functions as above. **Important:** in order to use CALC function correctly, the formula must be written in specific way. No matter what letter the variable has been set to, variable in formula is always „X".
   Example: Calculate $f(X) = X^2 + \sqrt[X]{256} - (X/2 + \log_{10} 100) + 4! \Big|_{X=4}$

```
SET X
ADD 4
ac_CALC ac_POW(X,2);ADD;ac_ROOT(256,X);SUB;(;X;DIV;2;ADD;
ac_LOGx(100,10););ADD;ac_FACTORIAL(X)
PRT X
```

   Answer: 40.0

2. **ac_eDIFF**
   Evaluates a first derivative of given formula with respect to given single value.
   Example: Evaluate $f'(Y) = Y^3 + 4Y \Big|_{Y=16}$

```
SET Y
ADD 16
ac_eDIFF ac_POW(X,3);ADD;4;MUL;X
PRT Y
```

   Answer: 772.0000001427251