

Picomath algebraic
manipulation package

ACORNSOFT MATHS PACK 2

$$\frac{1}{x-1}$$

$$\frac{1 + \frac{1}{x-1}}{1 - \frac{1}{x+1}} \rightarrow$$

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Accuracy

The expression must be such that the degree of any term containing X is 6 or less, that of any term containing Y is 4 or less, any containing Z is 2 or less. If the exact expansion contains terms of greater degree than these such terms will be lost, and inaccuracy will be introduced into the coefficients of the other terms.

RATIONAL

Program 4K, graphics 1/2K, needs floating point.

The Rational program expands an expression in X into the form $p(X)/q(X)$, where $p(X)$ and $q(X)$ are polynomials of degree four or less in X.

Enter the expression in terms of X. The program will print the expanded expression, then prompt to rerun (with a new expression) or quit.

Example

$$A = ?1 + (1 - X)/(1 + X) + (2 - X)/(2 + X)$$

THIS SIMPLIFIES TO

$$A = \frac{-X^2 + 3X + 6}{X^2 + 3X + 2}$$

Accuracy

The expression must be such that, when expressed in the form $p(X)/q(X)$, p and q are polynomials in X of degree four or less. If this is not the case, inaccuracy may occur, and the resultant expression may be more complex than the original expression.

TRIGONOM

Program 5K, graphics 1/2K, needs floating point.

The Trigonometry program expands trigonometric expressions in X and Y into a linear sum of simple trigonometric functions, and will integrate and differentiate with respect to X.

Enter the expression in terms of SIN, COS, TAN, COT, SEC or CSC (cosecant) of X or a multiple of X, and SIN or COS of Y. PI may be used, and radian measure is assumed. To the prompt:

E/D/I/N/Q ?

reply as for the polynomial program.

Examples

$$A = ?2 * \text{TANX} * \text{TANX} - \text{COTX} * \text{CSCX} + 3 * \text{COS}(2 * X) / 4 + \text{SINX} * \text{COSY}$$

E/D/I/N/Q ?E

$$A = -\text{COTX} * \text{CSCX} + 2 * \text{SEC} \uparrow 2X - 1.25 + \text{SINX} * \text{COSY} - 1.5 * \text{SIN} \uparrow 2X$$

E/D/I/N/Q ?I

$$\text{INT}(A)DX = \text{CSCX} + 2 * \text{TANX} - 1.25X - \text{COSX} * \text{COSY} - 0.75(X - \text{SINX} * \text{COSX})$$

E/D/I/N/Q ?N

.

$$A = ?\text{SECX}$$

E/D/I/N/Q ?I

$$\text{INT}(A)DX = \text{LN TAN}(X/2 + \text{PI}/4)$$

E/D/I/N/Q ?D

$$DA/DX = \text{TANX} * \text{SECX}$$

Accuracy

The program uses the following functions to generate the expansion:

1, tanx.secx, cotx.cscx, sec \uparrow 2x = secx.secx, cotx, tanx, secx, cscx, siny, cosy, cosx, cosx.siny, cosx.cosy, sinx, sinx.siny, sinx.cosy, sinx.cosx, sin \uparrow 2x.

If the expression cannot be exactly represented by a linear combination of these functions, the expansion given by the program will be inaccurate, and will frequently be much more complex than the original expression.

FOURIER

Program 5K, graphics 1/2K, needs floating point.

The Fourier program performs Fourier analysis of an expression in X into an expansion in terms of sums of sines and cosines of integer multiples of X, and will integrate or differentiate with respect to X. The expression is entered in terms of X, as in the polynomial program, using SIN and COS of (N*X). The constant PI may be used, and radian measure is assumed. To the prompt:

E/D/I/N/Q?

reply as for the polynomial program.

Example

$$A = ?\text{SIN}(2 * X) * \text{SIN}(5 * X) - 4 * \text{SINX} * \text{COS}(3 * X)$$

E/D/I/N/Q ?E

$$A = 2 * \text{SIN}(2X) + 0.5 * \text{COS}(3X) - 2 * \text{SIN}(4X) - 0.5 * \text{COS}(7X)$$

E/D/I/N/Q ?D

$$DA/DX = 4 * \text{COS}(2X) - 1.5 * \text{COS}(3X) - 8 * \text{COS}(4X) + 3.5 * \text{SIN}(7X)$$

(continued on back)

(continued)

Accuracy

The program produces a trigonometric polynomial, i.e. a linear sum of $\text{SIN}(nX)$ and $\text{COS}(nX)$, for $n \leq 8$, so if the exact expansion of the expression contains such terms with $n > 8$, these will be lost.

Errors

When the expression is entered, the programs replace occurrences of the variables X, Y and Z by %X, %Y and %Z, so that the expression may be evaluated using floating point arithmetic; they then insert the expression into line 20, as

```
20a%A= floating point expression  
30bR.
```

The expression is then evaluated for various values of %X, %Y and %Z, giving the result in %A. The most common errors occurring in evaluation of this line are:

29 Unknown function

The expression, with X, Y and Z replaced by %X, %Y and %Z, is not a legal floating-point expression. LIST 20 for inspection, but do not directly alter line 20 in any way.

169 Overflow – division by zero.

The programs evaluate the expression for non-algebraic values of X, so this error should not occur in expressions using X only. However the programs use values such as 0, +1, -1, +2, -2.. for Y and Z so expressions such as $1/Z$ in POLYNOM or CSC Y in TRIGONOM will cause this error.

191 Log or power of zero or a negative number.

The expression contains the power '↑' operator. Retype the expression using repeated multiplication instead.

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