```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%                                                    %
%  MathM.tex by Shoichi Midorikawa                   %
%                                                    %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%


\newdimen\ma \newdimen\mb \newdimen\mc \newdimen\md

\makeatletter

%%%%%%%%%%%%%%%%%%%%%%%% Arithmetic %%%%%%%%%%%%%%%%%%%%%%%%%%%%%

\newcount\ca  \newcount\cb  \newcount\cc  \newcount\cd  \newcount\ce
\newcount\cx \newcount\cxx

\def\Fn#1#2{%  #1を小数第4位を四捨五入するプログラム
  \count0=\X  \count1=\X  \count2=\Z
  \divide \count0 by \count2   \ca=\count0
  \multiply \count0 by \count2   \advance \count1 by -\count0   \multiply
\count1 by 10   \count0=\count1
  \divide \count0 by \count2   \cb=\count0
  \multiply \count0 by \count2   \advance \count1 by -\count0   \multiply
\count1 by 10   \count0=\count1
  \divide \count0 by \count2   \cc=\count0
  \multiply \count0 by \count2   \advance \count1 by -\count0   \multiply
\count1 by 10   \count0=\count1
  \divide \count0 by \count2   \cd=\count0
  \multiply \count0 by \count2   \advance \count1 by -\count0   \multiply
\count1 by 10   \count0=\count1
  \divide \count0 by \count2   \ce=\count0
  \edef\Re{\the\ce}
  \ifnum\Re>4 \advance \cd by 1 \fi        %#1の小数点第5位を四捨五入するプログラム
  \ifnum\cd=10 \cd=0 \cx=1 \else \cx=0 \fi   \advance \cc by \cx
  \ifnum\cc=10 \cc=0 \cx=1 \else \cx=0 \fi   \advance \cb by \cx
  \ifnum\cb=10 \cb=0 \cx=1 \else \cx=0 \fi   \advance \ca by \cx
}


\def\Fnb#1#2{%
  \count0=\X  \count1=\X  \count2=\Z
  \divide \count0 by \count2   \ca=\count0
  \multiply \count0 by \count2   \advance \count1 by -\count0   \multiply
\count1 by 10   \count0=\count1
  \divide \count0 by \count2   \cb=\count0
  \multiply \count0 by \count2   \advance \count1 by -\count0   \multiply
\count1 by 10   \count0=\count1
  \divide \count0 by \count2   \cc=\count0
  \multiply \count0 by \count2   \advance \count1 by -\count0   \multiply
\count1 by 10   \count0=\count1
  \divide \count0 by \count2   \cd=\count0
  \multiply \count0 by \count2   \advance \count1 by -\count0   \multiply
\count1 by 10   \count0=\count1
  \divide \count0 by \count2   \ce=\count0
  \multiply \count0 by \count2   \advance \count1 by -\count0   \multiply
\count1 by 10   \count0=\count1
```

```
  \divide \count0 by \count2   \cx=\count0
  \edef\Rx{\the\cx}
}


\def\R#1#2{%      結果の符号を決める
  \Fn{\X}{\Z}
  \edef\Ra{\the\ca}    \ifnum\Z<0 \edef\Ra{-\the\ca} \fi
  \def\Rdot{.} \edef\Rb{\the\cb} \edef\Rc{\the\cc} \edef\Rd{\the\cd}
\edef\Re{\the\ce}
  \advance \cd by \cxx    \advance \cc by \cd    \advance \cb by \cc
  \Ra
  \ifnum\cb>0 \Rdot\Rb \fi   \ifnum\cc>0 \Rc \fi
  \ifnum\cd>0 \Rd \fi        %\ifnum\ce>0 \Re \fi
}

\def\RB#1#2#3{%  割り算の時、結果の符号を決める。
  \Fn{\X}{\Z}
  \edef\Ra{\the\ca}    \ifnum\Y<0 \edef\Ra{-\the\ca} \fi
  \def\Rdot{.} \edef\Rb{\the\cb} \edef\Rc{\the\cc} \edef\Rd{\the\cd}
\edef\Re{\the\ce}
  \advance \cd by \cxx    \advance \cc by \cd    \advance \cb by \cc
  \Ra
  \ifnum\cb>0 \Rdot\Rb \fi \ifnum\cc>0 \Rc \fi
  \ifnum\cd>0 \Rd \fi  %\ifnum\ce>0 \Re \fi
}


\def\Eadd#1#2{%  足し算
\newdimen\X
\newdimen\Y
\newdimen\Z
\Z=1.0\p@
\X=#1\p@
\Y=#2\p@
\ifnum\X<-\Y \Z=-1.0\p@ \fi
\advance \X by \Y
\R{\X}{\Z}
}

{\catcode`\p=12\catcode`\t=12\gdef\Rval#1pt{#1}}
\def\EaddS#1#2#3{%
\newdimen\X
\newdimen\Y
\newdimen\Z
\X=#1\p@
\Y=#2\p@
\advance \X by \Y     %足し算
\edef\u{\expandafter\Rval\the\X}      %足し算結果
}


\def\Esub#1#2{%  引き算
\newdimen\X
\newdimen\Y
\newdimen\Z
\X=#1\p@
```

```
\Y=#2\p@
\Z=1.0\p@
\ifnum\X<\Y \Z=-1.0\p@ \fi
\advance \X by -\Y
\R{\X}{\Z}
}

\def\EsubS#1#2#3{%
\newdimen\X
\newdimen\Y
\newdimen\Z
\X=#1\p@
\Y=#2\p@
\advance \X by -\Y
\edef\u{\expandafter\Rval\the\X}
}


\def\Emul#1#2{%  掛け算
\newdimen\X
\newdimen\Y
\newdimen\Z
\Z=1.0\p@
\X=#1\p@
\X=#2\X
\Z=1.0\p@
\ifnum\X<0 \Z=-1.0\p@ \fi
\R{\X}{\Z}
}

\def\EmulS#1#2#3{%
\newdimen\X
\newdimen\Y
\X=#1\p@
\X=#2\X
\edef\u{\expandafter\Rval\the\X}
}


\def\Ediv#1#2{%
  \newdimen\X  \newdimen\Y  \newdimen\Z
  \X=#1\p@  \Y=#2\X \ifnum\X<0 \X=-\X \fi
  \Z=#2\p@  \ifnum\Z<0 \Z=-\Z \fi
  \RB{\X}{\Y}{\Z}
}


\def\EdivS#1#2#3{%
  \newdimen\X \newdimen\Z \newdimen\Y
  \X=#1\p@  \Y=#2\X  \ifnum\X<0 \X=-\X \fi
  \Z=#2\p@  \ifnum\Z<0 \Z=-\Z \fi
  \Fnb{\X}{\Z}
  \edef\Ra{\the\ca.} \ifnum\Y<0 \edef\Ra{-\the\ca.} \fi
  \edef\Rb{\the\cb}  \edef\Rc{\the\cc}  \edef\Rd{\the\cd}  \edef\Re{\the\ce}
  \edef\u{\Ra\Rb\Rc\Rd\Re\Rx}
}


%%%%%%%%%%%%%%%%% combinatorics %%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
%--------- Facotrial --------------

\def\factorial#1{
\count1=#1
\newcount\cnt
%\newcount\cntt
\newcount\mul
\cnt=0%
\mul=1%
\loop
\ifnum\count1>\cnt
%\cntt=\cnt
\advance \cnt by 1
\multiply \mul by \cnt
\repeat
\the\mul
}

%---------- Permutations ---------------

\def\perm#1#2{
\count0=#1
\count1=#1
\advance \count1 by -#2
\advance \count1 by 1
\newcount\mul
\mul=\count0
\loop
\ifnum\count0>\count1
\advance \count0 by -1
\multiply \mul by \count0
\repeat
\the\mul
}



%---------- Combinations ---------------

\def\comb#1#2{
\count0=#1
\count1=#1
\count2=1
\advance \count1 by -#2
\advance \count1 by 1
\newcount\mul
\mul=#1
\loop
\ifnum\count0>\count1
\advance \count0 by -1
\advance \count2 by 1
\multiply \mul by \count0
\divide \mul by \count2
\repeat
\ifnum#2=0 \mul=1 \fi
\the\mul
}


\newcounter{K}

\def\Expand(#1#2#3)^#4{%
```

```
\newcount\cnt
\newcount\cnst
\cnt=#4
\advance \cnt by -1
\cnst=#4
\ifnum#4=2
 \if#2+ #1^2 + 2 #1#3 + #3^2 \else
    #1^2 - 2 #1#3 + #3^2 \fi
\else
\newcount\N \N=\cnt
\setcounter{K}{2}
\if#2+
#1^{#4} + \advance \cnst by -1
#4 #1^{\the\cnst} #3 + \advance \cnst by -1
\@whilenum\value{K}<\N\do{
\comb{#4}{\theK} #1^{\the\cnst} #3^{\theK}  + \advance \cnst by -1
\stepcounter{K}}
#4 #1 #3^{\theK} +
#3^{#4}
\fi
\if#2-
\newcount\cnv \cnv=1
#1^{#4} -
\advance \cnst by -1
#4 #1^{\the\cnst} #3  +
\advance \cnst by -1
\@whilenum\value{K}<\N\do{
\comb{#4}{\theK} #1^{\the\cnst} #3^{\theK}
\ifnum\cnv=0 + \else - \fi \ifnum\cnv=0 \cnv=1 \else \cnv=0 \fi
\advance \cnst by -1 \stepcounter{K}}
#4 #1 #3^{\theK}
\ifnum\cnv=0 + \else - \fi \ifnum\cnv=0 \cnv=1 \else \cnv=0 \fi
#3^{#4}
\fi
\fi}



\makeatother
```