

! This is a test program for the FM 1.4 multiple-precision rational arithmetic package.

! All of the rational arithmetic routines are tested.

! If all tests are completed successfully, this line is printed:

! 499 cases tested. No errors were found.

```
MODULE SUM_R
```

```
INTERFACE SUM_RAT
```

```
  MODULE PROCEDURE SUM0
```

```
  MODULE PROCEDURE SUM1
```

```
  MODULE PROCEDURE SUM2
```

```
END INTERFACE
```

```
CONTAINS
```

```
  FUNCTION SUM0(A,B)      RESULT (RETURN_VALUE)
```

! Function that returns a rational result.

```
  USE FM_RATIONAL_ARITHMETIC
```

```
  IMPLICIT NONE
```

```
  TYPE (FM_RATIONAL) :: A,B,RETURN_VALUE
```

```
  RETURN_VALUE = A + B
```

```
  END FUNCTION SUM0
```

```
  FUNCTION SUM1(A,B)      RESULT (RETURN_VALUE)
```

! Function that returns a rational vector result.

```
  USE FM_RATIONAL_ARITHMETIC
```

```
  IMPLICIT NONE
```

```
  TYPE (FM_RATIONAL) :: A(3),B(3),RETURN_VALUE(3)
```

```
  INTEGER :: J
```

```
  DO J = 1, 3
```

```
    RETURN_VALUE(J) = A(J) + B(J)
```

```
  ENDDO
```

```
  END FUNCTION SUM1
```

```
  FUNCTION SUM2(A,B)      RESULT (RETURN_VALUE)
```

! Function that returns a rational matrix result.

```
  USE FM_RATIONAL_ARITHMETIC
```

```
  IMPLICIT NONE
```

```
  TYPE (FM_RATIONAL) :: A(3,3),B(3,3),RETURN_VALUE(3,3)
```

```
  INTEGER :: J, K
```

```
  DO J = 1, 3
```

```
    DO K = 1, 3
```

```
      RETURN_VALUE(J,K) = A(J,K) + B(J,K)
```

```
    ENDDO
```

```
  ENDDO
```

```
  END FUNCTION SUM2
```

```
END MODULE SUM_R
```

```
MODULE TEST_RATIONAL
```

```
USE FMVALS
```

```
USE FMZM
```

```
USE FM_RATIONAL_ARITHMETIC
```

```
TYPE (FM_RATIONAL), SAVE :: A, B, C, D, RESULT, CORRECT,           &  
                             AVEC(3), BVEC(3), CVEC(3), DVEC(3),     &  
                             AMAT(3,3), BMAT(3,3), CMAT(3,3), DMAT(3,3)
```

```
!           Declare the derived type variables of type (FM), (IM).  
!           These are in the form that would be found in a user program.
```

```
TYPE (FM), SAVE :: MFM1, MFM2, MFMVEC(3), MFMMAT(3,3)
```

```
TYPE (IM), SAVE :: MIM1, MIM2, MIM3, MIMVEC(3), MIMMAT(3,3), AMAT_IM(3,6)
```

```
!           These are the variables that are not multiple precision.
```

```
INTEGER, SAVE :: J1, JV(3), JV2(3,3)
```

```
REAL, SAVE :: R1, RSMALL, RV(3), RV2(3,3)
```

```
DOUBLE PRECISION, SAVE :: D1, DSMALL, DV(3), DV2(3,3)
```

```
COMPLEX, SAVE :: C1, CV(3), CV2(3,3)
```

```
COMPLEX (KIND(0.0D0)), SAVE :: CD1, CDV(3), CDV2(3,3)
```

```
CHARACTER(100), SAVE :: ST1, ST2, STV2(3,3)
```

```
INTEGER, SAVE :: KLOG, KWSAVE, ML(2), NCASE, NERROR
```

```
REAL, SAVE :: TIME1, TIME2
```

```
LOGICAL, EXTERNAL :: IMCOMPARE
```

```
CONTAINS
```

```
SUBROUTINE TEST1
```

```
IMPLICIT NONE
```

```
INTEGER :: J, K
```

```
WRITE (KW, "(/' Testing input and output conversion for rationals.')" )
```

```
KWSAVE = KW
```

```
!           NCASE is the number of cases tested.
```

```
NCASE = 1
```

```
RESULT = TO_FM_RATIONAL( 2, 3 )
```

```
CORRECT = 0
```

```
WRITE (KLOG,*) ' '
```

```
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
```

```
WRITE (KLOG,*) ' TO_FM_RATIONAL( 2, 3 ) '
```

```
KW = KLOG
```

```
CALL FM_PRINT_RATIONAL(RESULT)
```

```
KW = KWSAVE
```

```
WRITE (KLOG,*) ' '
```

```
MIM1 = 2
```

```
CALL IMEQ(MIM1%MIM, CORRECT%NUMERATOR)
```

```
MIM1 = 3
```

```
CALL IMEQ(MIM1%MIM, CORRECT%DENOMINATOR)
```

```
!           Use the .NOT. because FMCOMPARE returns FALSE for special cases like MD = UNKNOWN,  
!           and these should be treated as errors for these tests.
```

```

IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESULT%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' TO_FM_RATIONAL')
ENDIF

NCASE = 2
RESULT = TO_FM_RATIONAL( -2, 3 )
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) ' TO_FM_RATIONAL( -2, 3 ) '
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KWSAVE
WRITE (KLOG,*) ' '
MIM1 = -2
CALL IMEQ(MIM1%MIM, CORRECT%NUMERATOR)
MIM1 = 3
CALL IMEQ(MIM1%MIM, CORRECT%DENOMINATOR)
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESULT%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' TO_FM_RATIONAL')
ENDIF

NCASE = 3
RESULT = TO_FM_RATIONAL( 2, -3 )
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) ' TO_FM_RATIONAL( 2, -3 ) '
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KWSAVE
WRITE (KLOG,*) ' '
MIM1 = -2
CALL IMEQ(MIM1%MIM, CORRECT%NUMERATOR)
MIM1 = 3
CALL IMEQ(MIM1%MIM, CORRECT%DENOMINATOR)
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESULT%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' TO_FM_RATIONAL')
ENDIF

NCASE = 4
RESULT = TO_FM_RATIONAL( -2, -3 )
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) ' TO_FM_RATIONAL( -2, -3 ) '
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KWSAVE
WRITE (KLOG,*) ' '
MIM1 = 2
CALL IMEQ(MIM1%MIM, CORRECT%NUMERATOR)
MIM1 = 3
CALL IMEQ(MIM1%MIM, CORRECT%DENOMINATOR)
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESULT%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' TO_FM_RATIONAL')

```

ENDIF

NCASE = 5

RESULT = TO_FM_RATIONAL(12, 36)

WRITE (KLOG,*) ' '

WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE

WRITE (KLOG,*) ' TO_FM_RATIONAL(12, 36) '

KW = KLOG

CALL FM_PRINT_RATIONAL(RESULT)

KW = KWSAVE

WRITE (KLOG,*) ' '

MIM1 = 1

CALL IMEQ(MIM1%MIM,CORRECT%NUMERATOR)

MIM1 = 3

CALL IMEQ(MIM1%MIM,CORRECT%DENOMINATOR)

IF ((.NOT. IMCOMPARE(RESULT%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &

(.NOT. IMCOMPARE(RESULT%DENOMINATOR,'==',CORRECT%DENOMINATOR))) THEN

CALL ERRPRTRM(' TO_FM_RATIONAL')

ENDIF

NCASE = 6

RESULT = TO_FM_RATIONAL(84, 36)

WRITE (KLOG,*) ' '

WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE

WRITE (KLOG,*) ' TO_FM_RATIONAL(84, 36) '

KW = KLOG

CALL FM_PRINT_RATIONAL(RESULT)

KW = KWSAVE

WRITE (KLOG,*) ' '

CORRECT = TO_FM_RATIONAL(7, 3)

IF ((.NOT. IMCOMPARE(RESULT%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &

(.NOT. IMCOMPARE(RESULT%DENOMINATOR,'==',CORRECT%DENOMINATOR))) THEN

CALL ERRPRTRM(' TO_FM_RATIONAL')

ENDIF

NCASE = 7

RESULT = TO_FM_RATIONAL(TO_IM('3141592653589776'), TO_IM('271828182829'))

WRITE (KLOG,*) ' '

WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE

WRITE (KLOG,*) " TO_FM_RATIONAL(TO_IM('3141592653589776'), TO_IM('271828182829')) "

KW = KLOG

CALL FM_PRINT_RATIONAL(RESULT)

KW = KWSAVE

WRITE (KLOG,*) ' '

CORRECT = TO_FM_RATIONAL(TO_IM('101341698502896'), TO_IM('8768651059'))

IF ((.NOT. IMCOMPARE(RESULT%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &

(.NOT. IMCOMPARE(RESULT%DENOMINATOR,'==',CORRECT%DENOMINATOR))) THEN

CALL ERRPRTRM(' TO_FM_RATIONAL')

ENDIF

NCASE = 8

A = TO_FM_RATIONAL(TO_IM('3141592653589776'), TO_IM('271828182829'))

RESULT = A

WRITE (KLOG,*) ' '

WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE

WRITE (KLOG,*) " RESULT = A "

KW = KLOG

CALL FM_PRINT_RATIONAL(RESULT)

```

KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL( TO_IM('101341698502896'), TO_IM('8768651059') )
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESULT%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' = assignment')
ENDIF

```

```

NCASE = 9
A = TO_FM_RATIONAL( '3141592653589776' ) / TO_IM('271828182829')
RESULT = A
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " RESULT = A = TO_FM_RATIONAL( '3141592653589776' ) / TO_IM('271828182829') "
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL( TO_IM('101341698502896'), TO_IM('8768651059') )
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESULT%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' = assignment')
ENDIF

```

```

NCASE = 10
A = TO_FM_RATIONAL( '3141592653589776 / 271828182829' )
RESULT = A
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " RESULT = A = TO_FM_RATIONAL( '3141592653589776 / 271828182829' ) "
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL( TO_IM('101341698502896'), TO_IM('8768651059') )
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESULT%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' = assignment')
ENDIF

```

```

NCASE = 11
A = TO_FM_RATIONAL( '3141592653589776', '271828182829' )
RESULT = A
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " RESULT = A = TO_FM_RATIONAL( '3141592653589776', '271828182829' ) "
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL( TO_IM('101341698502896'), TO_IM('8768651059') )
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESULT%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' = assignment')
ENDIF

```

```

NCASE = 12
RESULT = 314159

```

```

WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " RESULT = 314159 "
KW = KLOG
CALL FM_PRINT_RATIONAL(RESET)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL( TO_IM('314159'), TO_IM('1') )
IF ( (.NOT. IMCOMPARE(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
    CALL ERRPRTRM(' = assignment')
ENDIF

```

```

NCASE = 13
RESULT = -314159
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " RESULT = -314159 "
KW = KLOG
CALL FM_PRINT_RATIONAL(RESET)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL( TO_IM('-314159'), TO_IM('1') )
IF ( (.NOT. IMCOMPARE(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
    CALL ERRPRTRM(' = assignment')
ENDIF

```

```

NCASE = 14
RESULT = TO_IM('3141592653589793')
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " RESULT = TO_IM('3141592653589793') "
KW = KLOG
CALL FM_PRINT_RATIONAL(RESET)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL( TO_IM('3141592653589793'), TO_IM('1') )
IF ( (.NOT. IMCOMPARE(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
    CALL ERRPRTRM(' = assignment')
ENDIF

```

```

NCASE = 15
RESULT = TO_IM('-3141592653589793')
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " RESULT = TO_IM('-3141592653589793') "
KW = KLOG
CALL FM_PRINT_RATIONAL(RESET)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL( TO_IM('-3141592653589793'), TO_IM('1') )
IF ( (.NOT. IMCOMPARE(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
    CALL ERRPRTRM(' = assignment')
ENDIF

```

```

NCASE = 16
RESULT = TO_FM_RATIONAL( 31, 47 )
MIM1 = RATIONAL_NUMERATOR( RESULT )
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " MIM1 = RATIONAL_NUMERATOR( RESULT ) "
KW = KLOG
CALL IM_PRINT(MIM1)
KW = KWSAVE
WRITE (KLOG,*) ' '
MIM2 = 31
IF ( (.NOT. IMCOMPARE(MIM1%MIM,'==',MIM2%MIM)) ) THEN
    CALL ERRPRTRM(' = assignment')
ENDIF

```

```

NCASE = 17
RESULT = TO_FM_RATIONAL( 31, 47 )
MIM1 = RATIONAL_DENOMINATOR( TO_FM_RATIONAL( 31, 47 ) )
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " MIM1 = RATIONAL_DENOMINATOR( TO_FM_RATIONAL( 31, 47 ) ) "
KW = KLOG
CALL IM_PRINT(MIM1)
KW = KWSAVE
WRITE (KLOG,*) ' '
MIM2 = 47
IF ( (.NOT. IMCOMPARE(MIM1%MIM,'==',MIM2%MIM)) ) THEN
    CALL ERRPRTRM(' = assignment')
ENDIF

```

```

NCASE = 18
AVEC = 31
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " AVEC = 31"
DO J = 1, 3
    KW = KLOG
    WRITE (KLOG,"(A,I1,A)") " AVEC(",J,") = "
    CALL FM_PRINT_RATIONAL(AVEC(J))
    KW = KWSAVE
    WRITE (KLOG,*) ' '
    CORRECT = TO_FM_RATIONAL( 31 )
    IF ( (.NOT. IMCOMPARE(AVEC(J)%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &
        (.NOT. IMCOMPARE(AVEC(J)%DENOMINATOR,'==',CORRECT%DENOMINATOR)) ) THEN
        CALL ERRPRTRM(' = assignment')
    ENDIF
ENDDO

```

```

NCASE = 19
AVEC = TO_FM_RATIONAL( TO_IM('101341698502896'), TO_IM('8768651059') )
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " AVEC = TO_FM_RATIONAL( TO_IM('101341698502896'), TO_IM('8768651059') )"
DO J = 1, 3
    KW = KLOG
    WRITE (KLOG,"(A,I1,A)") " AVEC(",J,") = "
    CALL FM_PRINT_RATIONAL(AVEC(J))
    KW = KWSAVE

```

```

WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL( TO_IM('101341698502896'), TO_IM('8768651059') )
IF ( (.NOT. IMCOMPARE(AVEC(J)%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(AVEC(J)%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' = assignment')
ENDIF
ENDDO

```

```

NCASE = 20
AVEC = TO_IM('101341698502896')
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " AVEC = TO_IM('101341698502896')\"
DO J = 1, 3
  KW = KLOG
  WRITE (KLOG,"(A,I1,A)") " AVEC(",J,") = \"
  CALL FM_PRINT_RATIONAL(AVEC(J))
  KW = KWSAVE
  WRITE (KLOG,*) ' '
  CORRECT = TO_IM('101341698502896')
  IF ( (.NOT. IMCOMPARE(AVEC(J)%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
        (.NOT. IMCOMPARE(AVEC(J)%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
    CALL ERRPRTRM(' = assignment')
  ENDIF
ENDDO

```

```

NCASE = 21
JV(1:3) = (/ 31, -41, 59 /)
AVEC = (/ 31, -41, 59 /)
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " AVEC = (/ 31, -41, 59 /)\"
DO J = 1, 3
  KW = KLOG
  WRITE (KLOG,"(A,I1,A)") " AVEC(",J,") = \"
  CALL FM_PRINT_RATIONAL(AVEC(J))
  KW = KWSAVE
  WRITE (KLOG,*) ' '
  CORRECT = TO_FM_RATIONAL( JV(J) )
  IF ( (.NOT. IMCOMPARE(AVEC(J)%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
        (.NOT. IMCOMPARE(AVEC(J)%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
    CALL ERRPRTRM(' = assignment')
  ENDIF
ENDDO

```

```

NCASE = 22
JV(1:3) = (/ 31, -41, 59 /)
AVEC = TO_FM_RATIONAL( (/ 31, -41, 59 /) )
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " AVEC = TO_FM_RATIONAL( (/ 31, -41, 59 /) )\"
DO J = 1, 3
  KW = KLOG
  WRITE (KLOG,"(A,I1,A)") " AVEC(",J,") = \"
  CALL FM_PRINT_RATIONAL(AVEC(J))
  KW = KWSAVE
  WRITE (KLOG,*) ' '
  CORRECT = TO_FM_RATIONAL( JV(J) )

```



```

IF ( (.NOT. IMCOMPARE(AVEC(J)%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(AVEC(J)%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' = assignment')
ENDIF
ENDDO

NCASE = 23
JV(1:3) = (/ 31, -41, 59 /)
AVEC = JV
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " AVEC = JV(1:3)"
DO J = 1, 3
  KW = KLOG
  WRITE (KLOG,"(A,I1,A)") " AVEC(",J,") = "
  CALL FM_PRINT_RATIONAL(AVEC(J))
  KW = KWSAVE
  WRITE (KLOG,*) ' '
  CORRECT = TO_FM_RATIONAL( JV(J) )
  IF ( (.NOT. IMCOMPARE(AVEC(J)%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
        (.NOT. IMCOMPARE(AVEC(J)%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
    CALL ERRPRTRM(' = assignment')
  ENDIF
ENDDO

NCASE = 24
MIMVEC(1:3) = (/ 31, -41, 59 /)
AVEC = TO_FM_RATIONAL( TO_IM( (/ 31, -41, 59 /) ) )
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " AVEC = TO_IM( (/ 31, -41, 59 /) )"
DO J = 1, 3
  KW = KLOG
  WRITE (KLOG,"(A,I1,A)") " AVEC(",J,") = "
  CALL FM_PRINT_RATIONAL(AVEC(J))
  KW = KWSAVE
  WRITE (KLOG,*) ' '
  CORRECT = TO_FM_RATIONAL( MIMVEC(J) )
  IF ( (.NOT. IMCOMPARE(AVEC(J)%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
        (.NOT. IMCOMPARE(AVEC(J)%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
    CALL ERRPRTRM(' = assignment')
  ENDIF
ENDDO

NCASE = 25
MIMVEC(1:3) = (/ 31, -41, 59 /)
AVEC = TO_IM( (/ 31, -41, 59 /) )
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " AVEC = TO_IM( (/ 31, -41, 59 /) )"
DO J = 1, 3
  KW = KLOG
  WRITE (KLOG,"(A,I1,A)") " AVEC(",J,") = "
  CALL FM_PRINT_RATIONAL(AVEC(J))
  KW = KWSAVE
  WRITE (KLOG,*) ' '
  CORRECT = TO_FM_RATIONAL( MIMVEC(J) )
  IF ( (.NOT. IMCOMPARE(AVEC(J)%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &

```

```

        (.NOT. IMCOMPARE(AVEC(J)%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
        CALL ERRPRTRM(' = assignment')
    ENDIF
ENDDO

NCASE = 26
MIMVEC(1:3) = (/ 31, -41, 59 /)
AVEC = MIMVEC
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " AVEC = MIMVEC(1:3)"
DO J = 1, 3
    KW = KLOG
    WRITE (KLOG,"(A,I1,A)") " AVEC(",J,") = "
    CALL FM_PRINT_RATIONAL(AVEC(J))
    KW = KWSAVE
    WRITE (KLOG,*) ' '
    CORRECT = TO_FM_RATIONAL( MIMVEC(J) )
    IF ( (.NOT. IMCOMPARE(AVEC(J)%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
        (.NOT. IMCOMPARE(AVEC(J)%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
        CALL ERRPRTRM(' = assignment')
    ENDIF
ENDDO

NCASE = 27
BVEC(1:3) = (/ TO_FM_RATIONAL( TO_IM('101341698502896'), TO_IM('8768651059') ), &
              TO_FM_RATIONAL( -41, 43 ), &
              TO_FM_RATIONAL( 314, 159 ) /)
AVEC = (/ TO_FM_RATIONAL( TO_IM('101341698502896'), TO_IM('8768651059') ), &
        TO_FM_RATIONAL( -41, 43 ), &
        TO_FM_RATIONAL( 314, 159 ) /)
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " AVEC = (/ TO_FM_RATIONAL( TO_IM('101341698502896'), ...)"
DO J = 1, 3
    KW = KLOG
    WRITE (KLOG,"(A,I1,A)") " AVEC(",J,") = "
    CALL FM_PRINT_RATIONAL(AVEC(J))
    KW = KWSAVE
    WRITE (KLOG,*) ' '
    CORRECT = BVEC(J)
    IF ( (.NOT. IMCOMPARE(AVEC(J)%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
        (.NOT. IMCOMPARE(AVEC(J)%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
        CALL ERRPRTRM(' = assignment')
    ENDIF
ENDDO

NCASE = 28
BVEC(1:3) = (/ TO_FM_RATIONAL( TO_IM('101341698502896'), TO_IM('8768651059') ), &
              TO_FM_RATIONAL( -41, 43 ), &
              TO_FM_RATIONAL( 314, 159 ) /)
AVEC = BVEC
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " AVEC = BVEC"
DO J = 1, 3
    KW = KLOG
    WRITE (KLOG,"(A,I1,A)") " AVEC(",J,") = "

```

```

CALL FM_PRINT_RATIONAL(AVEC(J))
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = BVEC(J)
IF ( (.NOT. IMCOMPARE(AVEC(J)%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(AVEC(J)%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' = assignment')
ENDIF
ENDDO

NCASE = 29
JV2 = 314
AMAT = 314
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " AMAT = 314"
DO J = 1, 3
  DO K = 1, 3
    KW = KLOG
    WRITE (KLOG, "(A,I1,A,I1,A)") " AMAT(", J, ",", ", K,") = "
    CALL FM_PRINT_RATIONAL(AMAT(J,K))
    KW = KWSAVE
    WRITE (KLOG,*) ' '
    CORRECT = TO_FM_RATIONAL( JV2(J,K) )
    IF ( (.NOT. IMCOMPARE(AMAT(J,K)%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
          (.NOT. IMCOMPARE(AMAT(J,K)%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
      CALL ERRPRTRM(' = assignment')
    ENDIF
  ENDDO
ENDDO

NCASE = 30
JV2(1,1:3) = (/ 1, 2, 3 /)
JV2(2,1:3) = (/ 4, 5, 6 /)
JV2(3,1:3) = (/ 7, 8, 9 /)
AMAT = RESHAPE( (/ 1, 4, 7,    &
                  2, 5, 8,    &
                  3, 6, 9 /) &
                , (/ 3,3 /) )
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " AMAT = RESHAPE( (/ 1, 4, 7, ..."
DO J = 1, 3
  DO K = 1, 3
    KW = KLOG
    WRITE (KLOG, "(A,I1,A,I1,A)") " AMAT(", J, ",", ", K,") = "
    CALL FM_PRINT_RATIONAL(AMAT(J,K))
    KW = KWSAVE
    WRITE (KLOG,*) ' '
    CORRECT = TO_FM_RATIONAL( JV2(J,K) )
    IF ( (.NOT. IMCOMPARE(AMAT(J,K)%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
          (.NOT. IMCOMPARE(AMAT(J,K)%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
      CALL ERRPRTRM(' = assignment')
    ENDIF
  ENDDO
ENDDO

NCASE = 31

```

```

MIMMAT = 159
AMAT = TO_IM( 159 )
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " AMAT = TO_IM( 159 )"
DO J = 1, 3
  DO K = 1, 3
    KW = KLOG
    WRITE (KLOG,"(A,I1,A,I1,A)") " AMAT(",J,",",",K,") = "
    CALL FM_PRINT_RATIONAL(AMAT(J,K))
    KW = KWSAVE
    WRITE (KLOG,*) ' '
    CORRECT = TO_FM_RATIONAL( MIMMAT(J,K) )
    IF ( (.NOT. IMCOMPARE(AMAT(J,K)%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &
        (.NOT. IMCOMPARE(AMAT(J,K)%DENOMINATOR,'==',CORRECT%DENOMINATOR)) ) THEN
      CALL ERRPRTRM(' = assignment')
    ENDIF
  ENDDO
ENDDO

```

```

NCASE = 32
MIMMAT(1,1:3) = (/ 1, 2, 3 /)
MIMMAT(2,1:3) = (/ 4, 5, 6 /)
MIMMAT(3,1:3) = (/ 7, 8, 9 /)
AMAT = TO_IM( RESHAPE( (/ 1, 4, 7,    &
                        2, 5, 8,    &
                        3, 6, 9 /) &
                    , (/ 3,3 /) ) &
          )
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " AMAT = TO_IM( RESHAPE( (/ 1, 4, 7, ..."
DO J = 1, 3
  DO K = 1, 3
    KW = KLOG
    WRITE (KLOG,"(A,I1,A,I1,A)") " AMAT(",J,",",",K,") = "
    CALL FM_PRINT_RATIONAL(AMAT(J,K))
    KW = KWSAVE
    WRITE (KLOG,*) ' '
    CORRECT = TO_FM_RATIONAL( MIMMAT(J,K) )
    IF ( (.NOT. IMCOMPARE(AMAT(J,K)%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &
        (.NOT. IMCOMPARE(AMAT(J,K)%DENOMINATOR,'==',CORRECT%DENOMINATOR)) ) THEN
      CALL ERRPRTRM(' = assignment')
    ENDIF
  ENDDO
ENDDO

```

```

NCASE = 33
MIMMAT(1,1:3) = (/ 1, 2, 3 /)
MIMMAT(2,1:3) = (/ 4, 5, 6 /)
MIMMAT(3,1:3) = (/ 7, 8, 9 /)
AMAT = TO_FM_RATIONAL( TO_IM( RESHAPE( (/ 1, 4, 7,    &
                                        2, 5, 8,    &
                                        3, 6, 9 /) &
                                    , (/ 3,3 /) ) &
                    ) )
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE

```

```

WRITE (KLOG,*) " AMAT = TO_IM( RESHAPE( (/ 1, 4, 7, ..."
DO J = 1, 3
  DO K = 1, 3
    KW = KLOG
    WRITE (KLOG,"(A,I1,A,I1,A)") " AMAT(",J,",",",K,") = "
    CALL FM_PRINT_RATIONAL(AMAT(J,K))
    KW = KWSAVE
    WRITE (KLOG,*) ' '
    CORRECT = TO_FM_RATIONAL( MIMMAT(J,K) )
    IF ( (.NOT. IMCOMPARE(AMAT(J,K)%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &
        (.NOT. IMCOMPARE(AMAT(J,K)%DENOMINATOR,'==',CORRECT%DENOMINATOR)) ) THEN
      CALL ERRPRTRM(' = assignment')
    ENDIF
  ENDDO
ENDDO

```

```

NCASE = 34
A = TO_FM_RATIONAL( -314, 159 )
AMAT = TO_FM_RATIONAL( -314, 159 )
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " AMAT = TO_FM_RATIONAL( -314, 159 )"
DO J = 1, 3
  DO K = 1, 3
    KW = KLOG
    WRITE (KLOG,"(A,I1,A,I1,A)") " AMAT(",J,",",",K,") = "
    CALL FM_PRINT_RATIONAL(AMAT(J,K))
    KW = KWSAVE
    WRITE (KLOG,*) ' '
    CORRECT = A
    IF ( (.NOT. IMCOMPARE(AMAT(J,K)%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &
        (.NOT. IMCOMPARE(AMAT(J,K)%DENOMINATOR,'==',CORRECT%DENOMINATOR)) ) THEN
      CALL ERRPRTRM(' = assignment')
    ENDIF
  ENDDO
ENDDO

```

```

NCASE = 35
BMAT(1,1:3) = (/ 1, 2, 3 /)
BMAT(2,1:3) = (/ 4, 5, 6 /)
BMAT(3,1:3) = (/ 7, 8, 9 /)
AMAT = TO_FM_RATIONAL( RESHAPE( (/ 1, 4, 7,    &
                                2, 5, 8,    &
                                3, 6, 9 /) &
                        , (/ 3,3 /) ) &
)
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " AMAT = TO_FM_RATIONAL( RESHAPE( (/ 1, 4, 7, ..."
DO J = 1, 3
  DO K = 1, 3
    KW = KLOG
    WRITE (KLOG,"(A,I1,A,I1,A)") " AMAT(",J,",",",K,") = "
    CALL FM_PRINT_RATIONAL(AMAT(J,K))
    KW = KWSAVE
    WRITE (KLOG,*) ' '
    CORRECT = BMAT(J,K)
    IF ( (.NOT. IMCOMPARE(AMAT(J,K)%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &

```

```

        (.NOT. IMCOMPARE(AMAT(J,K)%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
        CALL ERRPRTRM(' = assignment')
    ENDF
ENDDO
ENDDO

RETURN
END SUBROUTINE TEST1

```

```

SUBROUTINE TEST2
IMPLICIT NONE
INTEGER :: K

```

```

WRITE (KW, "(/' Testing addition of rationals.')" )

```

```

NCASE = 36
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " RESULT = +TO_FM_RATIONAL(7,9) "
RESULT = +TO_FM_RATIONAL(7,9)
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL( TO_IM('7'), TO_IM('9') )
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
     (.NOT. IMCOMPARE(RESULT%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
    CALL ERRPRTRM(' addition of rationals')
ENDIF

```

```

NCASE = 37
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " RESULT = A + B (= TO_FM_RATIONAL(5,6) + TO_FM_RATIONAL(7,9) ) "
A = TO_FM_RATIONAL(5,6)
B = TO_FM_RATIONAL(7,9)
RESULT = A + B
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL( TO_IM('29'), TO_IM('18') )
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
     (.NOT. IMCOMPARE(RESULT%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
    CALL ERRPRTRM(' addition of rationals')
ENDIF

```

```

NCASE = 38
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " RESULT = TO_FM_RATIONAL(5,6) + TO_FM_RATIONAL(7,9) "
RESULT = TO_FM_RATIONAL(5,6) + TO_FM_RATIONAL(7,9)
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)

```



```

IF ( (.NOT. IMCOMPARE(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' addition of rationals')
ENDIF

```

```

NCASE = 42
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " RESULT = A + K ( = "
WRITE (KLOG,*) "          TO_FM_RATIONAL(TO_IM('8917602794770965746052376207314'), "
WRITE (KLOG,*) "          TO_IM('6678420012453723448650677611683')) + 41 "
A = TO_FM_RATIONAL(TO_IM('8917602794770965746052376207314'), &
      TO_IM('6678420012453723448650677611683'))
K = 41
RESULT = A + K
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL(TO_IM('94244274435124542380243386095439'), &
      TO_IM('2226140004151241149550225870561'))
IF ( (.NOT. IMCOMPARE(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' addition of rationals')
ENDIF

```

```

NCASE = 43
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " RESULT = A + K ( = "
WRITE (KLOG,*) "          TO_FM_RATIONAL(TO_IM('-8917602794770965746052376207314'), "
WRITE (KLOG,*) "          TO_IM('6678420012453723448650677611683')) + 41 "
A = TO_FM_RATIONAL(TO_IM('-8917602794770965746052376207314'), &
      TO_IM('6678420012453723448650677611683'))
K = 41
RESULT = A + K
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL(TO_IM('88299205905277231882875135290563'), &
      TO_IM('2226140004151241149550225870561'))
IF ( (.NOT. IMCOMPARE(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' addition of rationals')
ENDIF

```

```

NCASE = 44
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " RESULT = A + K ( = "
WRITE (KLOG,*) "          TO_FM_RATIONAL(TO_IM('-8917602794770965746052376207314'), "
WRITE (KLOG,*) "          TO_IM('6678420012453723448650677611683')) - 41 "
A = TO_FM_RATIONAL(TO_IM('-8917602794770965746052376207314'), &
      TO_IM('6678420012453723448650677611683'))
K = -41
RESULT = A + K
KW = KLOG

```



```

CALL FM_PRINT_RATIONAL(RESET)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL(TO_IM('-94244274435124542380243386095439'), &
                        TO_IM('2226140004151241149550225870561'))
IF ( (.NOT. IMCOMPARE(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
     (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
    CALL ERRPRTRM(' addition of rationals')
ENDIF

```

```

NCASE = 45
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " RESULT = K + A ( = 3141 + TO_FM_RATIONAL(51234,62345) ) "
A = TO_FM_RATIONAL(51234,62345)
K = 3141
RESULT = K + A
KW = KLOG
CALL FM_PRINT_RATIONAL(RESET)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL(TO_IM('195876879'), &
                        TO_IM('62345'))
IF ( (.NOT. IMCOMPARE(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
     (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
    CALL ERRPRTRM(' addition of rationals')
ENDIF

```

```

NCASE = 46
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " RESULT = K + A ( = 41 + "
WRITE (KLOG,*) "          TO_FM_RATIONAL(TO_IM('8917602794770965746052376207314'), "
WRITE (KLOG,*) "          TO_IM('6678420012453723448650677611683')) "
A = TO_FM_RATIONAL(TO_IM('8917602794770965746052376207314'), &
                  TO_IM('6678420012453723448650677611683'))
K = 41
RESULT = K + A
KW = KLOG
CALL FM_PRINT_RATIONAL(RESET)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL(TO_IM('94244274435124542380243386095439'), &
                        TO_IM('2226140004151241149550225870561'))
IF ( (.NOT. IMCOMPARE(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
     (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
    CALL ERRPRTRM(' addition of rationals')
ENDIF

```

```

NCASE = 47
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " RESULT = K + A ( = 41 + "
WRITE (KLOG,*) "          TO_FM_RATIONAL(TO_IM('-8917602794770965746052376207314'), "
WRITE (KLOG,*) "          TO_IM('6678420012453723448650677611683')) "
A = TO_FM_RATIONAL(TO_IM('-8917602794770965746052376207314'), &
                  TO_IM('6678420012453723448650677611683'))
K = 41

```

```

RESULT = K + A
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL(TO_IM('88299205905277231882875135290563'), &
                          TO_IM('2226140004151241149550225870561'))
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
     (.NOT. IMCOMPARE(RESULT%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' addition of rationals')
ENDIF

NCASE = 48
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " RESULT = K + A ( = -41 + "
WRITE (KLOG,*) "          TO_FM_RATIONAL(TO_IM('-8917602794770965746052376207314')), "
WRITE (KLOG,*) "          TO_IM('6678420012453723448650677611683')) "
A = TO_FM_RATIONAL(TO_IM('-8917602794770965746052376207314'), &
                  TO_IM('6678420012453723448650677611683'))

K = -41
RESULT = K + A
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL(TO_IM('-94244274435124542380243386095439'), &
                          TO_IM('2226140004151241149550225870561'))
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
     (.NOT. IMCOMPARE(RESULT%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' addition of rationals')
ENDIF

NCASE = 49
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " RESULT = MIM1 + A ( = 314159 + TO_FM_RATIONAL(7654321,8234567) ) "
A = TO_FM_RATIONAL(7654321,8234567)
MIM1 = 314159
RESULT = MIM1 + A
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL(TO_IM('2586970988474'), &
                          TO_IM('8234567'))
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
     (.NOT. IMCOMPARE(RESULT%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' addition of rationals')
ENDIF

NCASE = 50
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " RESULT = MIM1 + A ( = TO_IM('265129767915894430221715901488988') + "
WRITE (KLOG,*) "          TO_FM_RATIONAL(TO_IM('612603611364303933104472337189512')), "
WRITE (KLOG,*) "          TO_IM('878773830101413992948550377979617')) "
A = TO_FM_RATIONAL(TO_IM('612603611364303933104472337189512'), &

```

```

                TO_IM('878773830101413992948550377979617'))
MIM1 = TO_IM('265129767915894430221715901488988')
RESULT = MIM1 + A
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL(TO_IM('77663033875116511578492782637666916261000649139603399829917049036'),
&
                TO_IM('292924610033804664316183459326539'))
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESULT%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
    CALL ERRPRTRM(' addition of rationals')
ENDIF

NCASE = 51
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " RESULT = MIM1 + A ( = TO_IM('265129767915894430221715901488988') + "
WRITE (KLOG,*) "          TO_FM_RATIONAL(TO_IM('-612603611364303933104472337189512'), "
WRITE (KLOG,*) "          TO_IM('878773830101413992948550377979617')) "
A = TO_FM_RATIONAL(TO_IM('-612603611364303933104472337189512'), &
                TO_IM('878773830101413992948550377979617'))
MIM1 = TO_IM('265129767915894430221715901488988')
RESULT = MIM1 + A
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL(TO_IM('77663033875116511578492782637666507858593072936981330181692256028'),
&
                TO_IM('292924610033804664316183459326539'))
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESULT%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
    CALL ERRPRTRM(' addition of rationals')
ENDIF

NCASE = 52
WRITE (KLOG,*) ' '
WRITE (KLOG, "(A,I6)") ' NCASE = ', NCASE
WRITE (KLOG,*) " RESULT = MIM1 + A ( = TO_IM('-265129767915894430221715901488988') + "
WRITE (KLOG,*) "          TO_FM_RATIONAL(TO_IM('-612603611364303933104472337189512'), "
WRITE (KLOG,*) "          TO_IM('878773830101413992948550377979617')) "
A = TO_FM_RATIONAL(TO_IM('-612603611364303933104472337189512'), &
                TO_IM('878773830101413992948550377979617'))
MIM1 = TO_IM('-265129767915894430221715901488988')
RESULT = MIM1 + A
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KSAVE
WRITE (KLOG,*) ' '
CORRECT =
                TO_FM_RATIONAL(TO_IM('-
                77663033875116511578492782637666916261000649139603399829917049036'), &
                TO_IM('292924610033804664316183459326539'))
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESULT%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
    CALL ERRPRTRM(' addition of rationals')

```

ENDIF

NCASE = 53

WRITE (KLOG,*) ' '

WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE

WRITE (KLOG,*) " RESULT = A + MIM1 (= TO_FM_RATIONAL(7654321,8234567) + 314159) "

A = TO_FM_RATIONAL(7654321,8234567)

MIM1 = 314159

RESULT = A + MIM1

KW = KLOG

CALL FM_PRINT_RATIONAL(RESULT)

KW = KWSAVE

WRITE (KLOG,*) ' '

CORRECT = TO_FM_RATIONAL(TO_IM('2586970988474'), &
TO_IM('8234567'))

IF ((.NOT. IMCOMPARE(RESULT%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &
(.NOT. IMCOMPARE(RESULT%DENOMINATOR,'==',CORRECT%DENOMINATOR))) THEN

CALL ERRPRTRM(' addition of rationals')

ENDIF

NCASE = 54

WRITE (KLOG,*) ' '

WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE

WRITE (KLOG,*) " RESULT = A + MIM1 (= "

WRITE (KLOG,*) " TO_FM_RATIONAL(TO_IM('612603611364303933104472337189512'), "

WRITE (KLOG,*) " TO_IM('878773830101413992948550377979617')) + "

WRITE (KLOG,*) " TO_IM('265129767915894430221715901488988') "

A = TO_FM_RATIONAL(TO_IM('612603611364303933104472337189512'), &
TO_IM('878773830101413992948550377979617'))

MIM1 = TO_IM('265129767915894430221715901488988')

RESULT = A + MIM1

KW = KLOG

CALL FM_PRINT_RATIONAL(RESULT)

KW = KWSAVE

WRITE (KLOG,*) ' '

CORRECT = TO_FM_RATIONAL(TO_IM('77663033875116511578492782637666916261000649139603399829917049036'),
&
TO_IM('292924610033804664316183459326539'))

IF ((.NOT. IMCOMPARE(RESULT%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &
(.NOT. IMCOMPARE(RESULT%DENOMINATOR,'==',CORRECT%DENOMINATOR))) THEN

CALL ERRPRTRM(' addition of rationals')

ENDIF

NCASE = 55

WRITE (KLOG,*) ' '

WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE

WRITE (KLOG,*) " RESULT = A + MIM1 (= "

WRITE (KLOG,*) " TO_FM_RATIONAL(TO_IM('-612603611364303933104472337189512'), "

WRITE (KLOG,*) " TO_IM('878773830101413992948550377979617')) + "

WRITE (KLOG,*) " TO_IM('265129767915894430221715901488988') "

A = TO_FM_RATIONAL(TO_IM('-612603611364303933104472337189512'), &
TO_IM('878773830101413992948550377979617'))

MIM1 = TO_IM('265129767915894430221715901488988')

RESULT = A + MIM1

KW = KLOG

CALL FM_PRINT_RATIONAL(RESULT)

KW = KWSAVE