

! This is a test program for the FM 1.3 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)
```

! Function that returns a rational result.

```
  USE FM_RATIONAL_ARITHMETIC  
  IMPLICIT NONE  
  TYPE (FM_RATIONAL) :: A,B,SUM0  
  CALL FM_ENTER_USER_FUNCTION(SUM0)  
  SUM0 = A + B  
  CALL FM_EXIT_USER_FUNCTION(SUM0)  
  END FUNCTION SUM0
```

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

! Function that returns a rational vector result.

```
  USE FM_RATIONAL_ARITHMETIC  
  IMPLICIT NONE  
  TYPE (FM_RATIONAL) :: A(3),B(3),SUM1(3)  
  INTEGER :: J  
  CALL FM_ENTER_USER_FUNCTION(SUM1)  
  DO J = 1, 3  
    SUM1(J) = A(J) + B(J)  
  ENDDO  
  CALL FM_EXIT_USER_FUNCTION(SUM1)  
  END FUNCTION SUM1
```

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

! Function that returns a rational matrix result.

```
  USE FM_RATIONAL_ARITHMETIC  
  IMPLICIT NONE  
  TYPE (FM_RATIONAL) :: A(3,3),B(3,3),SUM2(3,3)  
  INTEGER :: J, K  
  CALL FM_ENTER_USER_FUNCTION(SUM2)  
  DO J = 1, 3
```

```

DO K = 1, 3
    SUM2(J,K) = A(J,K) + B(J,K)
ENDDO
ENDDO
CALL FM_EXIT_USER_FUNCTION(SUM2)
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 :: J, K, KLOG, L, KWSAVE, ML(2), NCASE, NERROR
REAL, SAVE :: TIME1, TIME2
LOGICAL, EXTERNAL :: IMCOMPARE

```

```
CONTAINS
```

```

SUBROUTINE TEST1
IMPLICIT NONE

```

```

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',0,A,'A',B,'B',B,'B')
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',0,A,'A',B,'B',B,'B')
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',0,A,'A',B,'B',B,'B')
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(RESET)
KW = KSAVE
WRITE (KLOG,*) ' '
MIM1 = 2
CALL IMEQ(MIM1%MIM,CORRECT%NUMERATOR)
MIM1 = 3
CALL IMEQ(MIM1%MIM,CORRECT%DENOMINATOR)
IF ( (.NOT. IMCOMPARE(RESET%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR,'==',CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' TO_FM_RATIONAL ',0,A,'A',B,'B',B,'B')
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(RESET)
KW = KSAVE
WRITE (KLOG,*) ' '
MIM1 = 1
CALL IMEQ(MIM1%MIM,CORRECT%NUMERATOR)
MIM1 = 3
CALL IMEQ(MIM1%MIM,CORRECT%DENOMINATOR)
IF ( (.NOT. IMCOMPARE(RESET%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR,'==',CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' TO_FM_RATIONAL ',0,A,'A',B,'B',B,'B')
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(RESET)
KW = KSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL( 7, 3 )
IF ( (.NOT. IMCOMPARE(RESET%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR,'==',CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' TO_FM_RATIONAL ',0,A,'A',B,'B',B,'B')
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(RESET)
KW = KSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL( TO_IM('101341698502896'), TO_IM('8768651059') )

```

```

IF ( (.NOT. IMCOMPARE(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' TO_FM_RATIONAL', 0, A, 'A', B, 'B', B, 'B')
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(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' = assignment', 0, A, 'A', B, 'B', B, 'B')
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(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' = assignment', 0, A, 'A', B, 'B', B, 'B')
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(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' = assignment', 0, A, 'A', B, 'B', B, 'B')
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(RESET)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL( TO_IM('101341698502896'), TO_IM('8768651059') )
IF ( (.NOT. IMCOMPARE(RESET%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR,'==',CORRECT%DENOMINATOR)) ) THEN
      CALL ERRPRTRM(' = assignment',0,A,'A',B,'B',B,'B')
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',0,A,'A',B,'B',B,'B')
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',0,A,'A',B,'B',B,'B')
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',0,A,'A',B,'B',B,'B')

```

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(RESULT)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL( TO_IM('-3141592653589793'), TO_IM('1') )
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESULT%DENOMINATOR,'==',CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' = assignment',0,A,'A',B,'B',B,'B')
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',0,A,'A',B,'B',B,'B')
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',0,A,'A',B,'B',B,'B')
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(AVECC(J)%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(AVECC(J)%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
      CALL ERRPRTRM( ' = assignment', 0, A, 'A', B, 'B', B, 'B')
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(AVECC(J))
  KW = KWSAVE
  WRITE (KLOG,*) ' '
  CORRECT = TO_FM_RATIONAL( TO_IM('101341698502896'), TO_IM('8768651059') )
  IF ( (.NOT. IMCOMPARE(AVECC(J)%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
        (.NOT. IMCOMPARE(AVECC(J)%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
        CALL ERRPRTRM( ' = assignment', 0, A, 'A', B, 'B', B, 'B')
  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(AVECC(J))
  KW = KWSAVE
  WRITE (KLOG,*) ' '
  CORRECT = TO_IM('101341698502896')
  IF ( (.NOT. IMCOMPARE(AVECC(J)%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
        (.NOT. IMCOMPARE(AVECC(J)%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
        CALL ERRPRTRM( ' = assignment', 0, A, 'A', B, 'B', B, 'B')
  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(AVECC(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', 0, A, 'A', B, 'B', B, 'B')
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', 0, A, 'A', B, 'B', B, 'B')
  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', 0, A, 'A', B, 'B', B, 'B')
  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', 0, A, 'A', B, 'B', B, 'B')
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', 0, A, 'A', B, 'B', B, 'B')
  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', 0, A, 'A', B, 'B', B, 'B')
  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',0,A, 'A',B, 'B',B, 'B')
  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',0,A, 'A',B, 'B',B, 'B')
  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',0,A, 'A',B, 'B',B, 'B')
    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',0,A,'A',B,'B',B,'B')
    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',0,A,'A',B,'B',B,'B')
    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',0,A,'A',B,'B',B,'B')
    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',0,A,'A',B,'B',B,'B')
    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',0,A,'A',B,'B',B,'B')
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',0,A,'A',B,'B',B,'B')
    ENDIF
  ENDDO
ENDDO

RETURN
END SUBROUTINE TEST1

```

```

SUBROUTINE TEST2
IMPLICIT NONE

```

```

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(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' addition of rationals',0,A,'A',B,'B',B,'B')
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(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' addition of rationals',0,A,'A',B,'B',B,'B')
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)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL( TO_IM('29'), TO_IM('18') )
IF ( (.NOT. IMCOMPARE(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' addition of rationals',0,A,'A',B,'B',B,'B')
ENDIF

NCASE = 39
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)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL( TO_IM('-1'), TO_IM('18') )
IF ( (.NOT. IMCOMPARE(RESET%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' addition of rationals',0,A,'A',B,'B',B,'B')
ENDIF

NCASE = 40

```

```

WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " RESULT = TO_FM_RATIONAL(TO_IM('5555555555555555555555555555123'), "
WRITE (KLOG,*) "                TO_IM('2893333333333333213632'))          + "
WRITE (KLOG,*) "                TO_FM_RATIONAL(TO_IM('4444444444444444444444444444789'), "
WRITE (KLOG,*) "                TO_IM('371999999999999999632464')) "
RESULT = TO_FM_RATIONAL(TO_IM('5555555555555555555555555555123'),          &
                TO_IM('2893333333333333213632'))          +      &
        TO_FM_RATIONAL(TO_IM('4444444444444444444444444444789'),          &
                TO_IM('371999999999999999632464'))

KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL(TO_IM('49176954732510288060077777439647119341563786034605'), &
                TO_IM('2411111111111111109875382222222222232077632'))
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESULT%DENOMINATOR,'==',CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' addition of rationals',0,A,'A',B,'B',B,'B')
ENDIF

NCASE = 41
WRITE (KLOG,*) ' '
WRITE (KLOG,"(A,I6)") ' NCASE = ',NCASE
WRITE (KLOG,*) " RESULT = A + K ( = TO_FM_RATIONAL(51234,62345) + 3141) "
A = TO_FM_RATIONAL(51234,62345)
K = 3141
RESULT = A + K
KW = KLOG
CALL FM_PRINT_RATIONAL(RESULT)
KW = KWSAVE
WRITE (KLOG,*) ' '
CORRECT = TO_FM_RATIONAL(TO_IM('195876879'), &
                TO_IM('62345'))
IF ( (.NOT. IMCOMPARE(RESULT%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESULT%DENOMINATOR,'==',CORRECT%DENOMINATOR)) ) THEN
  CALL ERRPRTRM(' addition of rationals',0,A,'A',B,'B',B,'B')
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(RESULT%NUMERATOR,'==',CORRECT%NUMERATOR)) .OR. &

```



```

        (.NOT. IMCOMPARE(RESET%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
CALL ERRPRTRM(' addition of rationals', 0, A, 'A', B, 'B', B, 'B')
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(RESULT%NUMERATOR, '==', CORRECT%NUMERATOR)) .OR. &
      (.NOT. IMCOMPARE(RESULT%DENOMINATOR, '==', CORRECT%DENOMINATOR)) ) THEN
CALL ERRPRTRM(' addition of rationals', 0, A, 'A', B, 'B', B, 'B')
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(RESULT)
KW = KWSAVE
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', 0, A, 'A', B, 'B', B, 'B')
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(RESULT)
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',0,A,'A',B,'B',B,'B')
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(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',0,A,'A',B,'B',B,'B')
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 = 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',0,A,'A',B,'B',B,'B')
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',0,A,'A',B,'B',B,'B')
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',0,A,'A',B,'B',B,'B')
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',0,A,'A',B,'B',B,'B')
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 = KWSAVE
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',0,A,'A',B,'B',B,'B')
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 = 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',0,A,'A',B,'B',B,'B')
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',0,A,'A',B,'B',B,'B')

```