NAG Library Routine Document

G01RTF

Note: before using this routine, please read the Users' Note for your implementation to check the interpretation of ***bold italicised*** terms and other implementation-dependent details.

1 Purpose

G01RTF returns the value of the derivative $\phi'(\lambda)$ of the Landau density function, via the routine name.

2 Specification

```
FUNCTION G01RTF (X)
REAL (KIND=nag_wp) G01RTF
REAL (KIND=nag_wp) X
```

3 Description

G01RTF evaluates an approximation to the derivative $\phi'(\lambda)$ of the Landau density function given by

$$\phi'(\lambda) = \frac{d\phi(\lambda)}{d\lambda},$$

where $\phi(\lambda)$ is described in G01MTF, using piecewise approximation by rational functions. Further details can be found in KÎlbig and Schorr (1984).

To obtain the value of $\phi(\lambda)$, G01MTF can be used.

4 References

KÎlbig K S and Schorr B (1984) A program package for the Landau distribution *Comp. Phys. Comm.* **31** 97–111

5 Arguments

1: X – REAL (KIND=nag_wp) *Input*

On entry: the argument λ of the function.

6 Error Indicators and Warnings

None.

7 Accuracy

At least 7 significant digits are usually correct, but occasionally only 6. Such accuracy is normally considered to be adequate for applications in experimental physics.

Because of the asymptotic behaviour of $\phi'(\lambda)$, which is of the order of $\exp[-\exp(-\lambda)]$, underflow may occur on some machines when λ is moderately large and negative.

8 Parallelism and Performance

G01RTF is not threaded in any implementation.

9 Further Comments

None.

10 Example

This example evaluates $\phi'(\lambda)$ at $\lambda = 0.5$, and prints the results.

10.1 Program Text

```
    Program g01rtfe

!     G01RTF Example Program Text

!     Mark 26 Release. NAG Copyright 2016.

!     .. Use Statements ..
      Use nag_library, Only: a00acf, g01rtf, nag_wp
!     .. Implicit None Statement ..
      Implicit None
!     .. Parameters ..
      Integer, Parameter               :: nin = 5, nout = 6
!     .. Local Scalars ..
      Real (Kind=nag_wp)               :: x, y
      Integer                          :: ifail
!     .. Executable Statements ..
      Write (nout,*) 'G01RTF Example Program Results'
      Write (nout,*)

!     Check for valid licence prior to calling G01RTF
      If (.Not. a00acf()) Then
        Write (nout,*) ' ** A valid licence key was not found'

      Else
!       Skip heading in data file
        Read (nin,*)

!       Display title
        Write (nout,*) '  X          Y'
        Write (nout,*)

d_lp:   Do
          Read (nin,*,Iostat=ifail) x
          If (ifail/=0) Then
            Exit d_lp
          End If

!         Compute the value of the derivative of the Landau density function
          y = g01rtf(x)

!         Display results
          Write (nout,99999) x, y
        End Do d_lp
      End If

99999 Format (1X,F4.1,3X,1P,E12.4)
    End Program g01rtfe
```

10.2 Program Data

```
G01RTF Example Program Data
 0.5  : Value of X
```

10.3 Program Results

```
 G01RTF Example Program Results

   X           Y

 0.5    -3.6034E-02
```