

# NAG Library Routine Document

## G01QTF

**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

G01QTF returns the value of the second moment  $\Phi_2(x)$  of the Landau density function, via the routine name.

### 2 Specification

```
FUNCTION G01QTF (X)
REAL (KIND=nag_wp) G01QTF
REAL (KIND=nag_wp) X
```

### 3 Description

G01QTF evaluates an approximation to the second moment  $\Phi_2(x)$  of the Landau density function given by

$$\Phi_2(x) = \frac{1}{\Phi(x)} \int_{-\infty}^x \lambda^2 \phi(\lambda) d\lambda,$$

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

To obtain the value of  $\Phi_1(x)$ , G01PTF can be used.

### 4 References

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

### 5 Parameters

1: X – REAL (KIND=nag\_wp) *Input*  
*On entry:* the argument  $x$  of the function.

### 6 Error Indicators and Warnings

There are no failure exits from this routine.

### 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.

### 8 Further Comments

None.

## 9 Example

This example evaluates  $\Phi_2(x)$  at  $x = 0.5$ , and prints the results.

### 9.1 Program Text

```

Program g01qtfe

!      G01QTF Example Program Text

!      Mark 24 Release. NAG Copyright 2012.

!      .. Use Statements ..
Use nag_library, Only: a00acf, g01qtf, 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,*) 'G01QTF Example Program Results'
Write (nout,*)

!      Check for valid licence prior to calling G01QTF
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 2nd moment of the Landau density function
    y = g01qtf(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 g01qtfe

```

### 9.2 Program Data

```

G01QTF Example Program Data
0.5 : Value of X

```

### 9.3 Program Results

```

G01QTF Example Program Results

X          Y

0.5      9.0868E-01

```

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