

# NAG Library Routine Document

## G01MTF

**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

G01MTF returns the value of the Landau density function  $\phi(\lambda)$ , via the routine name.

### 2 Specification

```
FUNCTION G01MTF (X)
REAL (KIND=nag_wp) G01MTF
REAL (KIND=nag_wp) X
```

### 3 Description

G01MTF evaluates an approximation to the Landau density function  $\phi(\lambda)$  given by

$$\phi(\lambda) = \frac{1}{2\pi i} \int_{c-i\infty}^{c+i\infty} \exp(\lambda s + s \ln s) ds,$$

where  $c$  is an arbitrary real constant, using piecewise approximation by rational functions. Further details can be found in Kölbig and Schorr (1984).

To obtain the value of  $\phi'(\lambda)$ , G01RTF 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  $\lambda$  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  $\lambda$  is moderately large and negative.

### 8 Parallelism and Performance

Not applicable.

## 9 Further Comments

None.

## 10 Example

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

### 10.1 Program Text

```

Program g01mtfe

!      G01MTF Example Program Text

!      Mark 25 Release. NAG Copyright 2014.

!      .. Use Statements ..
Use nag_library, Only: a00acf, g01mtf, 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,*) 'G01MTF Example Program Results'
Write (nout,*)

!      Check for valid licence prior to calling G01MTF
If (.Not. a00acf()) Then
  Write (nout,*) ' ** A valid licence key was not found'

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

!      Display titles
  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 Landau density function
  y = g01mtf(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 g01mtfe

```

### 10.2 Program Data

```

G01MTF Example Program Data
0.5 : Value of X

```

### 10.3 Program Results

G01MTF Example Program Results

| X   | Y          |
|-----|------------|
| 0.5 | 1.6523E-01 |

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