

# Position Classification Standard for Mathematics Technician Series, GS-1521

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## SERIES DEFINITION

This series includes all classes of positions the duties of which are to supervise or perform work in the reduction and computation of quantitative data where such work requires the use of mathematical techniques in connection with particular engineering and scientific activities, but does not require professional knowledge of the mathematical theories, assumptions, or principles upon which the techniques are based.

The work of this series centers around the function of reducing experimental or other data to a form suitable for interpretation and evaluation by scientists and engineers. The application of mathematical methodology to this function is the primary focus and emphasis for positions in the series. However, it is not always possible to differentiate between the work of this series and that of positions in other closely related series solely on the basis of duties performed. Accordingly, in addition to the analysis of specifically assigned duties and responsibilities, it is necessary to consider determinations made by management concerning the kind of background qualifications to be required and the normal line of promotion within the organization. The mission of the organization is also an important consideration in resolving questions of series coverage. Thus, where the mission of the organization is closely related to a particular occupational series as, for example, the Geodetic Technician Series, GS-1374, nonprofessional positions engaged in the reduction of data relevant to the field of geodesy may be properly classified in that series. However, positions assigned similar work in an organization functioning as a central computing service for a variety of engineering and scientific activities may be identified with the Mathematics Technician Series, GS-1521.

## EXCLUSIONS

The following types of positions are excluded from this series:

1. Positions the duties of which require the application of a full professional knowledge of mathematics are classifiable to the [Mathematics Series, GS-1520](#). (See standards for the Mathematics Series for an explanation of the characteristics of professional work in mathematics.)
2. Positions the duties of which are to administer, supervise, or plan programs for a digital computer systems activity, or to operate digital computers and peripheral equipment. (See [Computer Operations Series, GS-0332](#), and [Information Technology Management Series GS-2210](#).)
3. Nonprofessional positions involving the observation and recording of scientific data in which the paramount requirements are knowledges and techniques characteristic of a recognized subject-matter specialty even though such duties may include substantial amounts of computational work; e.g., surveying technician, meteorological technician, engineering technician, and physical science technician.

4. Nonprofessional positions involving the collection, compilation, analysis, and presentation of statistical data, are classifiable to the [Statistical Clerical and Administrative Series, GS-1531](#).
5. Positions which are limited to the operation of a calculating machine to perform or verify addition, subtraction, multiplication, and division are classifiable to the Calculating Machine Operating Series, GS-0355.

## THE WORK OF THE MATHEMATICS TECHNICIAN

The characteristic common to all mathematics technicians is a capability for dealing with the mathematical symbols for magnitude, order, and relationship in their usual applications to particular engineering and scientific activities. There are two alternative avenues to increased responsibility for utilizing mathematical models in connection with the study of physical phenomena. One requires more profound comprehension of the system of abstract representation as found in professional work in mathematics. The other alternative emphasizes increased comprehension of the significance of the data represented by the mathematical model. For most mathematics technicians the pattern of development is a movement from the application of basic mathematical processes within rather rigidly prescribed procedural frameworks to the gradual expansion of applications and acquisition of new techniques relevant to the work of the activity in which employed. Thus, as the level of responsibility increases the technician becomes increasingly concerned with distinctive characteristics of the field of application such as are typically associated with the work of subject-oriented technicians; e.g. engineering technicians, physical science technicians, etc.

Although levels of work in this series are normally distinguished by increasing responsibility for specific practical application of mathematics rather than systematically increasing requirements for comprehension of the more sophisticated reaches of mathematics there are a very few exceptions to this pattern. These atypical positions require comprehension of some of the basic mathematical concepts and processes at advanced or sophisticated levels (calculus or the equivalent). Such positions should be classified to grade level by applying the criteria in the standards for the [Mathematics Series, GS-1520](#), and making any necessary allowances for differences in the relative scope and intensity of theoretical and practical knowledge and insight.

### *Work related to record reading and appraisal*

Responsibility for reading and interpreting records which embody the basic data with which he is to work frequently constitutes an integral part of the mathematic technician's job. The complexity and difficulty of these duties vary with the function with which the mathematics technician is associated. In activities where the recording procedures vary little from project to project the record reading duties are less demanding than those associated with activities where there is greater variety of data recording procedures.

In some instances numerical values for observations such as temperature, pressure, or stress are recorded automatically on tape or punch cards and are subsequently tabulated. Record reading

of this type consists of averaging the tabulated values at specified step-intervals and is relatively simple.

Deflection records are traces of one or more parameters on an automatically driven record form with a reference or zero line and timing markers. Where these records consist of but one or two traces and the deflections are read at given time intervals, the record reading duties are of a simple nature.

When deflection records include a large number of instrument traces and the fluctuation of the quantities being measured produce intersecting and coinciding traces, knowledge, experience and skill are required in identifying and obtaining values for the various traces throughout the continuum of the recording. In many instances the recording instruments are extremely sensitive to conditions extraneous to the test conditions and in reading such records judgment is required in eliminating the effects of such extraneous conditions.

Many records are in the form of still or motion picture photographs of the measuring equipment or the behavior of a test vehicle during the course of a test. The reading of records of this type varies in difficulty with the precision of measurement required and the condition of the photographs.

In many activities the record reading is done with the aid of machines which project and usually enlarge the original data recording on a screen which has cross hairs which can be adjusted to measure values at any given point in the projected image. These machines are usually coupled with an automatic recording device which records the values observed on punch cards, tape or in printed tabular form.

Where particular scientific subject-matter knowledges are the predominant requirements in interpreting records, the position is excluded from this series.

### *Work related to digital computer processes*

Many activities now use digital computers to accomplish some work formerly performed by mathematics technicians. However, the necessity for reducing mathematical operations to arithmetic processes with which the computer can deal involves much preliminary data reduction work which mathematics technicians are able to perform *Where such work consists of the reduction of data embodied in mathematical formulae so that they are expressed in arithmetic terms the classification evaluation should be based on appraisal of the mathematical techniques involved*; this notwithstanding the fact that such work constitutes an essential step in the programming of digital computers for mathematical applications. Criteria in the standards for the [Computer Operations Series, GS-0332](#), and [Information Technology Management Series, GS-2210](#), are not appropriate for the evaluation of such work.

## MISCELLANEOUS NOTES

### *Normal grade interval pattern*

Positions in this series at grades above GS-5 are normally classified at two-grade intervals. However, the classification of positions in the intermediate even grades is not precluded.

### *Class titles*

The Mathematics Aid title is used for classes of positions in grades GS-2, GS-3, and GS-4. The Mathematics Technician title is used for classes of positions in grades GS-5 and above. Supervisory positions should be identified by the prefix "Supervisory."

### *Supervisory positions*

Supervisory positions are included in the coverage of this series but these standards do not provide criteria for classifying positions in which supervisory responsibilities are grade controlling. Supervisory positions which involve supervision of positions typical of grades GS-5 and below should be classified using the published [General Schedule Supervisory Guide](#), Part I. Guides for the evaluation of positions which involve supervision of higher level technician positions properly classifiable at two-grade intervals will be developed.

## MATHEMATICS AID, GS-1521-02

This is the initial trainee level. Training is received in the performance under close supervision of the duties described at the GS-3 level. Simple record reading duties are performed and the computational work involves a few straight-forward arithmetic or algebraic operations.

## MATHEMATICS AID, GS-1521-03

Mathematics aids at this level use desk calculators, record reading machines and automatic graph plotting machines in performing simple computing, plotting, and record reading duties. For tasks not previously performed, the supervisor provides detailed instructions on procedures and methods to be used and makes frequent checks of the work in process to determine that instructions are being followed and to assure the accuracy of the work. On repetitive work, the aid may work independently in performing several operations in sequence, but the accuracy and adequacy of work is reviewed.

The computations involve only one or two computation work sheets with the arithmetic or algebraic operations to be performed clearly indicated. The aids use tables of trigonometric function logarithms or square roots to obtain values to be used in computation. The reading of values from tables or charts may involve simple interpolations. The graph plotting is limited to

preliminary plots and involves straight line functions or curves with clear and well-defined trends.

### **MATHEMATICS AID, GS-1521-04**

Mathematics aids at this level work under the supervision of a professional employee or mathematics technician who furnishes instructions with each new assignment and checks the work in process. In assignments of a recurrent nature where the methods and procedures have been previously learned, the supervisor checks the results only. Mathematics Aids GS-4 characteristically perform work as indicated in paragraph A or combinations of such work with that described in paragraph B and/or C.

- A. Perform mathematical computations in the reduction of experimental, or other types of data to a form suitable for analysis by scientist or engineers. The operations may be complex because of the number of compilations to be made and their inter-relationships but the individual computations performed are of a simple nature involving transcription of observed data to the prescribed computation work sheet and performing the operations indicated there. In this work, aids read and interpolate values from tables as indicated in instructions and refer to charts for physical constants used in the computations.
- B. Prepare graphs of experimental or other types of data as instructed. Fair in curves through all plotted points on preliminary plots or through means of points where the trend of the curve is well established. Where electro-plotting equipment is used, the aids set up and operate the machine.
- C. Perform record reading duties to obtain basic values to be used in computations. The simpler types of record reading are performed with only general instructions. An employee of higher grade usually examines records of more complex nature for obvious irregularities and prepares instructions as to reading procedures to be used. The work frequently involves the use of projectors coupled with devices to record values from tapes, punch cards or tabular listings.

### **MATHEMATICS TECHNICIAN, GS-1521-05**

Mathematics technicians at this level apply a wide range of techniques in data processing and computation work relevant to scientific and engineering activities. On repetitive types of assignments technicians are given general instructions concerning objectives to be achieved without detailed instructions as to methods. Detailed instructions are furnished where assignments are unique and require marked changes in established procedures. Mathematics Technicians GS-5 characteristically perform work as indicated in paragraph A or combinations of such work with that described in paragraph B and/or C.

- A. Perform mathematical computations required in the reduction of experimental or other types of data to a form suitable for interpretation and evaluation by scientists or engineers.

According to the type of data and the kind of project involved, select from previously established computing procedures the one to be used. Making use of the procedure selected usually entails: (1) substituting values obtained from tables and calibration charts into standard formulas and solving for the terms required in the procedure; (2) modifying column headings of the precedent work sheets to make them applicable to the different sets of conditions; and (3) breaking down algebraic equations into operations capable of being on computing devices.

B. Prepare working and final graphs of the data in accordance with general instructions. Select the type of graph paper to be used and determine the scale to be used considering the use to be made of the graph and the range of data. Fair in the curve through the points plotted or the average of the points plotted. Make cross plots for analysis obtaining values to be plotted from graphs already prepared.

C. Read many types of records including those where identification is made difficult by confusion of traces, indistinctness of the recording or extraneous interferences. Refer to notes furnished by the originating activity concerning conditions during the test or concerning peculiarities of the recording instruments to resolve difficulties in reading.

## **MATHEMATICS TECHNICIAN, GS-1521-07**

Mathematics technicians at this level have responsibility for data reduction work pertaining to relatively unique types of projects. Such work typically entails close working relationships with engineers or scientists in order to obtain the necessary awareness of the objectives, conditions, and boundaries of the work of the project. These technicians are expected to select or formulate methods for accomplishing necessary data reduction on the project or significant phases thereof. Project scientists or engineers review the recommended procedure primarily to assure validity of assumptions concerning the relationships inherent in the source data rather than to appraise the mechanics of the data transformation process *per se*. Mathematics Technicians GS-7 characteristically perform work as indicated in paragraph A or combinations of such work with that described in paragraph B and/or C.

A. Responsible for data reduction work pertaining to project work which imposes significant demands for: comprehension of the objectives and general methods of the overall study; knowledge of detailed processes for a wide range of mathematical operations; and application of experienced judgment in integrating these into work procedures embodying short cuts and simplifications where the magnitude of error thereby introduced will not affect the validity of the overall results. Such work is performed on the basis of a general assignment of responsibility to follow through the full continuity of the job from the comparison and evaluation of alternative methods of approach, through the assembly of results in appropriate form for presentation.

Among the specific work processes involved are: determining number of significant figures required; ascertaining the need for algebraically transforming equations to facilitate the processing of the data and; selecting the most economical sequence of performing operations

in consideration of recurrence of expressions, requirements for checking intermediate steps, and the like.

B. Working from a tentative list of desired graphs or schematic diagrams prepare working and final graphs of experimental or other data. Plan the layouts, and frequently make decisions as to how much should be presented and what are the critical portions of the figures plotted. Determine what cross plots from previously plotted data are necessary to show the various relationships desired. On the basis of knowledge of similar projects call to the attention of the scientist or engineer data which appear to be unreliable or not pertinent to the relationships desired. Eliminate such data as authorized.

C. Examine the data recordings to be read, identify critical areas which will present difficulties in identification or interpretation, prepare notes for procedures to be followed, and indicate the paths of crossing and confusing traces. Where readings fail to follow expected trends determine whether the values are beyond the range of the instruments, are the result of temporary failure of the instruments, or are due to extraneous influences. In making such determinations may consult the project engineer or scientist.