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Introduction

MTH 102 - Elementary Mathematics II is designed to teach you how differential and integral calculus could be used in solving problems in the contemporary business, technological and scientific world.

What you will learn in this Course

You will be taught the basis of mathematics required in solving scientific problems.

Course Aim

There are ten study units in the course and each unit has its objectives. You should read the objectives of each unit and bear them in mind as you go through the unit.

To introduce you to the words and concepts in Elementary mathematics

To familiarize you with the peculiar characteristics in Elementary mathematics.

To expose you to the need for and the demands of mathematics in the Science world.

Course Objectives The objectives of this course are

* To inculcate appropriate mathematical skills required in Science and Engineering.

Working through this Course

{ You have to work through all the study units in the course.

[...]

{ Seymour, L.S. . Outline Series: Theory and Problems of Set Theory and related topics, pp. 1 – 133.

Sunday, O.I. . Introduction to Real Analysis

Methods for

Business Economics. By Stephen P. Shao.

Mathematics for Commerce & Economics By Qazi Zameeruddin &

V.K. Khanna 1995.

Engineering Mathematics By K. A Stroad.

Business Mathematics and Information Technology.

MANUAL By. Foulks Lynch.

* Introduction to Mathematical Economics SCHAUM'S Out lines Assignment File

mark you obtain for this course. Further information on assignments will be found in the Assignment File itself and later in this Course Guide in the section on assessment. Presentation Schedule The Presentation Schedule included in your course materials gives you the important dates for the completion of tutor-marked assignments and attending tutorials.

Exercises TMAS

{ Every unit contains at least one or two assignments. You are advised to work through all the assignments and submit them for assessment. Your tutor will assess the assignments and select four which will constitute the 30% of your final grade.

Final Examination and Grading

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{ At the end of the course, you will write a final examination which will constitute 70% of your final grade. In the examination which shall last for two hours, you will be requested to answer three questions out of at least five questions.

[...]

In distance learning, the study units replace the university lecture. This is one of the great advantages of distance learning; you can read and work through specially designed study materials at your own pace, and at a time and place that suits you best. Think of it as reading the lecture instead of listening to the lecturer. In the same way a lecturer might give you some reading to do, the study units tell you when to read, and which are your text materials or set books. You are provided exercises to do at appropriate points, just as a lecturer might give you an in-class exercise. Each of the study units follows a common format. The first item is an introduction to the subject matter of the unit, and how a particular unit is

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integrated with the other units and the course as a whole. Next to this is a set of learning objectives. These objectives let you know what you should be able to do by the time you have completed the unit.

In addition do the following

Read this Course Guide thoroughly, it is your first assignment.

Organise a Study Schedule. Design a Course Overview "to guide you through the Course".

Note the time you are expected to spend on each unit and how the assignments relate to the units. Important information, e.g. details of your tutorials, and the date of the first day of the Semester is available from the study centre. You need to gather all the information into one place, such as your diary or a wall calendar. Whatever method you choose to use, you should decide on and write in your own dates and schedule of work for each unit.

Once you have created your own study schedule, do everything to stay faithful to it. The major reason that students fail is that they get behind with their course work. If you get into difficulties with your schedule, please, let your tutor know before it is too late for help.

Turn to Unit 1, and read the introduction and the objectives for the unit.

Assemble the study materials. You will need your set books and the unit you are studying at any point in time.

Work through the unit. As you work through the unit, you will know what sources to consult for further information.

Keep in touch with your study centre. Up-to-date course information will be continuously available there.

Well before the relevant due dates, keep in mind that you will learn a lot by doing the assignment carefully. They have been designed to help you meet the objectives of the course and, therefore, will help you pass the examination. Submit all assignments not later than the due date.

Function

To decide whether an equation defines a function, it is helpful to isolate the dependent variable on the left side.

For instance, to decide whether the equation defines y as a function of x , write the equation in the form.

Yes, each value of x determines exactly one value of y is a

No, some values of x determine two values of y .

Yes, each value of x determine exactly one value of y .

No, some value of x determine two values of y .

[...]

e.

f.

Example 2: Determine whether an Equation Represents a Function.

Determine whether each equation defines y as a function of x

Solve each equation for y in terms of x . If two or more values of y can be obtained for a given x , the equation is not a function.

Solve for y by subtracting x^2 from both sides.

From this last equation we can see that for each value of x , there is one and only one value of y .

Apply the square root properly: if $u^2=d$ then

Then $+$ in this last equation shows that for certain values of x , there are two values of y . For example, if $x=1$, then. For this reason, the equation does not define y as a function of x .
Function Notation.

When using an equation to define a function, you generally isolate the dependent variable on the left. For instance, writing the equation indicates that y is the dependent variable. In function notation, this equation has the form The independent variable is x and the name of the function is " f ". The symbol f is read as " f of x " or " f at x " and it denotes the value of the independent variable or the value of the function at the number x .

When $x= 1$, the value of is $f = 2x^2 - 4x + 1$

This is the given function.

Replace each occurrence of x with

Perform the multiplications.

Fig 1.

$$F = 2x^2 - 4x + 1$$

Because two different values of x yield the same value of f , the function is not one to one, as shown in fig 1.21.

You can use the horizontal line to test or determine whether the function in Example

1 intersects the graph of the function twice, the function is not one to one.

$$2 \leq x \leq 4 \text{ and } 5 \leq x \leq 10$$

We find f by substituting x^2 for x in the equation.
Square x^2 using $(a+b)^2 = a^2 + 2ab + b^2$.

$$5x$$

b. $f(x)$ a. To evaluate f , substitute x as x as shown in each set of parentheses as follows.
 $x^2 - 2x + b$.

$$2 \leq x \leq 4$$

Graphs of Functions The graph of a function is the graph of its ordered pairs. For example, the graph of $f = 3x$ is the set of points in the rectangular coordinates system satisfying $y = 3x$. When the graph of a function is sketched, the standard convention is to let the horizontal axis represents the independent variable. When this convention is used, the test described in Example 1 has vertical line test.

This test states that if every vertical line intersects the graph of an equation at most once, then the equation defines y as a function of x . For instance, in figure 1.12, the graph in parts and pass the vertical line test but those in parts and do not. The domain of a function may be described explicitly or it may be implied by an equation used to define the function.

Example 6: Finding the Domain and Range of a function

0, it follows that the domain of the function is the interval $x \geq 1$ or $x \leq -1$. To find the range, is never negative. Moreover, as x takes on the various values in the domain, y takes on all non negative values.

[...]

Because this function is defined for $x \geq 1$ and for $x \leq -1$, the domain is the entire set of real numbers.

When x

1, the function behaves as in parts . For $x \geq 1$, the values of $f(x)$ is positive, and therefore the range of the function is $y \geq 0$, as shown in figure 1.22

A function is one to one if to each value of the dependent variable in the range there corresponds exactly one value of the independent variable.

The vertical line test for function

If any vertical line intersects a graph in more than one point, the graph does not define y as a function of x .

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Use the vertical line test to identify graphs in which y is a function of x

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y is a function of x y is not a function of x . two values of y correspond to an x -value.

When $x = 4$, the value of f is

In the following exercise, use the vertical line test to identify graphs in which y is a function of x .

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ii.

combinations of functions The function given by $y = f \circ g$ is the composite of f with g . The domain of $y = f \circ g$ is the set of all x in the domain of g such that $g(x)$ is in the domain of f .

Two functions can be combined in various ways to create new functions.

Forming composite functions

Let $f(x) = 2x - 4$ and $g(x) = x^2 + 3$, and find a. $f \circ g$ b. $g \circ f$ a. The composite of f with g is given by $(f \circ g)(x) = 2g(x) - 4$ Evaluate f at g .

$$= 2x^2 + 2$$

b. The composite of g with f is given by $(g \circ f)(x) = f(x)^2 + 3$ Evaluate g at f .

[...]

1 and $g \circ f$ $g \circ f$.

INVERSE FUNCTION

Definition of the inverse of a function.

The graphs of f and f^{-1} are mirror images of each other, as in figure 1.

$$Y = f^{-1}$$

Informally find the inverse function of each function a. $f = 1/5x$ b. $f =$

Find the inverse function of $f =$

Begin by substituting f with y . Then interchange x and y and solve for y .

Replace f with y .

Interchange x and y .

Using x as the independent variable, you can write

In the figure 1.24, note that the domain of f coincides with the range of f .

$$Y=x \quad F =$$

After you have found the inverse of a function, you should check your result. You can check your results graphically by observing that graphs of f and f^{-1} are reflections of each other in the line $y = x$.

Find the inverse of function of

NB: Not every function has an inverse function. In the fact, for a function to have an inverse function, it must be one- to- one.

A function that has no inverse function.

Show that the function $f = x^2 - 1$ has no inverse function.

Begin by sketching the graph of f , as shown in figure 1.

[...]

Show that the function $f = x^2 + 4$ has no inverse function.

$$x^2 + y^2 = 4$$

B. In the following exercises 5 – 6, find the domain and range of the function. Use interval notation to write your result.

In exercises 7 – 8 evaluate the function at the specified the values of the independent variable.

In exercises 9 – 10, evaluate the difference quotient and simplify the result $f = x^3 - x$

E. Find: $f + g$, $f \cdot g$ and gf if defined.

Given that $f =$

a. fg b. gf and $g = x^2 - 1$, find the composite functions: c. gf d. fg e. fgf f. gfg

In exercises 15 – 16, show that f and g are inverse functions by showing that $fg = x$

G.

and $gf = x$. Then sketch the graphs of f and g on the same coordinate axes .

Find the inverse function of f .

Conclusion and Summary

A function is a correspondence from a first set, called the domain to a second set, called the range such that each element in the domain corresponds to exactly one element in the range.

Calculus an Applied Approach Larson Edwards Sixth Edition

Blitzer Algebra and Trigonometry Custom 4th Edition Engineering Mathematics by K.A Stroud.

Properties of Limits

i.

=L

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In fig2.1 illustrates this result graphically. Note that the two graphs are identical except that

Find the limit

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I.

References

Calculus An Applied Approach Larson Edwards Sixth Edition.

=0 the denominator

In fig2.1 illustrates this result graphically. Note that the two graphs are identical except that

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Find the limit

III. Calculus An Applied Approach Larson Edwards Sixth Edition.

Continuity of Polynomial and Rational Functions

In mathematics, continuity means rigorous formulation of the intuitive concept of function that varies with no abrupt breaks or jumps.

Idea of Continuity

Let c be a number in the interval I , and let f be a function whose domain contains the interval I .

$f(c)$ is defined exists

If f is continuous at every point in the interval I , then it is continuous on an open interval (a, b) .

$N:B$

Roughly, we can say that a function is said to be continuous on an interval if its graph on the interval can be traced using a pencil and paper without lifting the pencil from the paper i.e. the graph of f is unbroken at c , and there are no holes, jumps, or gaps or to say that a function is continuous at $x=c$ when there is no interruption in the graph of f at c .

Specifically, when direct substitution can be used to evaluate the limit of a function at c , then the function is continuous at c . The two types of functions that have this property are polynomial functions and rational functions.

Determining continuity of each function $f(x) = \frac{1}{x}$

Each of these functions is a rational function and is therefore continuous at every number in its domain.

The domain of $f(x) = \frac{1}{x}$ consists of all real numbers except $x = 0$. So, this function is continuous on the intervals $(-\infty, 0)$ and $(0, \infty)$.

The domain of $f(x) = x^2$

consists of all real numbers.

[...]

Consider an open interval I that contains a real number c . If a function f is defined on I , and f is not continuous at c , then f is said to have a discontinuity at c .

Discontinuities fall into two categories: removable and non-removable.

A discontinuity is called removable if f can be made continuous by appropriately defining $f(c)$. For

instance, the function in Example 2b has a removable discontinuity at . To remove the discontinuity, all you need to do is redefine the function so that $F = 2$.

A discontinuity at $x = c$ is non removable if the function cannot be made continuous at $x=c$ by defining or redefining the function at $x=c$.

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