To the Student:

After your registration is complete and your proctor has been approved, you may take the Credit by Examination for Mathematical Models with Applications 1A.

WHAT TO BRING

- several sharpened No. 2 pencils
- a graphing calculator

ABOUT THE EXAM

The examination for the first semester of MTHMOD 1 consists of 30 problem-solving questions. The exam is based on the Texas Essential Knowledge and Skills (TEKS) for this subject. The full list of TEKS is included in this document (it is also available online at the Texas Education Agency website, http://www.tea.state.tx.us/). The TEKS outline specific topics covered in the exam, as well as more general areas of knowledge and levels of critical thinking. Use the TEKS to focus your study in preparation for the exam.

You will be tested over your K–8 math skills as well as your Algebra I skills. You will use algebraic, graphical, and geometric reasoning to recognize patterns and structure, to model information, and to solve real-life applied problems involving money, data, chance, patterns, and science.

The examination will take place under supervision, and the recommended time limit is three hours. You may not use any notes or books. A percentage score from the examination will be reported to the official at your school.

In preparation for the examination, review the TEKS for this subject. All TEKS are assessed. It is important to prepare adequately. Since questions are not taken from any one source, you can prepare by reviewing any of the state-adopted textbooks that are used at your school. However, we strongly suggest that you purchase the textbook that TTUISD uses for its MTHMOD 1A course. If you choose to purchase the textbook, you will need to read over Chapters 1–3. The textbook is:


For more information about CBE policies, visit http://www.help.k12.ttu.edu/.

Good luck on your examination!
Review Tips

The MTHMOD 1A CBE will consist of questions that ask you to solve equations and word problems. It will be helpful for you to know key terms for both types of problems. You want to make sure you understand what you are being asked to do when solving problems.

To help guide you in your preparation for the exam, ask yourself the following questions. These questions do not reflect every single item on the exam, and not everything they cover will be on the exam, but they broadly summarize what you should know about this subject.

- Do I know what a function is? Could I explain it to someone if they asked, using key words such as domain, range, equation notation, etc?
- Do I know what the linear parent function looks like?
- Do I know how to identify dependent and independent variables?
- Do I know how to find domain and range values?
- Do I know the order of operations for solving equations? Am I able to show my work when I solve equations?
- Do I understand absolute value and how to solve problems that involve absolute value?
- Do I understand how to solve and graph inequalities?
- Can I write a linear equation from information given in a word problem?
- Do I know how to graph a function?
- Do I know how to look at a graph and explain what it means?
- Do I know the difference between continuous and discrete data?
- Do I understand scatter plots and how to identify positive, negative, or no correlation?
- Do I know how to take information from a word problem and organize it into a table, then make a scatter plot from that table?
- Do I know how to look at a scatter plot and explain what it means?
- Do I know how to draw a mapping diagram?
- Do I know how to write function rules from data given in a table?
- Do I know how to find the constant of variation for inverse variation?
- Do I know how to look at a table and know whether it represents a direct or indirect variation?
### Formula Chart

You do not need to memorize the formulas provided below; they will be provided for you on the CBE in the exact same format. Just make sure that you understand how to use them. Not all formulas will be used, so do not panic if you finish all of the questions and you have not used every formula.

#### Compound Interest:

\[ A = P \left(1 + \frac{r}{n}\right)^{nt} \]

Where:
- \( A \) is the compound amount
- \( P \) is the principal
- \( r \) is the annual interest rate
- \( n \) is the number of compounding periods per year
- \( t \) is the number of years

#### Present Value:

\[ PV = \frac{FV}{\left(1 + \frac{r}{n}\right)^{nt}} \]

Where:
- \( PV \) is the present value
- \( FV \) is the future value
- \( r \) is the annual interest rate
- \( n \) is the number of compounding periods per year
- \( t \) is the number of years

#### Future Value of Ordinary Annuity:

\[ FV = P \left( 1 + \frac{1}{i} \right)^n - 1 \]

Where:
- \( FV \) = future value
- \( P \) = annuity payment
- \( n \) = total number of periods
- \( i \) = interest rate per pay period (as a decimal)

#### Future Value of an Annuity Due:

\[ FV = P \left( 1 + i \right)^n - 1 \cdot \left( 1 + i \right) \]

Where:
- \( FV \) = future value
- \( P \) = annuity payment
- \( n \) = total number of periods
- \( i \) = interest rate per pay period (as a decimal)

*continued →*
### Graphing Calculator: TVM Solver *(Finance Apps on the calculator)*

- \( N \) = total number of compounding periods
- \( I\% = r \), where \( r \% \) is the annual interest rate
- \( PV \) = present value (principal)
- \( pmt \) = payment
- \( FV \) = future value
- \( P/Y \) = number of payments per year
- \( C/Y \) = number of compounding periods per year
- \( Pmt\ end \) = payment due end of period
- \( Pmt\ begin \) = payment due at beginning of period

### Annual Percentage Rate (APR): \( APR = \frac{72i}{3P(n+i)+i(n-1)} \)

Where \( APR \) = annual percentage rate

\( i \) = interest (finance) charge on the loan

\( p \) = principal (amount borrowed)

\( n \) = number of months

### Trig Ratios (all apply to the acute angle \( A \) of a right triangle):

\[
\begin{align*}
\sin A &= \frac{\text{opposite leg}}{\text{hypotenuse}} \\
\cos A &= \frac{\text{adjacent leg}}{\text{hypotenuse}} \\
\tan A &= \frac{\text{opposite leg}}{\text{adjacent leg}}
\end{align*}
\]

### Growth Model: \( P(t) = P_0(1+r)^t \)

Where \( P_0 \) = initial amount

\( r \) = annual growth rate

\( t \) = number of elapsed years

### Decay Model: \( P(t) = P_0(1-r)^t \)

Where \( P_0 \) = initial amount

\( r \) = annual growth rate

\( t \) = number of elapsed years

### Perimeter and Area Formulas:

- **Perimeter:** sum of all sides
- **Circumference of a circle:** \( C = 2\pi r \) or \( C = \pi d \)

<table>
<thead>
<tr>
<th>Shape</th>
<th>Area Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square</td>
<td>( A = s^2 )</td>
</tr>
<tr>
<td>Rectangle</td>
<td>( A = lw )</td>
</tr>
<tr>
<td>Parallelogram</td>
<td>( A = bh )</td>
</tr>
<tr>
<td>Triangle</td>
<td>( A = \frac{1}{2}bh )</td>
</tr>
<tr>
<td>Trapezoid</td>
<td>( A = \frac{1}{2}h(b_1 + b_2) )</td>
</tr>
<tr>
<td>Circle</td>
<td>( A = \pi r^2 )</td>
</tr>
</tbody>
</table>
### Surface Area and Volume Formulas for Solids

**Prisms**

<table>
<thead>
<tr>
<th>Type</th>
<th>Lateral Area</th>
<th>Surface Area</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lateral Area</strong></td>
<td>$LA = ph$</td>
<td>$SA = ph + 2B$</td>
<td>$V = Bh$</td>
</tr>
<tr>
<td><strong>Surface Area</strong></td>
<td>$p = \text{perimeter of base}$</td>
<td>$h = \text{height of figure}$</td>
<td>$B = \text{area of base}$</td>
</tr>
</tbody>
</table>

**Cylinder**

<table>
<thead>
<tr>
<th>Type</th>
<th>Lateral Area</th>
<th>Surface Area</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lateral Area</strong></td>
<td>$LA = 2\pi rh$</td>
<td>$SA = 2\pi rh + 2\pi r^2$</td>
<td>$V = \pi r^2h$</td>
</tr>
</tbody>
</table>

**Pyramid**

<table>
<thead>
<tr>
<th>Type</th>
<th>Lateral Area</th>
<th>Surface Area</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lateral Area</strong></td>
<td>$LA = \frac{1}{2}ps$</td>
<td>$SA = \frac{1}{2}ps + B$</td>
<td>$V = \frac{1}{3}Bh$</td>
</tr>
<tr>
<td><strong>Surface Area</strong></td>
<td>$s = \text{slant height}$</td>
<td>$B = \text{area of base}$</td>
<td></td>
</tr>
</tbody>
</table>

**Cone**

<table>
<thead>
<tr>
<th>Type</th>
<th>Lateral Area</th>
<th>Surface Area</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lateral Area</strong></td>
<td>$LA = \pi rs$</td>
<td>$SA = \pi rs + \pi r^2$</td>
<td>$V = \frac{1}{3}\pi r^2h$</td>
</tr>
</tbody>
</table>

**Sphere**

<table>
<thead>
<tr>
<th>Type</th>
<th>Surface Area</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Surface Area</strong></td>
<td>$SA = 4\pi r^2$</td>
<td>$V = \frac{4}{3}\pi r^3$</td>
</tr>
</tbody>
</table>

**Pythagorean Theorem:** $a^2 + b^2 = c^2$
§111.36. Mathematical Models with Applications (One-Half to One Credit).

(a) General requirements. The provisions of this section shall be implemented beginning September 1, 1998. Students can be awarded one-half to one credit for successful completion of this course. Recommended prerequisite: Algebra I.

(b) Introduction.

(1) In Mathematical Models with Applications, students continue to build on the K-8 and Algebra I foundations as they expand their understanding through other mathematical experiences. Students use algebraic, graphical, and geometric reasoning to recognize patterns and structure, to model information, and to solve problems from various disciplines. Students use mathematical methods to model and solve real-life applied problems involving money, data, chance, patterns, music, design, and science. Students use mathematical models from algebra, geometry, probability, and statistics and connections among these to solve problems from a wide variety of advanced applications in both mathematical and nonmathematical situations. Students use a variety of representations (concrete, pictorial, numerical, symbolic, graphical, and verbal), tools, and technology (including, but not limited to, calculators with graphing capabilities, data collection devices, and computers) to link modeling techniques and purely mathematical concepts and to solve applied problems.

(2) As students do mathematics, they continually use problem-solving, language and communication, connections within and outside mathematics, and reasoning (justification and proof). Students also use multiple representations, technology, applications and modeling, and numerical fluency in problem-solving contexts.

(c) Knowledge and skills.

(1) The student uses a variety of strategies and approaches to solve both routine and non-routine problems. The student is expected to:

(A) compare and analyze various methods for solving a real-life problem;

(B) use multiple approaches (algebraic, graphical, and geometric methods) to solve problems from a variety of disciplines; and

(C) select a method to solve a problem, defend the method, and justify the reasonableness of the results.

(2) The student uses graphical and numerical techniques to study patterns and analyze data. The student is expected to:

(A) interpret information from various graphs, including line graphs, bar graphs, circle graphs, histograms, scatterplots, line plots, stem and leaf plots, and box and whisker plots to draw conclusions from the data;

(B) analyze numerical data using measures of central tendency, variability, and correlation in order to make inferences;

(C) analyze graphs from journals, newspapers, and other sources to determine the validity of stated arguments; and

(D) use regression methods available through technology to describe various models for data such as linear, quadratic, exponential, etc., select the most appropriate model, and use the model to interpret information.

(3) The student develops and implements a plan for collecting and analyzing data (qualitative and quantitative) in order to make decisions. The student is expected to:

(A) formulate a meaningful question, determine the data needed to answer the question, gather the appropriate data, analyze the data, and draw reasonable conclusions;

(B) communicate methods used, analyses conducted, and conclusions drawn for a data-analysis project by written report, visual display, oral report, or multi-media presentation; and

(C) determine the appropriateness of a model for making predictions from a given set of data.

(4) The student uses probability models to describe everyday situations involving chance. The student is expected to:

(A) compare theoretical and empirical probability; and

(B) use experiments to determine the reasonableness of a theoretical model such as binomial, geometric, etc.

(5) The student uses functional relationships to solve problems related to personal income. The student is expected to:

(A) use rates, linear functions, and direct variation to solve problems involving personal finance and budgeting, including compensations and deductions;

(B) solve problems involving personal taxes; and

(C) analyze data to make decisions about banking.

(6) The student uses algebraic formulas, graphs, and amortization models to solve problems involving credit. The student is expected to:

(A) analyze methods of payment available in retail purchasing and compare relative advantages and disadvantages of each option;

(B) use amortization models to investigate home financing and compare buying and renting a home; and
(C) use amortization models to investigate automobile financing and compare buying and leasing a vehicle.

(7) The student uses algebraic formulas, numerical techniques, and graphs to solve problems related to financial planning. The student is expected to:

(A) analyze types of savings options involving simple and compound interest and compare relative advantages of these options;

(B) analyze and compare coverage options and rates in insurance; and

(C) investigate and compare investment options including stocks, bonds, annuities, and retirement plans.

(8) The student uses algebraic and geometric models to describe situations and solve problems. The student is expected to:

(A) use geometric models available through technology to model growth and decay in areas such as population, biology, and ecology;

(B) use trigonometric ratios and functions available through technology to calculate distances and model periodic motion; and

(C) use direct and inverse variation to describe physical laws such as Hook's, Newton's, and Boyle's laws.

(9) The student uses algebraic and geometric models to represent patterns and structures. The student is expected to:

(A) use geometric transformations, symmetry, and perspective drawings to describe mathematical patterns and structure in art and architecture; and

(B) use geometric transformations, proportions, and periodic motion to describe mathematical patterns and structure in music.

Source: The provisions of this §111.36 adopted to be effective September 1, 1998, 22 TexReg 7623; amended to be effective August 1, 2006, 30 TexReg 1931; amended to be effective February 22, 2009, 34 TexReg 1056.