

## **Mathematical Models with Applications, First Semester**

### **Understanding CBE/EA requirements**

Before you take the Mathematical Models with Applications, First Semester Credit by Examination/Examination for Acceleration from The University of Texas K-16 Education Center, here are some things you need to know. You have **sixty** days from the date of registration to take the exam.

Successfully completing the Mathematical Models with Applications, First Semester CBE/EA will earn you one-half unit of high school credit for the course. This review sheet can help you prepare for the exam, by giving you an idea of what you need to study, review, and learn. To succeed, you should be thoroughly familiar with the subject matter before you attempt to take the exam.

Please note that exams and review sheets are updated regularly. When you take the exam, you need to bring your confirmation letter, because it contains the unique number that indicates which edition of the exam you will take. Your grade will be available two to three weeks after you take the exam.

When you take the exam, please be prepared to show your competence and understanding of the Texas Essential Knowledge and Skills (TEKS) that the Texas Education Agency has specified for the course. Because this CBE/EA review sheet may not refer to all the material that will be in the exam, you should use the complete TEKS for Mathematical Models with Applications, First Semester to guide your exam preparation. You can view these TEKS online at <http://www.tea.state.tx.us/teks/>

### **Preparing for the exam**

To prepare for the exam, you may use any Texas state-adopted textbook for the course. The exam does not refer to any particular text, but it requires that you know the important concepts and objectives covered in Mathematical Models with Applications, First Semester, as outlined by the TEKS.

The prerequisite for Mathematical Models with Applications, First Semester is the successful completion of first-year algebra or the equivalent. It is assumed that if you are taking this examination, you have already mastered the objectives for all of the levels of mathematics through first-year algebra.

### **Concepts and objectives**

As you prepare for the Mathematical Models with Applications, First Semester, please keep in mind that you will be asked to show mastery of the following concepts and objectives.

Each topic is followed by a list of objectives you need to be able to perform in order to successfully solve the problems related to that topic. Because they will appear throughout the exam, be sure that you know the following abbreviations: APR, MSRP, PIP, CD. They are

defined in the following topics, and they will be spelled out in their first mention in the text of the exam. Thereafter, however, only the abbreviations will be used.

- Stock Market

1. Define the following terms associated with a stock quotation:  

<i>stock</i>	<i>share</i>
<i>stock market or stock exchange</i>	<i>stock quotation</i>
<i>stockbrokers</i>	<i>commission</i>
<i>stockholders or investors</i>	<i>trading</i>
<i>profit</i>	<i>dividends</i>
<i>market value</i>	
2. Interpret information given in a stock quotation.
3. Use computations to solve problems involving stock quotations.
4. Given the number of shares, the amount per share, and the amount of the dividend paid by the stock on a quarterly or yearly basis, find the earnings from the dividends.
5. Determine if you earned or lost money based on the stock information given in a problem.
6. Calculate how much it costs to purchase and sell stock, given the number of shares and the market value of the shares.
7. Calculate how much you will lose or receive by selling your stock, given the number of shares you want to sell, the market value of the shares when you bought them, and the market value of the shares when you sell them.
8. Perform calculations involving stock quotations while taking stockbroker's fee, or commission, into consideration.

- Simple and Compound Interest

1. Define the following terms associated with simple and compound interest:  

<i>principal</i>	<i>present value</i>
<i>maturity value</i>	<i>future value</i>
<i>average daily balance</i>	<i>interest</i>
<i>interest rate</i>	
2. Calculate the interest and future value using the simple interest formula.
3. Compare the future values on simple interest investments when different amounts are invested for the same period of time.
4. Calculate the interest and future value using the compound interest formula.
5. Compare the future values of a simple interest account and a compound interest account and explain why the future values are different.
6. Compare the future value of different investments when the same amount is invested for the same amount of time, but the interest is compounded at various times of the year.
7. Calculate the interest and future value of an annuity.

- Buying versus Leasing a Vehicle

1. Define the following terms associated with buying and leasing vehicles:  

<i>residual value</i>	<i>rebates</i>	<i>purchase price</i>
<i>actual cost</i>	<i>finance charge</i>	<i>annual percentage rate (APR)</i>

<i>trade-in</i>	<i>down payment</i>	<i>monthly payment</i>
<i>lease</i>	<i>lease term</i>	<i>capitalized cost</i>
<i>discounts</i>	<i>depreciation fee</i>	<i>monthly leasing payment</i>
<i>leasing fee</i>	<i>money factor</i>	<i>manufacturer's suggested retail price (MSRP)</i>

- Given the amount of the monthly payment on a vehicle and the number of payments, calculate the total cost of that vehicle.
  - Given the amount of the monthly payment on a vehicle, the amount of the down payment, and the number of payments, calculate the total cost of that vehicle.
  - Given the price of a vehicle, the annual percentage rate, and the number of months financed, calculate the finance charge on that vehicle with no down payment or trade-in.
  - Given the price of a vehicle, the annual percentage rate, and the number of months financed, estimate the monthly payment for that vehicle with no down payment or trade-in.
  - Given the price of a vehicle, the annual percentage rate, and the number of months financed, calculate the actual cost of that vehicle with no down payment or trade-in.
  - Given the price of a vehicle, the annual percentage rate, and the number of months financed, calculate the finance charge on that vehicle with a down payment.
  - Given the price of a vehicle, the annual percentage rate, and the number of months financed, estimate the monthly payment for that vehicle with a down payment.
  - Given the price of a vehicle, the annual percentage rate, and the number of months financed, calculate the actual cost of that vehicle with a down payment.
  - Determine which vehicle financing option will fit within a given budget.
  - Given the MSRP (manufacturer's suggested retail price), the length of the lease, the APR, and the residual cost of the vehicle at the end of the lease, calculate the monthly lease payment for a vehicle with no discounts or down payment.
  - Given the monthly payment and the number of months in the lease, calculate the total amount spent on a vehicle lease.
  - Given the MSRP, the length of the lease, the APR, and the residual of the vehicle at the end of the lease, calculate the monthly payment for a vehicle with a discount or down payment.
- Vehicle Insurance
    - Define the following terms associated with insuring a vehicle:
 

<i>driving records</i>	<i>liability</i>
<i>benchmark rates</i>	<i>premium</i>
<i>claim</i>	<i>deductible</i>
    - Define the following types of coverage:
 

<i>liability</i>	<i>uninsured/underinsured motorist protection</i>
<i>collision</i>	<i>comprehensive physical damage insurance</i>
	<i>personal injury protection (PIP)</i>
    - Calculate a yearly insurance premium based on given rates.
    - Calculate a yearly insurance premium based on given rating factors.
    - Calculate an insurance premium after discounts are awarded.

6. Calculate how much it will cost for you to repair your vehicle if you don't claim the accident on your insurance.
  7. Calculate how much you will pay if you claim the accident on your insurance.
- Buying versus Leasing a House
    1. Define the following terms associated with buying or leasing/renting a house:

<i>lease/rent</i>	<i>renter's insurance</i>	<i>mortgage</i>
<i>mortgage company</i>	<i>credit report</i>	<i>down payment</i>
<i>realtor</i>	<i>commission</i>	<i>offer</i>
<i>earnest money</i>	<i>fair market value</i>	<i>contract</i>
<i>appraisal</i>	<i>survey</i>	<i>closing costs</i>
<i>fixed-rate mortgage</i>	<i>principal</i>	<i>amortization</i>
<i>escrow</i>	<i>foreclose</i>	<i>closing</i>
<i>origination fee</i>	<i>APR fee</i>	<i>equity</i>
    2. Calculate the total monthly payment on a house, given the loan payment and the monthly escrow payment.
    3. Use the Amortization Formula to calculate the monthly loan payment on a house.
    4. Use the Amortization Formula to calculate the total monthly payment on a house, including the monthly escrow payments.
    5. Calculate the total amount spent to purchase a house.
    6. Calculate the total amount of money spent to lease a house.
    7. Compare the advantages and disadvantages of buying versus leasing a house.
  - Credit Card Debt
    1. Define the following terms associated with credit card debt:

<i>credit</i>	<i>previous balance</i>	<i>average daily balance</i>
<i>daily balance</i>	<i>monthly payment</i>	<i>annual percentage rate (APR)</i>
    2. Calculate the daily balance of a credit card account.
    3. Calculate the average daily balance of a credit card account.
    4. Calculate the monthly percentage rate, given the APR.
    5. Calculate the amount of interest you will pay on the balance of a credit card account.
    6. Determine the amount you must pay monthly in order to pay off a credit card balance in a certain amount of time.
    7. Compare the various amounts of interest you would have to pay, depending on how much time it takes you to pay off your credit card balance.



$n$  = number of times the interest is compounded in a year  
 $t$  = time, in years

- Future Value of Annuity Formula

$$S = P \frac{(1 + i)^{nt} - 1}{i}$$

$S$  = compounded amount, or the principal plus interest

$P$  = amount deposited each period

$i = r/n$  = annual percentage rate divided by number of times the interest is compounded in a year

$n$  = number of times the interest is compounded in a year

$t$  = time, in years

- Buying a Vehicle

$$\text{Finance Charge} = \frac{A(N + 1)(R)}{2P}$$

$A$  = loan amount

$N$  = total number of payments

$R$  = annual percentage rate (APR)

$P$  = number of payments per year

- Leasing a Vehicle

Residual value = MSRP  $\times$  residual value percentage

Capitalized cost = MSRP – discount – down payment

Depreciation fee =  $\frac{\text{capitalized cost} - \text{residual value}}{\text{length of lease in months}}$

Money factor = APR  $\div$  12

Leasing fee = money factor (capitalized cost – residual value)

Monthly payment = depreciation fee + leasing fee

- Buying a House

$$\text{Payment} = P \frac{i}{1 - (1 + i)^{-n}}$$

$P$  = principal or loan amount

$i$  = rate per period

$n$  = total number of payments

- Credit Card Debt

Daily balance = previous balance + new purchases – payments

Average daily balance = sum of the balances for each day divided by the number of days in the period

Monthly percentage rate = APR ÷ 12

Monthly Payment Formula

$$M = \frac{Pr(1+r)^n}{(1+r)^n - 1}$$


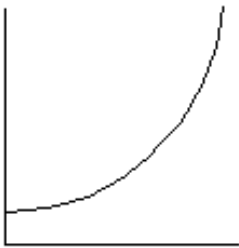
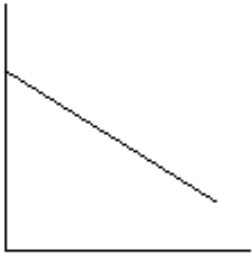

$M$  = monthly payment

$P$  = current balance

$r$  = monthly interest rate

$n$  = number of payments

- Growth and Decay

Type of Function	Linear (straight line)	Exponential (curved line)
Growth (rises to the right)	 $y = mx + b, m > 0$	 $y = Ca^x, a > 1$
Decay (falls to the right)	 $y = mx + b, m < 0$	 $y = Ca^x, 0 < a < 1$

- Trigonometric Applications

$$\sin a = \frac{\text{side opposite the angle}}{\text{hypotenuse}}$$

$$\cos a = \frac{\text{side adjacent to the angle}}{\text{hypotenuse}}$$

$$\tan a = \frac{\text{side opposite the angle}}{\text{side adjacent to the angle}}$$

### Time for the exam

You will be allowed **3 hours** to take the exam.

### Types of questions

The exam consists of 25 real-world problems that will require you to use problem-solving skills.

### Sample exam

Be sure to read this sample exam for a better idea of the types of questions you will find on the exam. An example of each type of question is given below.

You may need to use arithmetic skills from previous math courses. Most of the problems will require multiple steps to solve them, so do not be too hasty. Be sure that you have addressed all aspects of the problem. Show all of your work, as you may receive partial credit if your work is correct, even if your solution is incorrect. Following are examples of the kinds of problems you may find on the exam.

*Examples:*

K-mart pays a quarterly dividend of 75 cents per share on its stock. Find the yearly dividend for 50 shares.

You found a car advertised online for \$400 per month for 5 years with a down payment of \$1,500. What is the total cost of the vehicle?

You choose to finance the entire amount of a \$75,000 house over a 30-year period at a fixed interest rate of 8.5%. The closing costs on the house are \$1,735.32. What is the total amount you will spend on the house?

The population of your hometown is 100,900. It is estimated that the population will increase by 3,000 each year. Write an equation to represent the population,  $P$ , in terms of years,  $y$ .



## **Bringing identification and materials for the exam**

### **Required photo identification**

Students must present an official ID (driver's license, school ID, an ID from the Department of Public Safety, or passport) with photo and signature.

For more information about acceptable forms of identification, you can call the K-16 Education Testing Center (512-232-5000 or 1-888-232-4723).

### **Authorized materials for the exam**

Bring with you two sharpened number 2 pencils with erasers and a graphing calculator. Scratch paper and graphing paper will be provided. You will not be allowed to bring any other items into the exam area.

## **Meeting requirements for taking the exam**

### **Required score (CBE)**

If you have had previous instruction in the grade or course and are testing to complete requirements and gain credit, you must score a minimum of 70%.

### **Required score (EA)**

If you are taking the Examination for Acceleration (skipping a grade or a required course), you must score at least 90% to earn credit in the state of Texas.

### **Refund policy**

The \$45 fee for the Credit by Examination or Examination for Acceleration is not refundable or transferable to another person or another subject.

### **Test proctor and location**

You are responsible for arranging a testing time, in advance, with the counselor or test supervisor in your school or alternate test site.

If you plan to test in the K-16 Education Center at The University of Texas at Austin, please register for your exam at least 24 hours in advance of your desired testing date. Schedule your exam so that you will have plenty of time to take the test in one sitting.

The times for sitting are listed at the Testing link of the K-16 Education Center's Credit by Examination/Examination for Acceleration web link.

Saturday testing is available once a month, by appointment only. Please call 512-232-5000 or 1-888-232-4723 to schedule an appointment for a Saturday testing session.

### **Obtaining grades by phone**

In compliance with the Family Education Rights and Privacy Act (FERPA), no information will be released over the telephone without your assigned Personal Identification Number. You will find this PIN on your enrollment receipt.

### **Re-examination**

If you score less than the minimum of 90% required to pass an Examination for Acceleration, a re-examination is available for a \$45 fee. Re-examination will be administered only after you have received an official notification that the first exam score was below 90%.

If you score less than the minimum of 70% required to pass a Credit by Examination, a re-examination is available for a \$45 fee. Re-examination will be administered only after you have received an official notification that the first exam score was below 70%.