To the Student:

After your registration is complete, you may take the online Credit by Examination for PRE CALC 1B.

WHAT TO BRING

- several sharpened No. 2 pencils
- graphing calculator
- extra sheets of scratch paper

ABOUT THE EXAM

The examination for the second semester of Precalculus consists of 30 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). 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. TEKS covered in this semester are indicated by a checkmark; the exam will focus on the checkmarked TEKS, but may touch on any of the full list.

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

A list of key concepts is included in this document to focus your studies. 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. A formula chart will be provided to you for use on your exam.

Good luck on your examination!

PRE CALC 1B Key Concepts

In order to pass the Precalculus 1B CBE, the student should be able to do the following:

- define and use radian measure;
- convert angles measured in degrees to radians and angles measured in radians to degrees;
- find coterminal angles;
- use angles to model and solve real-life problems involving arc length, area, and angular and linear velocities;
- identify a unit circle and describe its relationship to real numbers;
- define the six trigonometric functions using a unit circle;
- evaluate trigonometric functions using the unit circle;
- use domain and period to evaluate sine and cosine functions;
- use a calculator to evaluate trigonometric functions;
- define the six trigonometric functions using a right triangle;
- evaluate trigonometric functions of acute angles;
- use a calculator to evaluate trigonometric functions;
- use the fundamental trigonometric identities;
- use trigonometric functions to model and solve real-life problems;
- evaluate trigonometric functions of any angle;
- find reference angles;
- evaluate trigonometric functions of real numbers;
- sketch the graphs of the six basic trigonometric functions;
- use amplitude, period, phase, and vertical shifts to sketch translations of the graphs of the six trigonometric functions;
- use sine and cosine functions to model real-life data;
- evaluate and graph the inverse trig functions;

- evaluate the compositions of trig functions;
- solve a right triangle;
- solve real-life problems involving right triangles;
- solve real-life problems involving directional bearings;
- solve real-life problems involving harmonic motion;
- recognize and write the fundamental trigonometric identities;
- use the fundamental trigonometric identities to evaluate trigonometric functions;
- use the fundamental trigonometric identities to simplify or rewrite trigonometric expressions;
- verify trigonometric identities;
- solve trigonometric equations;
- use inverse trigonometric functions to solve trigonometric equations;
- use sum and difference formulas to evaluate trigonometric functions, verify identities, and solve trigonometric equations;
- solve oblique triangles using either the law of sines or law of cosines;
- find the area of oblique triangles using Hero's formula;
- represent vectors as directed line segments and perform mathematical operations on vectors;
- find direction angles of vectors;
- apply the concepts above to model and solve real-life applications;
- write and use the general and standard forms of the conic sections;
- analyze and graph parabolas, ellipses, and hyperbolas;
- recognize and classify conic sections by their equations;
- apply the concepts of conic sections to real-life problems;
- find the eccentricity and degenerate cases of the conic sections;
- evaluate sets of parametric equations for given values of the parameter;

- graph curves that are represented by sets of parametric equations;
- rewrite sets of parametric equations as single rectangular equations and find sets of parametric equations for graphs; and
- convert rectangular coordinates and equations to polar form and graph polar equations.

PRE CALC 1B Formula Chart

$\omega = \dfrac{\theta}{t}$

$v = \dfrac{s}{t}$

$v = r\,\omega$

$x = r \cos \theta$

$y = r \sin \theta$

$x = \left(v_0 \cos\theta\right)t$

$y = \left(v_0 \sin\theta\right)t - 16t^2 + h_0$

$y = \left(v_0 \sin\theta\right)t - 4.9t^2 + h_0$

$\sin (u + v) = \sin u \cos v + \cos u \sin v$

$\sin (u - v) = \sin u \cos v - \cos u \sin v$

$\cos (u + v) = \cos u \cos v - \sin u \sin v$

$\cos (u - v) = \cos u \cos v + \sin u \sin v$

$\tan (u + v) = \dfrac{\tan u + \tan v}{1 - \tan u \tan v}$

$\tan (u - v) = \dfrac{\tan u - \tan v}{1 + \tan u \tan v}$

$\sin 2u = 2 \sin u \cos u$

$\cos 2u = \cos^2 u - \sin^2 u$

$\tan 2u = \dfrac{2 \tan u}{1 - \tan^2 u}$

$\dfrac{(x-h)^2}{a^2} + \dfrac{(y-k)^2}{b^2} = 1$

$\dfrac{(x-h)^2}{a^2} - \dfrac{(y-k)^2}{b^2} = 1$

$y = a(x - h)^2 + k$

$x = a(y - k)^2 + h$

Texas Essential Knowledge and Skills
PRE CALC 1B – Precalculus, Second Semester

TTU: PRE CALC 1B CBE, v.4.0	
TEKS: §111.42. Precalculus, Adopted 2012 (One-Half Credit)	
TEKS Covered	**TEKS Covered**
§111.38. Implementation of Texas Essential Knowledge and Skills for Mathematics, High School, Adopted 2012.	
(a) The provisions of §§111.39-111.45 of this subchapter shall be implemented by school districts.	
(b) No later than June 30, 2015, the commissioner of education shall determine whether instructional materials funding has been made available to Texas public schools for materials that cover the essential knowledge and skills for mathematics as adopted in §§111.39-111.45 of this subchapter.	
(c) If the commissioner makes the determination that instructional materials funding has been made available under subsection (b) of this section, §§111.39-111.45 of this subchapter shall be implemented beginning with the 2015-2016 school year and apply to the 2015-2016 and subsequent school years.	
(d) If the commissioner does not make the determination that instructional materials funding has been made available under subsection (b) of this section, the commissioner shall determine no later than June 30 of each subsequent school year whether instructional materials funding has been made available. If the commissioner determines that instructional materials funding has been made available, the commissioner shall notify the State Board of Education and school districts that §§111.39-111.45 of this subchapter shall be implemented for the following school year.	
(e) Sections 111.31-111.37 of this subchapter shall be superseded by the implementation of §§111.38-111.45 under this section.	
Source: The provisions of this §111.38 adopted to be effective September 10, 2012, 37 TexReg 7109.	
§111.42. Precalculus, Adopted 2012.	
(a) General requirements. Students shall be awarded one-half to one credit for successful completion of this course. Prerequisites: Algebra I, Geometry, and Algebra II.	
(b) Introduction.	
(1) The desire to achieve educational excellence is the driving force behind the Texas essential knowledge and skills for mathematics, guided by the college and career readiness standards. By embedding statistics, probability, and finance, while focusing on fluency and solid understanding, Texas will lead the way in mathematics education and prepare all Texas students for the challenges they will face in the 21st century.	
(2) The process standards describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. When possible, students will apply mathematics to problems arising in everyday life, society, and the workplace. Students will use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution. Students will select appropriate tools such as real objects, manipulatives, paper and pencil, and technology and techniques such as mental math, estimation, and number sense to solve problems. Students will effectively communicate mathematical ideas, reasoning, and their implications using multiple representations such as symbols, diagrams, graphs, and language. Students will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.	
(3) Precalculus is the preparation for calculus. The course approaches topics from a function point of view, where appropriate, and is designed to strengthen and enhance conceptual understanding and mathematical reasoning used when modeling and solving mathematical and real-world problems. Students systematically work with functions and their multiple representations. The study of Precalculus deepens students' mathematical understanding and fluency with algebra and trigonometry and extends their ability to make connections and apply concepts and procedures at higher levels. Students investigate and explore mathematical ideas, develop multiple strategies for analyzing complex situations, and use technology to build understanding, make connections between representations, and provide support in solving problems.	
(4) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.	
(c) Knowledge and skills.	

TTU: PRE CALC 1B CBE, v.4.0	
TEKS: §111.42. Precalculus, Adopted 2012 (One-Half Credit)	
TEKS Covered	**TEKS Covered**
(1) Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	
(A) apply mathematics to problems arising in everyday life, society, and the workplace;	✓
(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;	✓
(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;	✓
(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	✓
(E) create and use representations to organize, record, and communicate mathematical ideas;	✓
(F) analyze mathematical relationships to connect and communicate mathematical ideas; and	✓
(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.	✓
(2) Functions. The student uses process standards in mathematics to explore, describe, and analyze the attributes of functions. The student makes connections between multiple representations of functions and algebraically constructs new functions. The student analyzes and uses functions to model real-world problems. The student is expected to:	
(A) use the composition of two functions to model and solve real-world problems;	
(B) demonstrate that function composition is not always commutative;	
(C) represent a given function as a composite function of two or more functions;	
(D) describe symmetry of graphs of even and odd functions;	✓
(E) determine an inverse function, when it exists, for a given function over its domain or a subset of its domain and represent the inverse using multiple representations;	
(F) graph exponential, logarithmic, rational, polynomial, power, trigonometric, inverse trigonometric, and piecewise defined functions, including step functions;	✓
(G) graph functions, including exponential, logarithmic, sine, cosine, rational, polynomial, and power functions and their transformations, including $af(x)$, $f(x) + d$, $f(x - c)$, $f(bx)$ for specific values of a, b, c, and d, in mathematical and real-world problems;	✓
(H) graph arcsin x and arccos x and describe the limitations on the domain;	✓
(I) determine and analyze the key features of exponential, logarithmic, rational, polynomial, power, trigonometric, inverse trigonometric, and piecewise defined functions, including step functions such as domain, range, symmetry, relative maximum, relative minimum, zeros, asymptotes, and intervals over which the function is increasing or decreasing;	✓
(J) analyze and describe end behavior of functions, including exponential, logarithmic, rational, polynomial, and power functions, using infinity notation to communicate this characteristic in mathematical and real-world problems;	
(K) analyze characteristics of rational functions and the behavior of the function around the asymptotes, including horizontal, vertical, and oblique asymptotes;	
(L) determine various types of discontinuities in the interval $(-\infty, \infty)$ as they relate to functions and explore the limitations of the graphing calculator as it relates to the behavior of the function around discontinuities;	
(M) describe the left-sided behavior and the right-sided behavior of the graph of a function around discontinuities;	
(N) analyze situations modeled by functions, including exponential, logarithmic, rational, polynomial, and power functions, to solve real-world problems;	
(O) develop and use a sinusoidal function that models a situation in mathematical and real-world problems; and	✓
(P) determine the values of the trigonometric functions at the special angles and relate them in mathematical and real-world problems.	✓

TTU: PRE CALC 1B CBE, v.4.0	
TEKS: §111.42. Precalculus, Adopted 2012 (One-Half Credit)	
TEKS Covered	**TEKS Covered**
(3) Relations and geometric reasoning. The student uses the process standards in mathematics to model and make connections between algebraic and geometric relations. The student is expected to:	
(A) graph a set of parametric equations;	✓
(B) convert parametric equations into rectangular relations and convert rectangular relations into parametric equations;	✓
(C) use parametric equations to model and solve mathematical and real-world problems;	✓
(D) graph points in the polar coordinate system and convert between rectangular coordinates and polar coordinates;	✓
(E) graph polar equations by plotting points and using technology;	✓
(F) determine the conic section formed when a plane intersects a double-napped cone;	✓
(G) make connections between the locus definition of conic sections and their equations in rectangular coordinates;	✓
(H) use the characteristics of an ellipse to write the equation of an ellipse with center (h, k); and	✓
(I) use the characteristics of a hyperbola to write the equation of a hyperbola with center (h, k).	✓
(4) Number and measure. The student uses process standards in mathematics to apply appropriate techniques, tools, and formulas to calculate measures in mathematical and real-world problems. The student is expected to:	
(A) determine the relationship between the unit circle and the definition of a periodic function to evaluate trigonometric functions in mathematical and real-world problems;	✓
(B) describe the relationship between degree and radian measure on the unit circle;	✓
(C) represent angles in radians or degrees based on the concept of rotation and find the measure of reference angles and angles in standard position;	✓
(D) represent angles in radians or degrees based on the concept of rotation in mathematical and real-world problems, including linear and angular velocity;	✓
(E) determine the value of trigonometric ratios of angles and solve problems involving trigonometric ratios in mathematical and real-world problems;	✓
(F) use trigonometry in mathematical and real-world problems, including directional bearing;	✓
(G) use the Law of Sines in mathematical and real-world problems;	✓
(H) use the Law of Cosines in mathematical and real-world problems;	✓
(I) use vectors to model situations involving magnitude and direction;	✓
(J) represent the addition of vectors and the multiplication of a vector by a scalar geometrically and symbolically; and	✓
(K) apply vector addition and multiplication of a vector by a scalar in mathematical and real-world problems.	✓
(5) Algebraic reasoning. The student uses process standards in mathematics to evaluate expressions, describe patterns, formulate models, and solve equations and inequalities using properties, procedures, or algorithms. The student is expected to:	
(A) evaluate finite sums and geometric series, when possible, written in sigma notation;	
(B) represent arithmetic sequences and geometric sequences using recursive formulas;	
(C) calculate the nth term and the nth partial sum of an arithmetic series in mathematical and real-world problems;	
(D) represent arithmetic series and geometric series using sigma notation;	
(E) calculate the nth term of a geometric series, the nth partial sum of a geometric series, and sum of an infinite geometric series when it exists;	

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TEKS: §111.42. Precalculus, Adopted 2012 (One-Half Credit)	
TEKS Covered	**TEKS Covered**
(F) apply the Binomial Theorem for the expansion of (a + b)n in powers of a and b for a positive integer n, where a and b are any numbers;	
(G) use the properties of logarithms to evaluate or transform logarithmic expressions;	
(H) generate and solve logarithmic equations in mathematical and real-world problems;	
(I) generate and solve exponential equations in mathematical and real-world problems;	
(J) solve polynomial equations with real coefficients by applying a variety of techniques in mathematical and real-world problems;	
(K) solve polynomial inequalities with real coefficients by applying a variety of techniques and write the solution set of the polynomial inequality in interval notation in mathematical and real-world problems;	
(L) solve rational inequalities with real coefficients by applying a variety of techniques and write the solution set of the rational inequality in interval notation in mathematical and real-world problems;	
(M) use trigonometric identities such as reciprocal, quotient, Pythagorean, cofunctions, even/odd, and sum and difference identities for cosine and sine to simplify trigonometric expressions; and	✓
(N) generate and solve trigonometric equations in mathematical and real-world problems.	✓
Source: The provisions of this §111.42 adopted to be effective September 10, 2012, 37 TexReg 7109.	