

 CollegeBoard

**CLEP<sup>®</sup>**

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# **CLEP<sup>®</sup>** Precalculus

AT A GLANCE

## Description of the Examination

The CLEP® Precalculus examination assesses student mastery of skills and concepts required for success in a first-semester calculus course. A large portion of the exam is devoted to testing a student's understanding of functions and their properties. Many of the questions test a student's knowledge of specific properties of the following types of functions: linear, quadratic, absolute value, square root, polynomial, rational, exponential, logarithmic, trigonometric, inverse trigonometric, and piecewise defined. Questions on the exam will present these types of functions symbolically, graphically, verbally, or in tabular form. A solid understanding of these types of functions is at the core of all precalculus courses, and it is a prerequisite for enrolling in calculus and other college-level mathematics courses.

The examination contains approximately 48 questions, in two sections, to be answered in approximately 90 minutes.

- **Section 1:** 25 questions, approximately 50 minutes.  
The use of an **online graphing calculator (non-CAS)** is allowed for this section. Only some of the questions will require the use of the calculator.
- **Section 2:** 23 questions, approximately 40 minutes.  
No calculator is allowed for this section.

Although most of the questions on the exam are multiple choice, there are some questions that require students to enter a numerical answer.

## Graphing Calculator

A graphing calculator, which is integrated into the exam software, is available to students only during Section 1 of the exam. Students are expected to know how and when to make use of it.

**For more information about the graphing calculator, please visit the Precalculus exam description on the CLEP website, [clep.collegeboard.org](http://clep.collegeboard.org).**

In order to answer some of the questions in Section 1 of the exam, students may be required to use the online graphing calculator in the following ways:

- Perform calculations (e.g., exponents, roots, trigonometric values, logarithms).
- Graph functions, and analyze the graphs.
- Find zeros of functions.
- Find points of intersection of graphs of functions.
- Find minima/maxima of functions.
- Find numerical solutions to equations.
- Generate a table of values for a function.

## Knowledge and Skills Required

Questions on the examination require candidates to demonstrate the following abilities:

- Recalling factual knowledge and/or performing routine mathematical manipulation.
- Solving problems that demonstrate comprehension of mathematical ideas and/or concepts.
- Solving nonroutine problems or problems that require insight, ingenuity, or higher mental processes.

The subject matter of the Precalculus examination is drawn from the following topics. The percentages next to the topics indicate the approximate percentage of exam questions on that topic.

### 20% ALGEBRAIC EXPRESSIONS, EQUATIONS, AND INEQUALITIES

- Ability to perform operations on algebraic expressions
- Ability to solve equations and inequalities, including linear, quadratic, absolute value, polynomial, rational, radical, exponential, logarithmic, and trigonometric
- Ability to solve systems of equations, including linear and nonlinear

### 15% FUNCTIONS: CONCEPT, PROPERTIES, AND OPERATIONS

- Ability to demonstrate an understanding of the concept of a function, the general properties of functions (e.g., domain, range), function notation, and to perform symbolic operations with functions (e.g., evaluation, inverse functions)

### 30% REPRESENTATIONS OF FUNCTIONS: SYMBOLIC, GRAPHICAL, AND TABULAR

- Ability to recognize and perform operations and transformations on functions presented symbolically, graphically, or in tabular form
- Ability to demonstrate an understanding of basic properties of functions and to recognize elementary functions (linear, quadratic, absolute value, square root, polynomial, rational, exponential, logarithmic, trigonometric, inverse trigonometric, and piecewise-defined functions) that are presented symbolically, graphically, or in tabular form

### 10% ANALYTIC GEOMETRY

- Ability to demonstrate an understanding of the analytic geometry of lines, circles, parabolas, ellipses, and hyperbolas

### 15% TRIGONOMETRY AND ITS APPLICATIONS<sup>1</sup>

- Ability to demonstrate an understanding of the basic trigonometric functions and their inverses and to apply the basic trigonometric ratios and identities (in right triangles and on the unit circle)
- Ability to apply trigonometry in various problem-solving contexts

### 10% FUNCTIONS AS MODELS

- Ability to interpret and construct functions as models and to translate ideas among symbolic, graphical, tabular, and verbal representations of functions

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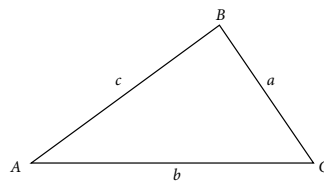
1. Note that trigonometry permeates most of the major topics and accounts for more than 15% of the exam. The actual proportion of exam questions that requires knowledge of either right triangle trigonometry or the properties of the trigonometric functions is approximately 30%–40%.

## Notes and Reference Information

The following information will be available for reference during the exam.

1. Figures that accompany questions are intended to provide information useful in answering the questions. All figures lie in a plane unless otherwise indicated. The figures are drawn as accurately as possible EXCEPT when it is stated in a specific question that the figure is not drawn to scale. Straight lines and smooth curves may appear slightly jagged on the screen.
2. Unless otherwise specified, all angles are measured in radians, and all numbers used are real numbers. For some questions in this test, you may have to decide whether the calculator should be in radian mode or degree mode.
3. Unless otherwise specified, the domain of any function  $f$  is assumed to be the set of all real numbers  $x$  for which  $f(x)$  is a real number. The range of  $f$  is assumed to be the set of all real numbers  $f(x)$ , where  $x$  is in the domain of  $f$ .
4. In this test,  $\log x$  denotes the common logarithm of  $x$  (that is, the logarithm to the base 10), and  $\ln x$  denotes the natural logarithm of  $x$  (that is, the logarithm to the base  $e$ ).
5. The inverse of a trigonometric function  $f$  may be indicated using the inverse function notation  $f^{-1}$  or with the prefix “arc” (e.g.,  $\sin^{-1} x = \arcsin x$ ).
6. The range of  $\sin^{-1} x$  is  $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ .  
The range of  $\cos^{-1} x$  is  $[0, \pi]$ .  
The range  $\tan^{-1} x$  is  $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ .

7.



$$\text{Law of Sines: } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\text{Law of Cosines: } c^2 = a^2 + b^2 - 2ab \cos C$$

8. Sum and Difference Formulas:

$$\sin(\alpha + \beta) = \sin \alpha \cos \beta + \cos \alpha \sin \beta$$

$$\sin(\alpha - \beta) = \sin \alpha \cos \beta - \cos \alpha \sin \beta$$

$$\cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta$$

$$\cos(\alpha - \beta) = \cos \alpha \cos \beta + \sin \alpha \sin \beta$$

## Study Resources

Most textbooks used in college-level precalculus courses cover the topics in the outline above, but the approaches to certain topics and the emphases given to them may differ.

To prepare for the CLEP Precalculus exam, it is advisable to study one or more college textbooks, which can be found for sale online or in most college bookstores. When selecting a textbook, check the table of contents against the knowledge and skills required for this test.

A recent survey conducted by CLEP found that the following textbooks (for group authors, first author listed only) are among those used by college faculty who teach the equivalent course.

Blitzer, <i>Precalculus</i> (Pearson)
Blitzer, <i>Algebra and Trigonometry</i> (Pearson)
Stewart, <i>Precalculus: Mathematics for Calculus</i> (Brooks/Cole)
Sullivan, <i>Precalculus</i> (Pearson)

Visit [clep.collegeboard.org/earn-college-credit/practice](http://clep.collegeboard.org/earn-college-credit/practice) for additional precalculus resources. You can also find suggestions for exam preparation in Chapter IV of the *CLEP Official Study Guide*. In addition, many college faculty post their course materials on their schools' websites.

## Sample Test Questions

The following sample questions do not appear on an actual CLEP examination. They are intended to give potential test takers an indication of the format and difficulty level of the examination and to provide content for practice and review. Knowing the correct answers to all of the sample questions is not a guarantee of satisfactory performance on the exam.

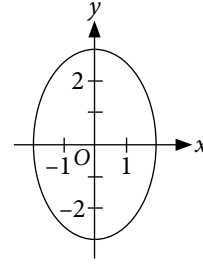
### SECTION I

**Directions:** A graphing calculator will be available for the questions in this section. Some questions will require you to select from among five choices. For these questions, select the BEST of the choices given. If the exact numerical value of your answer is not one of the choices, select the choice that best approximates this value. Some questions will require you to enter a numerical answer in the box provided.

1. Abigail built a table with a rectangular top. The width of the tabletop is 3.5 feet less than the length. The tabletop has a surface area of 24.5 square feet. What is the perimeter of the tabletop?
  - A. 10.5 feet
  - B. 18.5 feet
  - C. 21.0 feet
  - D. 28.0 feet
  - E. 35.0 feet
2. A tank is in the shape of a right circular cylinder. It has radius  $r$ , and the height is 3 times the diameter. Which of the following is the volume of the tank?
  - A.  $\frac{1}{3}\pi r^3$
  - B.  $\frac{4}{3}\pi r^3$
  - C.  $3\pi r^3$
  - D.  $6\pi r^3$
  - E.  $27\pi r^3$
3. The cost of 3 granola bars and 2 bottles of water is \$7. The cost of 2 granola bars and 1 bottle of water is \$4. How much does each item cost?
  - A. A granola bar costs \$1, and a bottle of water costs \$1.
  - B. A granola bar costs \$1, and a bottle of water costs \$2.
  - C. A granola bar costs \$1, and a bottle of water costs \$3.
  - D. A granola bar costs \$2, and a bottle of water costs \$1.
  - E. A granola bar costs \$2, and a bottle of water costs \$2.
4. How many solutions does the equation  $x^2 \cos(x^2) = 0$  have on the interval  $[-\pi, \pi]$ ?
5. Carter began walking from a campsite. He walked 2 miles due east from his campsite, and then he walked 4 miles in a direction that was 45 degrees east of north. What was his distance from the campsite, in miles?
  - A. 2.9
  - B. 3.8
  - C. 4.5
  - D. 5.1
  - E. 5.6

## SECTION II

**Directions:** A calculator will *not* be available for the questions in this section. Some questions will require you to select from among five choices. For these questions, select the **BEST** of the choices given. Some questions will require you to enter a numerical answer in the box provided.



$$f(x) = \begin{cases} -2x + 5 & \text{for } x \leq 1 \\ 1 - 3x^2 & \text{for } x > 1 \end{cases}$$

6. Let  $f$  be the piecewise function defined above. What is the range of  $f$ ?
- $(-\infty, 3]$  only
  - $(-2, 3]$  only
  - $[3, \infty)$  only
  - $(-\infty, -2) \cup (-2, \infty)$
  - $(-\infty, -2) \cup [3, \infty)$

$$\frac{4 - \frac{3}{x} + \frac{10}{x^2}}{3 + \frac{4}{x} - \frac{2}{x^2}} = 1$$

7. What are the solutions to the equation shown above?
- $x = -8$  and  $x = 1$
  - $x = -4$  and  $x = 3$
  - $x = -3$  and  $x = 4$
  - $x = -1$  and  $x = 8$
  - $x = 3$  and  $x = 4$

8. The function  $f$  is defined by  $f(x) = 2 \sin\left(\frac{x}{3}\right)$ . On which of the following intervals is  $f$  decreasing for all values of  $x$  in the interval?

- $0 \leq x \leq \frac{\pi}{2}$
- $0 \leq x \leq 3\pi$
- $\frac{\pi}{2} \leq x \leq \frac{3\pi}{2}$
- $\frac{3\pi}{2} \leq x \leq \frac{9\pi}{2}$
- $3\pi \leq x \leq 9\pi$

9. Which of the following is an equation of the figure shown in the  $xy$ -plane above?

- $\frac{x^2}{4} + \frac{y^2}{9} = 1$
- $x^2 + y^2 = 36$
- $2x^2 + 3y^2 = 1$
- $\frac{x^2}{9} - \frac{y^2}{4} = 1$
- $x^2 - y^2 = 36$

10. If  $2 \log t = \log(3 - 2t)$ , then  $t =$

- $-\frac{2}{3}$  only
- $\frac{1}{3}$  only
- 1 only
- 3 and 1
- $-\frac{2}{3}$  and  $\frac{1}{3}$

## Credit Recommendations

The American Council on Education has recommended that colleges grant 3 credits for a score of 50, which is equivalent to a course grade of C, on the CLEP Precalculus exam.

Each college, however, is responsible for setting its own policy. For candidates with satisfactory scores on the CLEP Precalculus examination, colleges may grant credit toward fulfillment of a distribution requirement, or for a particular course that matches the exam in content. Check with your school to find out the score it requires for granting credit, the number of credit hours granted, and the course that can be bypassed with a passing score.

### Answers to Sample Questions:

1-C; 2-D; 3-B; 4-7; 5-E; 6-E; 7-E; 8-D; 9-A; 10-C.