AP® Precalculus

Course and Exam Description Clarifications and Corrections

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Course and Exam Description Clarifications and Corrections

To be implemented for Fall 2026

General Clarifications

Available Resources listed in the topic pages were updated to indicate whether they can now be found in AP Classroom or in the Online Teacher Community.

Unit Guides

The following Essential Knowledge statements (EKs) were updated:

UNIT 1

- **EK 1.1.A.1**
  Updated to read, "A *function* is a mathematical relation that maps a set of input values to a set of output values such that each input value is mapped to exactly one output value. The set of input values is called the *domain* of the function, and the set of output values is called the *range* of the function. The variable representing input values is called the *independent variable*, and the variable representing output values is called the *dependent variable*. **Two functions, *f* and *g*, are equal if they have the same domain, and for every input value *a* in that same domain, both functions yield the same output value** $(f(a)=g(a))$**.**"
- **EK 1.1.A.2**
  Updated to read, "The input and output values of a function vary in tandem according to the *function rule*, which can be expressed graphically, numerically, analytically, or verbally. **The *image of an input value* is the single output value yielded by the function rule. The *preimage of an output value* is the set of input values for which the function rule yields that output value.**"

- **EK 1.1.A.3 and EK 1.1.A.4**
  Updated to introduce the following Exclusion Statement: "Discriminating between open intervals and closed intervals as it relates to intervals on which a function is increasing or intervals on which a function is decreasing is outside the scope of the AP Precalculus course and exam."
- **EK 1.3.A.3**
  Clarified to read, "The average rate of change **of a function *f*** over the closed interval $[a, b]$ is the slope of the secant line from the point $(a, f(a))$ to $(b, f(b))$."
- **EK 1.4.A.1**
  Corrected to read, "A nonconstant polynomial function of *x* is any function representation that is equivalent to the analytical form $p(x) = a_n x^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \ldots + a_2 x^2 + a_1 x + a_0$, where *n* is a positive integer, a_i is a real number for each *i* from **0** to *n*, and a_n is nonzero. The polynomial has degree *n*, the leading term is $a_n x^n$, and the leading coefficient is a_n. A **nonzero** constant is also a polynomial function of degree zero."
- **EK 1.4.A.2**
  Clarified to read, "Where a polynomial function switches between increasing and decreasing, or at the included endpoint of a polynomial with a restricted domain, the polynomial function will have a *local*, or *relative*, maximum or minimum output value. **If any local maximum is greater than all other function output values, then that local maximum is a** *global*, or *absolute*, maximum. **Similarly, if any local minimum is less than all other function output values, then that local minimum is a** global, or absolute, minimum."
- **EK 1.4.A.4**
  Updated to read, "A polynomial function of even degree has either a global maximum or a global minimum. For a quadratic function, the global maximum or global minimum occurs at the *vertex*."
- **EK 1.12.A.5**
  Updated to read, "Additive and multiplicative transformations can be combined, resulting in combinations of horizontal and vertical translations and dilations. **The set of points prior to the transformations is called the *preimage* of the transformations, and the set of points after the transformations is called the *image* of the transformations.**"

UNIT 2

- **EK 2.1.B.1**
  Clarified to read, "Successive terms in **an increasing or decreasing** geometric sequence have a common ratio, or constant proportional change."
- **EK 2.1.B.2**
  Clarified to read, "The general term of **an increasing or decreasing** geometric sequence with a common ratio *r* is denoted by g_n and is given by $g_n = g_0 r^n$, where g_0 is the initial value, or by $g_n = g_k r^{(n-k)}$, where g_k is the *k*th term of the sequence."
- **EK 2.1.B.3**
  Updated to read, "An increasing arithmetic sequence increases equally with each step, whereas an increasing geometric sequence of positive values increases by a larger amount with each successive step."

- **EK 2.2.A.3**

  Corrected to read, "Exponential functions of the form $f(x)=ab^x$ are similar to geometric sequences of the form $g_n = g_0 r^n$, as both can be expressed as an initial value (*a* or g_0) times repeated multiplication by a constant **ratio** (*b* or *r*)."
- **EK 2.2.A.4**

  Corrected to read, "Similar to geometric sequences of the form $g_n = g_k r^{(n-k)}$, which are based on a known ratio, *r*, and a *k*th term, exponential functions can be expressed in the form $f(x) = y_i \boldsymbol{b}^{(x-x_1)}$ based on a known ratio, ***b***, and a point, (x_i, y_i)."
- **EK 2.2.B.1**

  Updated to read, "Over equal-length input-value intervals, if the output values of a function change at constant rate, then the function is linear; if the output values of a function change proportionally, then the function is exponential. **For an exponential function, the known ratio cannot be 0 or 1.**"
- **EK 2.3.A.4**

  Updated to read, "If the output values of the function *f* are not proportional over equal-length input-value intervals, but the output values of an additive transformation of *f* are proportional over equal-length input-value intervals, then *f* can be modeled by an additive transformation of an exponential function."
- **EK 2.5.B.3**

  Updated to read, "Exponential models can be used to predict values for the dependent variable, depending on the contextual constraints on the domain, **and may be used to determine values of the independent variable**."
- **EK 2.6.B.1**

  Updated to read, "For a given value of an independent variable, a *residual* of a regression is the actual value of the dependent variable value minus the value predicted by the function regression model. A *residual plot* is a graphical representation of the residuals of a regression, with the residuals on the vertical axis and the independent variable on the horizontal axis. A model is justified as *appropriate* for a data set if the residual plot appears without pattern."
- **EK 2.6.B.2**

  Updated to read, "For given values of an independent variable, the *errors* in a model can relate to the signed differences in the values of the dependent variable predicted by the function regression model and the actual values OR the unsigned absolute values of the residuals. Errors may reveal that the model underestimates or overestimates actual values on a given input-value interval. The data set and context can provide clues as to whether underestimates or overestimates are preferred on a given input-value interval."
- **EK 2.7.A.4**

  Corrected to read, "If the function $f(x)=x$ is composed with any function *g*, the resulting composite function is the same as *g*; that is, $g(f(x)) = f(g(x)) = g(x)$. The function $f(x)=x$ is called the *identity function*. When composing two functions, the **identity** function acts in the same way as 0, the additive identity, when adding two numbers and 1, the multiplicative identity, when multiplying two numbers."
- **EK 2.13.B.1**

  Updated to read, "The function $\boldsymbol{f(x) = ab^{(x+h)} + k}$ is a combination of additive transformations of an exponential function in general form. The inverse of $y=f(x)$ can be found by determining the inverse operations to reverse the mapping."

- **EK 2.13.B.2**

  Updated to read, "The function $\boldsymbol{f(x) = a\log_b(x+h)+k}$ is a combination of additive transformations of a logarithmic function in general form. The inverse of $y = f(x)$ can be found by determining the inverse operations to reverse the mapping."
- **EK 2.14.A.6**

  Updated to read, "Logarithmic function models can be used to predict values for the dependent variable, **and they may be used to determine values of the independent variable.**"
- **EK 2.15.A.1**

  Updated to read, "In a semi-log plot, one of the axes is logarithmically scaled **with logarithm base *n*, where $\boldsymbol{n > 1}$**. When the *y*-axis of a semi-log plot is logarithmically scaled, data of functions that demonstrate exponential characteristics will appear linear."
- **EK 2.15.A.2**

  Updated to read, "If for large input values of a bivariate data set the logarithms of the output values trend linear, then transformations of an exponential function can be used to model the data set. Therefore, an advantage of semi-log plots is that the dependent variable values do not need to be transformed by a constant to reveal that transformations of an exponential function would produce an appropriate model."

UNIT 3

- **EK 3.2.A.2**

  Updated to read, "When considering a circle centered at the origin, the radian measure of an angle in standard position is the ratio of the length of the arc of the circle that the angle subtends to the radius of that same circle. For a unit circle, which has radius 1, one radian is the measure of the angle subtended at the center of the circle by an arc that has length 1."
- **EK 3.4.A.2**

  Clarified to read, "As the input values, or angle measures, of the sine function increase, the output values oscillate between -1 and 1, taking every value in between and tracking the vertical **displacement** of points on the unit circle from the *x*-axis."
- **EK 3.4.A.4**

  Clarified to read, "As the input values, or angle measures, of the cosine function increase, the output values oscillate between -1 and 1, taking every value in between and tracking the horizontal **displacement** of points on the unit circle from the *y*-axis."
- **EK 3.6.A.1**

  Clarified to read, "Functions that can be written in the form $f(\theta) = a\sin(b(\theta+c))+d$ or $g(\theta) = a\cos(b(\theta+c))+d$, where *a*, *b*, *c*, and *d* are real numbers, $a \neq 0$, and $\boldsymbol{b \neq 0}$, are sinusoidal functions and are transformations of the sine and cosine functions. Additive and multiplicative transformations are the same for both sine and cosine because the cosine function is a phase shift of the sine function by $-\frac{\pi}{2}$ units."
- **EK 3.7.A.5**

  Updated to read, "Sinusoidal functions that model a data set are frequently only useful over their contextual domain, can be used to predict values of the dependent variable from values of the independent variable, **and may be used to determine values of the independent variable from values of the dependent variable**."

- **EK 3.13.A.1**
  Updated to read, "The polar coordinate system is based on a grid of circles centered at the origin and on lines through the origin. The positive *x*-axis is called the polar axis. Polar coordinates of a point are defined as an ordered pair, (r, θ). The value of θ is given by the measure of an angle in standard position whose terminal ray lies in a line that passes through the point, and *r* is the radial displacement of the point from the origin. Positive values of *r* indicate radial displacement from the origin along the terminal ray of the angle θ. Negative values of *r* indicate radial displacement from the origin along the line containing the terminal ray of the angle θ—but in the opposite direction of the terminal ray of the angle θ. In the polar coordinate system, the same point can be represented many ways with combinations of positive and negative values of *r* and θ."
- **EK 3.14.A.3**
  Updated to read, "When graphing polar functions in the form of $r = f(\theta)$, changes in input values **relate** to changes in angle measures from the **polar axis**, and changes in output values **relate** to changes in **signed radial displacements** from the origin."
- **EK 3.15.A.1**
  Clarified to read, "If a polar function, $r = f(\theta)$, is positive and increasing or negative and decreasing, then the distance between **the point with polar coordinates** $\boldsymbol{(f(\theta), \theta)}$ **and the origin is increasing.**"
- **EK 3.15.A.2**
  Clarified to read, "If a polar function, $r = f(\theta)$, is positive and decreasing or negative and increasing, then the distance between **the point with polar coordinates** $\boldsymbol{(f(\theta), \theta)}$ **and the origin is decreasing.**"
- **EK 3.15.A.4**
  Clarified to read, "The average rate of change of *r* with respect to θ over an interval of θ is the ratio of the change in the **signed** radius values to the change in θ over an interval of θ. Graphically, the average rate of change indicates the rate at which the **signed** radius is changing per radian."

Exam Information Clarifications and Corrections

This section provides updates to the Exam Information section. Most updates include formatting changes or minor language clarifications. Other corrections and clarifications are set out below.

EXAM OVERVIEW

- **Multiple-choice questions, Part A**
  The number of questions was changed from 28 to 29, and the timing was changed from 80 minutes to 65 minutes.
- **Multiple-choice questions, Part B**
  The number of questions was changed from 12 to 13.
- **Free-response questions, Parts A and B**
  In both parts, the timing was changed from 30 minutes to 35 minutes. In addition, the structure of Question 2 was updated.

SAMPLE FRQs

- **Question 1**
  Part C (i) has a minor modification with no change to the scoring guidelines.
- **Question 2**
  Part B (iii) was removed, and Part C was modified to expand the scope of the question. The scoring guidelines for Parts B (iii) and C were updated accordingly.