Pre-Calculus 30 Math Rubrics

P30.1 Student extends understanding of angle to angle in standard position, expressed in degrees and radians.

Beginning (1)	Approaching (2)	Meeting (3)	Exemplary (4)
I need more help with becoming consistent with the criteria.	I can sketch angles in standard position in positive and negative degrees. I can convert degrees to radians and vice versa.	I can sketch one radian in standard position. I can write an expression for all co-terminal angles given a specified domain. I can calculate co-terminal angles in a specific domain (in degrees and radians).	I can describe relationships between the angle measurement systems. I can explain relationships between radian measure and arc on circle of radians. I can solve situational questions.

P30.2 Student demonstrates understanding of the unit circle and its relationship to the six trigonometric ratios for any angle in standard position.

Beginning (1)	Approaching (2)	Meeting (3)	Exemplary (4)
I need more help with becoming consistent with the criteria.	I can derive and apply equation $x^2 + y^2 = 1$ with coordinates on a terminal arm or unit circle. I can determine with technology trig ratios of any angle in radians or degrees.	I can determine exact trig ratios for measures that are multiples of 0^0, 30^0, 45^0, 60^0, 90^0 and radian measures. I can solve multiple step trig equations.	I am able to explain the relationship between angles and their points on the unit circle.

P30.3 Student demonstrates understanding of the graphs of the primary trigonometric functions.

Beginning (1)	Approaching (2)	Meeting (3)	Exemplary (4)
I need more help with becoming consistent with the criteria.	I can sketch the graph of sin x, cos x, and tan x over one positive and one negative period. I can determine the characteristics of a trig functions y=sin x, y= cos x and y= tan x. (amplitude, asymptotes, domain, range, period, x-intercepts).	I can write equations for a given trig graph. I can graph $y = a \sin b (x-c) + d$ and $y = a \cos b (x-c) + d$ I can determine and summarize the characteristics of transformed graphs of sin x, cos x, and tan x.	I can explain transformational impact of coefficients a,b,c,d in terms of amplitude, period, phase shift, domain, range and zeroes. I can explain the relationship between the sine function and the cosine function. I can solve situational problems.

P30.4 Student demonstrates understanding of first and second degree trigonometric equations

Beginning (1)	Approaching (2)	Meeting (3)	Exemplary (4)
I need more help with becoming consistent with the criteria.	I can verify whether a value is a solution to a trig equation. I can apply strategies algebraically to determine exact solutions for a trig equation (in degrees and radians).	I am able to explain relationships of solutions between trig equations and zero of related trig functions (sine and cosine). I can determine general solutions for trig equations. I can solve a multi- step equation.	I am able to analyze and make an equation given the roots and domain.

P30.5 Student demonstrates understanding of trigonometric identities including: reciprocal identities quotient identities Pythagorean identities sum or difference identities (restricted to sine, cosine, and tangent) double-angle identities (restricted to sine, cosine, and tangent).

Beginning (1)	Approaching (2)	Meeting (3)	Exemplary (4)
I need more help with becoming consistent with the criteria.	I can verify a trig statement for a given value. I am able to prove "one-step" trig identities algebraically. I can determine the exact values of trig ratios using sum, difference, and double angle identities.	I can prove more complicated identities.	I can determine non-permissible values of trig identities. I am able to explain proof strategies.

P30.6 Student demonstrates an understanding of operations on, and compositions of, functions.

Beginning (1)	Approaching (2)	Meeting (3)	Exemplary (4)

I need more help with becoming consistent with the criteria.	I can write equations of a function that result from the sum, difference, product, or quotient of two or more functions.	I can write a(n) equation/function as a composition of two or more functions. I can sketch a function that is a sum or difference, of two given graphs. I can determine the domain and range for sums, differences, and composite functions.	I can explain strategies for determining f(f(x)), f(g(x)) and g(f(x)). I can sketch a function that is a product, quotient or composites of two given graphs.

P30.7 Student extends understanding of transformations to include functions (given in equation or graph form) in general, including horizontal and vertical translations, and horizontal and vertical stretches.

Beginning (1)	Approaching (2)	Meeting (3)	Exemplary (4)
I need more help with becoming consistent with the criteria.	I can identify the parameters; a, b, h, & k, and describe their effect on the graph of y=f(x) given the equation y=f(x). I can sketch functions with single transformations, stretches, and reflections of y = f(x) when given the graph of y=f(x).	I can describe and graph combinations of transformations, stretches, and reflections. I can write the equation of functions that has undergone specified translations and or stretches from a given function in the form y = a f(b(x-h))+k.	I can generalize about the effects of the placement of different coefficients on the original graph of y = f(x).

P30.8 Student demonstrates understanding of functions, relations, and inverses and their related equations resulting in reflections through the: x-axis, y-axis, line y=x

Beginning (1)	Approaching (2)	Meeting (3)	Exemplary (4)
I need more help with becoming consistent with the criteria.	I can write equations of functions with single transformations or reflections through the x- axis, y-axis or y = x line. Given the equation of a function I can write the equation of its inverse.	I can develop and apply numeric, algebraic, graphic strategies to determine if two relations are inverses of each other.	I can explain strategies to determine if a relation and its inverse are functions. I can determine what restrictions must be placed on domain of a function for its inverse to be a function.

P30.9a Student demonstrates understanding of logarithms including relating logarithms to exponents and solving equations by graphing.

Beginning (1)	Approaching (2)	Meeting (3)	Exemplary (4)
I need more help with becoming consistent with the criteria.	I can express a logarithmic expression as an exponential expression and vice versa. I can determine without technology the exact value of a logarithm. Given the graph of $y = \log_b x, b > 1$ I am able to identify the domain, range, vertical asymptote, and intercepts. I am able to identify the transformations of the graph from the equation.	I can sketch with or without technology the graphs of logarithmic functions in the form of $y = \log_b x, b > 1$. I am able to apply strategies for sketching transformations of the graph $y = \log_b x, b > 1$ with types of transformations.	I can explain how to estimate the value of logarithms using benchmarks. I can explain the role of the vertical asymptote for logarithm functions. I can explain strategies for sketching transformations of the graph $y = \log_b x, b > 1$ with multiple types of transformations. I am able to demonstrate graphically that $y = \log_b x, b > 1$ and $y=b^x$ are inverses of each other.

P30.9b Student demonstrates understanding of logarithms including evaluating logarithms deriving laws of logarithms solving equations graphing.

Beginning (1)	Approaching (2)	Meeting (3)	Exemplary (4)
I need more help with becoming consistent with the criteria.	I can apply the laws of logarithms to determine equivalent expressions for given logarithmic statements involving one step. I can apply strategies for solving single	I can apply the laws of logarithms to determine equivalent expressions for given logarithmic statements involving multi-steps. I can apply strategies for solving multi- step logarithmic equations including quadratic and extraneous roots.	I can solve situational questions that involve exponential growth or decay, such as loans, mortgages, and investments. I can solve situational questions involving logarithmic scales, such as the Richter scale and pH scale.I can explain why a value obtained in solving a logarithmic equation may be extraneous.

	step logarithmic equations.	I am able to demonstrate process, but may contain simplification errors.	I can explain strategies for solving logarithmic equations.

P30.9c Student demonstrates understanding of exponential functions.

Beginning (1)	Approaching (2)	Meeting (3)	Exemplary (4)
I need more help with becoming consistent with the criteria.	I can solve exponential equations in which the bases are/are not powers of one another. Given the graph $y = a^x$, I can identify the domain, range, horizontal asymptote and intercepts. I can identify whether an exponential function represents growth or decay. I can identify the transformations of the graph $y = a^x$	I am able to sketch the graphs of exponential functions with or without technology. I can apply strategies for sketching transformations of the graph $y = a^x$ with types of transformations.	I can explain the role of horizontal asymptotes for exponential functions. I can explain strategies for sketching transformations of the graph $y = a^x$ with multiple types of transformations

P30.10a Student demonstrates understanding of polynomials of degree greater than 2 (limited to polynomials of degree ≤ 5 with integral coefficients).

Beginning (1)	Approaching (2)	Meeting (3)	Exemplary (4)
I need more help with becoming consistent with the criteria.	I can divide a polynomial by x-a using either long division or synthetic division. I can use the remainder theorem to determine the remainder. I am able to use the factor theorem to determine if x-a is a factor of P(x). I can identify the degree, leading coefficient, and constant of each polynomial function.	I am able to demonstrate the process of factoring polynomials of degree 2 and higher using the factor theorem.	I am able to fully factor polynomials of degree 2 or higher. I am able to solve problems.

P30.10b Student demonstrates understanding of polynomial functions of degree greater than 2 (limited to polynomials of degree ≤ 5 with integral coefficients).

Beginning (1)	Approaching (2)	Meeting (3)	Exemplary (4)
I need more help with becoming consistent with the criteria.	I can identify polynomial functions and their characteristics. I can match a polynomial function with its graph based on degree, end behavior, and number of x intercepts. Given a graph, I am able to determine the least possible degree, sign of leading coefficient, x-intercepts, intervals where a function is positive and negative. I analyze factored equations to sketch polynomial functions.	I analyze equations to sketch polynomial functions.	I solve problems. I explain relationships between zeroes and roots.

P30.11a Student demonstrates understanding of radical functions with restrictions on the domain.

Beginning (1)	Approaching (2)	Meeting (3)	Exemplary (4)
I need more help with becoming consistent with the criteria.	I demonstrate the process of: • sketch the graph of $y = \sqrt{(x)}$ using a table of values • identify the role of a, b, h, k given an equation	I use transformations to graph $-k = a\sqrt{b(x-h)}$. I can explain the role of a, b, h, and k given an equation. I sketch the graph of $y = \sqrt{f(x)}$ given the graph of $y = f(x)$. I can compare the domains and ranges of $y = \sqrt{f(x)}$ and $y = f(x)$. I graphically solve radical equations with technology.	I can determine a radical function from its graph. I explain level 2 and 3 concepts. I express level 2 and 3 answers in simplest form.

P30.11b Student demonstrates understanding of rational functions with restrictions on the domain.

Beginning (1)	Approaching (2)	Meeting (3)	Exemplary (4)

I need more help with becoming consistent with the criteria.	I can determine the characteristics of the graphs of rational functions including vertical asymptotes, points of discontinuity (holes), horizontal asymptotes.	I can determine the equation of oblique asymptotes. I can graph rational functions.	I can explain concepts related to graphing rational functions. I can create a rational function, given a set of characteristics.

P30.12 Student demonstrates understanding of permutations, including the fundamental counting principle.

Beginning (1)	Approaching (2)	Meeting (3)	Exemplary (4)
I need more help with becoming consistent with the criteria.	When specified, I can demonstrate the process to: • Solve basic permutations • Apply the fundamental counting principle • Solve basic combinations	When specified, I can demonstrate the process to solve: • Permutations with repetitions I can determine whether a question is a permutation or a combination.	I can solve equations involving permutations and combinations. I explain concepts relating to permutations and combinations.

P30.13 Student demonstrates understanding of combinations of elements, including the application to the binomial theorem.

Beginning (1)	Approaching (2)	Meeting (3)	Exemplary (4)
I need more help with becoming consistent with the criteria.	I can complete a missing row of Pascal's triangle. I can determine missing numbers in expansions involving the binomial theorem.	I can apply the binomial theorem to expansions of $(x+y)$.	I can apply the binomial theorem to expansions of $(ax+by)$. I relate the binomial theorem to Pascal's triangle.