PreCalculus Standards Guide

Graded Standard	Aligned Content Standards	Sample Problems
Spatial and Visual Skills		
1) Be able to apply the midpoint, distance, and slope formulas to calculate information from coordinates	HS.G.GPE.B.4	Given the three points: A(-2, 1), B (2, 3), and C (3, 1) A) Find the midpoint of AC B) Find BC C) Find the slope of the line containing the segment AB
2) Be able to identify symmetry, intercepts and domain and range of an equation	HS.M, HS.F.IF.A.1, HS.F.IF.B.4, HS.F.IF.C.7, HS.F.IF.C.7a	Using the equation $y = x^3$, graph using a table. Identify all intercepts and test for symmetry.
3) Be able to write the equation for a circle and draw its graph	HS.G.GPE.A.1	Using the equation below; complete the square to find the equation and graph a circle: $$x^2 + y^2 + 4x + 2y - 20 = 0$$
Functions and Their Properties		
4) Be able to identify functions from equations, coordinates, and graphs and be able to locate important properties (i.e. maxima, minima, slope, etc.)	HS.F.IF.A.1, HS.F.IF.A.2, , HS.F.IF.B.4, HS.F.IF.B.5	Given the equation: $g(x): -3x^2 - 5$ a) Graph b) Identify any maxima/minima c) Test algebraically for even/odd functionality d) Is the function increasing or decreasing between [0,3)
5) Be able to transform functions in both equation and graph form	HS.F.IF.C.7, HS.F.IF.C.8, HS.F.IF.C.9, HS.F.BF.B.3	Given the parent function: $y = \sqrt{x}$ a) Shift left 2 units and up 3 b) Reflect about the x-axis c) Vertically stretch by 3 d) Show the child function in both equation and graph.
6) Be able to graph and evaluate piece-wise functions involving constants, linear and quadratic equations	HS.F.IF.C.7, HS.F.IF.C.7A, HS.F.IF.C.7B	$f(x)$ $$= \begin{cases} x + 3; & if -2 \le x < 1 \\ 5; & if\ x = 1 \\ -x + 2; & if\ x > 1 \end{cases}$$ a) Find the domain and range of the function b) Evaluate for f(-2), f(1), f(2) c) Graph

Graded Standard	Aligned Content Standards	Sample Problems
7) Be able to evaluate composites using properties of functions	HS.F.IF.A.2, HS.IF.C.9	Given $f(x) = \frac{3}{x-1}$ $g(x) = \frac{2}{x}$ a) Find $f°g(x)$ b) Find the domain of $f°g(x)$
8) Be able to find and verify the inverse of a function	F.BF.4A, F.BF.4B, F.BF.4C, F.BF.4D	Verify that f(x) and g(x) are inverses of each other: $f(x) = 2x + 6$ $g(x) = \frac{1}{2}x - 3$
Linear and Quadratic Functions		
9) Be able to model data using linear functions	HS.F.IF.C.7.A, HS.A.REI.B.3, HS.M	The cost C, in dollars, of renting a moving truck for a day is given by the function $C(x)$=0.25x+35, where x is the number of miles driven. a) What is the cost to drive 40 miles? b) If the cost of renting the moving truck is $80, how many miles did you drive? c) Suppose you want the cost to be no more than $100. What is the maximum number of miles that you can drive?
10) Be able to model data using quadratic functions	HS.F.IF.C.7.A, HS.A.REI.B.4, HS.M	You are given 400 meters of fencing and you wish to enclose a rectangular area. a) Express the area A of the rectangle as a function of the width w of the rectangle b) For what value of w is the largest? c) What is the maximum area?
Higher Polynomial and Rational Functions		
11) Be able to solve and graph higher polynomial functions	APR.A.1, IF.C.7.C	Given the polynomial function: $f(x) = (x - 5)^3(x + 4)^2$ a) List each real zero and multiplicity b) Determine the near-zero behavior c) Determine end-behavior and maximum number of turning points d) Graph

Graded Standard	Aligned Content Standards	Sample Problems
12) Be able to solve and graph rational functions and identify important properties (domain, asymptotes, holes, etc.)	APR.B.6, APR.D.7, IF.C.7.D	Graph the function including all asymptotes, holes and zeros: $$T(x) = \frac{4x^5}{x^3 - 1}$$ Solve the equation: $$3 = \frac{1}{x - 1} + 1$$
13) Be able to identify all the real and complex zeros of a polynomial function	APR.B.3, APR.B.2, CN.C.8, CN.C.9	Find all the zeros of the function: $$f(x) = x^5 - 5x^4 + 12x^3 - 24x^2 + 32x - 16$$
Exponential and Logarithmic Functions		
14) Be able to identify, evaluate and graph an exponential function	F.BF.5, IF.C.7	Solve the equation: $$8^{-x+14} = 16^x$$ Graph the equation: $$f(x) = 2^{x+2} + 1$$
15) Be able to identify, evaluate and graph a logarithmic function	F.BF.5, IF.C.7	Solve the equation: $$\log_2 8^x = -3$$ Graph the equation: $$f(x) = 3 + \log_3(x + 2)$$
16) Be able to use properties of exponents and logarithms to expand and simplify expressions	F.LE.A.4	Write each expression as a single logarithm: $$2\log_a 5(x^3) - \frac{1}{2}\log_a(2x + 3)$$
Non-Linear Inequalities		
17) Be able to solve non-linear inequalities including quadratic, exponential and rational functions	A.REI.D.11	Solve the inequality $$\frac{2x + 5}{x + 1} > \frac{x + 1}{x - 1}$$
Trigonometric Functions		
18) Be able to find angle measure in degrees and convert to radian measure	HS.TF.A.1, HS.TF.A.2,	Convert $48°$ to radians Convert $\frac{\pi}{8}$ to degrees Convert $61°42'21"$ to decimal Convert $18.255°$ to $D°M'S"$
19) Be able to find the exact values of trigonometric functions using the unit circle	HS.TF.A.2, HS.TF.A.3	$sin\theta = \frac{12}{13}, \theta \, is \, in \, Quadrant \, II$ Find the exact value of the remaining six trigonometric functions.

Graded Standard	Aligned Content Standards	Sample Problems
20) Be able to identify properties and graph the six trigonometric functions	HS.TF.A.4, HS.TF.A.5, HS.BF.B.3, HS.M	Graph the following functions: $$y = -\frac{1}{2}\cos(2\theta)$$ $$y = 5 - 3\sin\left(\frac{1}{2}\theta\right)$$ $$y = 2tan\theta - 1$$
Analytical Trigonometry		
21) Be able to find to evaluate the value of an inverse trigonometric function	HS.TF.B.6, HS.TF.B.7	Find the exact value of each expression: a) $\sin(\cos^{-1}\frac{1}{2})$ b) $\sec(\tan^{-1}\frac{1}{2})$ c) $\sin(\sin^{-1}-2)$
22) Be able to use the foundational trigonometric identities to simplify, expand and prove identities	HS.TF.C.8, HS.TF.C.9	Establish the identity: $$1 - \frac{\cos^2\theta}{1 + \sin\theta} = \sin\theta$$
23) Be able to identify and use special case identities (Sum and Difference, Double and Half Angle, Sum-to-Product, and Product-to-Sum formulas)	HS.TF.C.8, HS.TF.C.9	1) Find the exact value of: $\sin(\alpha + \beta)$ and $\sin(\alpha - \beta)$ $$\sin\alpha = \frac{3}{5} \ and \cos\beta = (\frac{2\sqrt{5}}{5})$$ 2) Find $\sin 2\theta$ and $\sin\frac{\theta}{2}$ $$\sin\theta = \frac{3}{5}, 0 < \theta < \frac{\pi}{2}$$ 3) Express as a sum containing only sines or cosines $$\sin 4\theta \sin 2\theta$$ 4) Express as a product of sines or cosines $$\sin 4\theta + \sin 2\theta$$
24) Be able to solve and generalize trigonometric functions	HS.TF.B.7	Solve and generalize the equation: $$\sin(3\theta + \frac{\pi}{18}) = 1$$
Applications of Trigonometric Functions		
25) Be able to solve triangles	HS.G.SRT.8, HS.G.SRT.10, HS.G.SRT.11	Solve each triangle as efficiently as possible: a) b=4, A=10°, C=90° b) b=4, c=6, B=20° c) a=10, b=8, c=5
26) Be able to find the area of the triangle	HS.G.SRT.9, HS.G.A.1	Find the area of each triangle: a) a=3, b=4, C=40° b) a=5, b=8, c=9

Graded Standard	Aligned Content Standards	Sample Problems
27) Be able to model simple harmonic and damped motion	HS.F.BF.5	For each equation below: a) Describe the motion b) What is the maximum displacement? c) What is the frequency? d) What is the time for each oscillation? e) Where is the object at 20 seconds? f) Graph $$d(t) = -3\sin\frac{1}{2}t$$ $$d(t) = e^{(-\frac{t}{2\pi})}\cos 2t$$
28) Be able to combine multiple trigonometric functions to represent combination of waves	HS.TF.9	Graph each function: a) $f(x) = x + \cos x$ b) $f(x) = \cos 2x + \cos x$
The Polar System and Vectors		
29) Be able to represent and operate on numbers and equations in both the rectangular and the polar planes	HS.N.CN.4, HS.N.CN.5, HS.N.CN.6	Convert the polar coordinates to rectangular: $$\left(4, \frac{3\pi}{2}\right)$$ Transform the polar equation to rectangular: $$r = \sin\theta + 1$$ Transform the rectangular equation to polar: $$x^2 = 4y$$
30) Be able to graph polar equations	HS.N.CN.4, HS.N.CN.5	Graph the following equations manually: a) $r = 2 - 3\cos\theta$ b) $r^2 = 9\cos 2\theta$ c) $r = 4\sin 5\theta$
31) Be able to graph, manipulate and evaluate vectors	HS.N.VM.A.1, HS.N.VM.A.2, HS.N.VM.A.3, HS.N.VM.B, HS.N.	$$v = 3i - 5j$$ $$w = -2i + 3j$$ Graph each vector and find: a) $3v - 2w$ b) $\|v - w\|$ c) $\|v\| + \|w\|$
32) Be able to find the dot product and the angle between two vectors	HS.N.VM.B.4, HS.N.VM.B.5	$$v = 2i + 2j$$ $$w = i + 2j$$ Given the vectors above find: a) The Dot Product b) The Angle between the two vectors c) State whether the vector are parallel, orthogonal, or neither.

Graded Standard	Aligned Content Standards	Sample Problems
Conics		
33) Be able to analyze and graph conics including parabolas, ellipses, and hyperbolas	HS.GPE.A.1, HS.GPE.A.2, HS.GPE.A.3	Identify and graph the conic below: $-x^2 + 4y^2 - 2x - 16y + 11 = 0$
34) Be able to find the angle of rotation for conic sections and graph	HS.GPE.A.1, HS.GPE.A.2, HS.GPE.A.3	Rotate the axes of the equation below to remove the xy-term: $x^2 + 4xy + y^2 - 3 = 0$
Matrices		
35) Be able to perform algebraic operations using matrices	HS.VM.C.7, HS.VM.C.8, HS.VM.C.9, HS.VM.C.10, HS.VM.C.11, HS.VM.C.12	$A = \begin{matrix} 0 & 3 & -5 \\ 1 & 2 & 6 \end{matrix}$ $B = \begin{matrix} 4 & 1 & 0 \\ -2 & 3 & -2 \end{matrix}$ $C = \begin{matrix} 4 & 1 \\ 6 & 2 \\ -2 & 3 \end{matrix}$ a) Find A − B b) Find AC c) Find AC-3I$_2$
36) Be able to use matrices to solve multi-variable systems	HS.VM.C.6, HS.REI.C.8, HS.REI.C.9, HS.M	Solve the system below using matrices: $\begin{cases} x + 4y - 3z = -8 \\ 3x - y + 3z = 12 \\ x + y + 6z = 1 \end{cases}$
37) Be able to perform partial fraction decomposition	HS.APR.D.6	Write the partial fraction decomposition of the rational expression: $\dfrac{x + 1}{x^2(x - 2)^2}$