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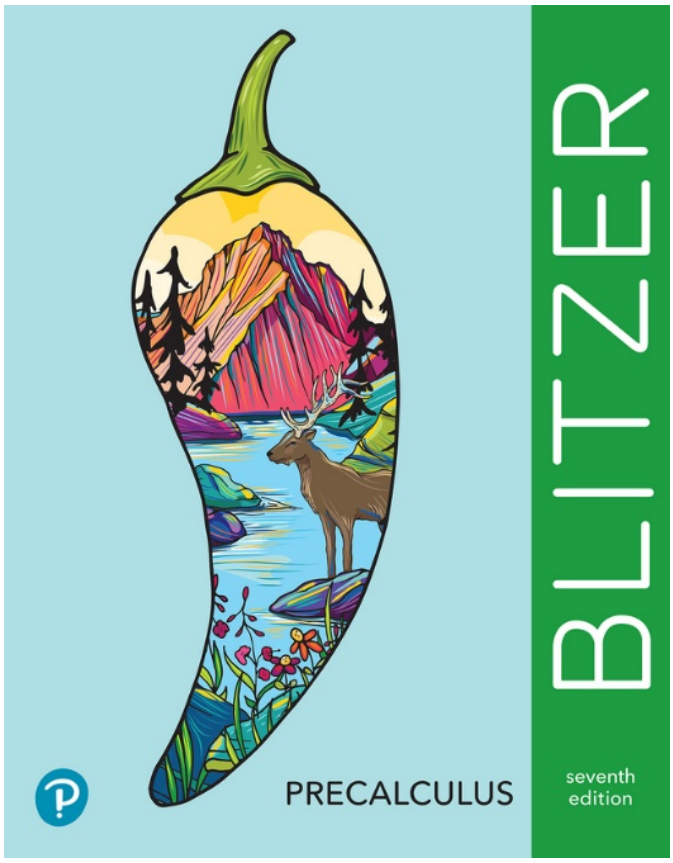

To the

Utah Core Standards for Mathematics 2016
High School, Precalculus

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High School, Precalculus

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Utah Core Standards for Mathematics Precalculus	Precalculus 7th Edition, ©2022
Mathematical Practices	
1. Make sense of problems and persevere in solving them.	**SE/TE:** 5-6, 9, 13, 21, 24-25, 33, 36-38, 40, 48, 50, 52, 58-59, 61-64, 74, 77, 79, 93-94, 99, 101-105, 111-113, 115, 118, 120, 130, 132, 134, 151, 153-155, 158, 166, 175, 184-186, 188, 191-193, 203, 205, 207, 224, 232-234, 237-238, 247-248, 250, 256, 263, 265, 274, 277, 283, 286, 312, 314, 316, 323, 325-326, 338, 340, 344, 346, 356, 362, 369-370, 374, 376-377, 385-386, 389-390, 394, 412-413, 455, 473, 482, 485, 496, 501, 505, 525-526, 528-529, 533, 544, 556-557, 559, 569, 572, 588, 591, 593, 619, 625-713, 724-725, 729, 739, 772, 776, 783, 786-787, 792, 817-818, 820, 823, 833, 837, 847-849, 852-853, 859, 869, 894-897, 904, 923, 936, 939, 947, 953, 955-956, 970, 984-985, 991-992, 1000, 1003, 1008, 1016-1017, 1055, 1076-1080, 1105, 1115
2. Reason abstractly and quantitatively.	**SE/TE:** 19-20, 125-126, 141, 161-162, 181, 201, 217, 228, 244-245, 260, 271-272, 281-282, 367-368, 381-382, 404-405, 418, 428, 453, 468, 478-479, 493, 511, 538, 635-636, 646-647, 669, 680, 692, 700, 716, 735, 744, 756, 768, 781, 796, 806, 877-878, 885-886, 907, 916, 932, 946, 959-960, 982, 997, 1012, 1024, 1034, 1045, 1064, 1075, 1090, 1099-1100
3. Construct viable arguments and critique the reasoning of others.	**SE/TE:** 19-20, 32, 47, 57, 69, 87, 109, 125-126, 141, 161-162, 181, 201, 217, 228, 244-245, 260, 271-272, 281-282, 295-296, 318, 335, 336, 354, 367-368, 381-382, 404-405, 418, 428, 453, 468, 478-479, 493, 511, 538, 554, 568, 581, 603-604, 617, 635-636, 646-647, 669, 680, 692, 700, 716, 735, 744, 756, 768, 781, 796, 806, 835, 843-844, 854, 864, 877-878, 885-886, 907, 916, 932, 946, 959-960, 982, 997, 1012, 1024, 1034, 1045, 1064, 1075, 1090, 1099-1100, 1107-1108, 1119, 1134-1135
4. Model with mathematics.	**SE/TE:** 5, 11, 59, 71, 90, 131, 169, 206, 231, 235, 264, 266, 340, 469-470, 475, 483, 532, 550, 571, 574-576, 626, 637, 663, 677, 683, 686, 737, 747, 778, 790, 803, 823, 839, 908, 912, 921, 926, 928, 948, 970, 984

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5. Use appropriate tools strategically.	**SE/TE:** 7, 26, 28, 42-43, 161, 168, 170, 212-213, 251, 276, 278, 284, 287-290, 330-331, 343, 364, 376, 389, 393-394, 406, 408, 410-411, 413, 415, 446, 476, 480, 483-484, 487, 500, 502, 524, 589, 594, 596, 599, 637, 659, 673, 694, 704-706, 709, 749-750, 758, 763, 819, 840, 851, 868, 873, 900, 903, 919-920, 924, 935, 940-941, 952, 971, 988, 1001-1002, 1004-1005, 1019, 1022, 1027, 1030, 1039-1040, 1056-1057, 1060, 1071, 1081, 1102-1103, 1112, 1116
6. Attend to precision.	**SE/TE:** 18-19, 31, 46-47, 139-141, 280-281, 318, 333-335, 352-353, 366-367, 380-381, 402-404, 416-417, 427, 451-452, 467, 478, 491-492, 507-510, 537-538, 553, 566, 602, 615-616, 634-635, 645-646, 679-680, 691, 699, 715-716, 733-735, 742-744, 755, 767, 781, 794-796, 805, 981, 996, 1010-1011, 1033-1034, 1044
7. Look for and make use of structure.	**SE/TE:** 5, 11, 59, 71, 90, 131, 169, 206, 231, 235, 264, 266, 340, 469-470, 475, 483, 532, 550, 571, 574-576, 626, 637, 663, 677, 683, 686, 737, 747, 778, 790, 803, 823, 839, 908, 912, 921, 926, 928, 948, 970, 984
8. Look for and express regularity in repeated reasoning.	**SE/TE:** 19, 31, 47, 56, 67, 68-69, 86-87, 109, 125, 141, 161, 168, 181, 201, 216, 228, 244, 260, 272, 281, 295, 318, 335, 353, 367, 381, 404, 417, 428, 452-453, 468, 478, 492-493, 510, 538, 553-554, 566-567, 581, 602-603, 616, 635, 646, 669, 680, 691, 699, 716, 735, 744, 755-756, 767-768, 781, 796, 806, 835, 843, 854, 864, 877, 885, 907, 916, 931, 945-946, 959, 981, 997, 1011, 1023, 1034, 1044, 1064, 1075, 1090, 1099, 1107, 1119, 1134

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Number and Quantity—	
Vector and Matrix Quantities (N.VM)	
Standard N.VM.1 Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., *v, |v|, ||v||, v).*	**SE/TE:** 782-792, 793-796, 797-804, 805-806, 1200
Standard N.VM.2 Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point. .	**SE/TE:** 782-783, 787-788, 793-796
Standard N.VM.3 Solve problems involving velocity and other quantities that can be rep- resented by vectors.	**SE/TE:** 791-792, 793-796, 800-804, 805-806
Standard N.VM. 4 Add and subtract vectors.	**SE/TE:** 784-792, 793-796
a. Add vectors end to end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.	**SE/TE:** 784-792, 793-796
b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.	**SE/TE:** 784-787, 789-792
c. Understand vector subtraction *v – w as v + (–w)*, where *–w* is the additive inverse of *w*, with the same magnitude as *w* and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.	**SE/TE:** 785-792, 793-796
Standard N.VM.5 Multiply a vector by a scalar.	**SE/TE:** 784-792, 793-796, 1200
a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., *as c(vx , vy) = (cvx, cvy).*	**SE/TE:** 784-792, 793-796, 1200

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b. Compute the magnitude of a scalar multiple cv using $\|\|cv\|\| = \|c\|v$. Compute the direction of cv knowing that when $\|c\|v \neq 0$, the direction of cv is either along v (for $c > 0$) or against vs (for $c < 0$).	**SE/TE:** 784-792, 793-796
Standard N.VM.6 Use matrices to represent and manipulate data, e.g., to represent pay- offs or incidence relationships in a network.	**SE/TE:** 894-903, 904-907, 908-913, 914-916, 917-928, 929-932, 933-943
Standard N.VM.7 Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.	**SE/TE:** 920-922, 927-928, 929-932, 936-937
Standard N.VM.8 Add, subtract, and multiply matrices of appropriate dimensions.	**SE/TE:** 918-928, 929-932, 933-937, 940-943, 944-946
Standard N.VM.9 Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.	**SE/TE:** 922-926, 929-932
Standard N.VM.10 Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.	**SE/TE:** 919, 932, 933-943, 944-946, 947-957, 958-959
Standard N.VM.11 Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.	**SE/TE:** 930, 932, 959
Standard N.VM.12 Work with 2 × 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.	**SE/TE:** 928, 930-932, 959
Standard N.VM.13 Solve systems of linear equations up to three variables using matrix row reduction.	**SE/TE:** 894-903, 904-907, 908-913, 914-916, 948-957, 958-959

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Complex Number Systems (N.CN)	
Standard N.CN.3 Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.	For related content, please see: **SE/TE:** 311-315, 317-318, 769-776, 779-781, 1199
Standard N.CN.4 Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.	**SE/TE:** 770-776, 779-781, 1199
Standard N.CN.5 Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. *For example, (-1 + $\sqrt{3}$ i)^3 = 8, because (-1 + $\sqrt{3}$ i) has modulus 2 and argument 120°.*	**SE/TE:** 770-776, 779-781, 1199
Standard N.CN.6 Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.	**SE/TE:** 771-772, 779-781
Standard N.CN.10 Multiply complex numbers in polar form and use DeMoivre's Theorem to find roots of complex numbers.	**SE/TE:** 773-778, 779-781, 1199
Algebra	
Reasoning With Equations And Inequalities (A.REI)	
Standard A.REI.8 Represent a system of linear equations as a single matrix equation in a vector variable.	**SE/TE:** 894-903, 904-907, 908-913, 914-916
Standard A.REI.9 Find the inverse of a matrix, if it exists, and use it to solve systems of linear equations (using technology for matrices of dimension 3 x 3 or greater).	**SE/TE:** 934-943, 944-946, 948-950, 954-957, 958-959

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Functions	
Interpreting Functions (F.IF)	
Standard F.IF.7 Graph functions expressed symbolically, and show key features of the graph, by hand in simple cases and using technology for more complicated cases.	**SE/TE:** 164-176, 177-181, 182-195, 196-201, 202-213, 214-217, 218-226, 227-228, 231-242, 243-245, 284, 287-290, 291-296, 337-349, 350-354, 384-399, 400-405, 411-415, 416-418, 440-449, 450-453, 454-464, 465-468, 583-600, 601-603, 612-613
d. Graph rational functions, identifying zeros, asymptotes, and point discontinuities when suitable factorizations are available, and showing end behavior.	**SE/TE:** 384-399, 400-405, 411-413, 416-418, 419, 423-426, 427-429, 1171-1172
f. Define a curve parametrically and draw its graph.	**SE/TE:** 1025-1026, 1029-1031, 1033-1034
Standard F.IF.10 Use sigma notation to represent the sum of a finite arithmetic or geo- metric series.	**SE/TE:** 1059-1061, 1062-1065, 1071, 1073, 1081, 1087
Standard F.IF.11 Represent series algebraically, graphically, and numerically.	**SE/TE:** 1058-1061, 1062-1065, 1070-1072, 1073-1075, 1080-1087, 1088-1091
Building Functions (F.BF)	
Standard F.BF.1 Write a function that describes a relationship between two quantities.	**SE/TE:** 163-176, 177-181, 182-195, 196-201, 202-213, 214-217, 231, 233, 235, 237-238, 289, 384-399, 400-405, 411-415, 416-418, 419, 423-426, 427-429, 440-449, 450-453, 454-464, 465-468, 469-477, 477-479, 480, 483-484, 487-489, 491-494, 495-506, 507-510, 542-543, 548-549, 571-573, 583-600, 601-603, 612-613
c. Compose functions. *For example, if* T(y) *is the temperature in the atmosphere as a function of height, and* h(t) *is the height of a weather balloon as a function of time, then* T(h(t)) *is the temperature at the location of the weather balloon as a function of time.*	**SE/TE:** 246-257, 258-260, 261-263, 269, 628-632
Standard F.BF.4 Find inverse functions.	**SE/TE:** 261-268, 269-271, 454-455, 618-632, 633-635
b. Verify by composition that one function is the inverse of another.	**SE/TE:** 261, 263-264, 268, 269-271

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c. Read values of an inverse function from a graph or a table, given that the function has an inverse.	**SE/TE:** 261-263, 266, 268, 269-271, 454-455, 618-632, 633-635
d. Produce an invertible function from a non-invertible function by restricting the domain.	**SE/TE:** 268, 269-271, 454-455, 618-624, 626-627, 629-632
Standard F.BF.5 Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.	**SE/TE:** 454-464, 465-468, 469-477, 477-479, 480-489, 490-494
Trigonometric Functions (F.TF)	
Standard F.TF.4 Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.	**SE/TE:** 548-549, 553-554, 583-584
Standard F.TF.6 Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.	**SE/TE:** 618-624, 626-627, 629-632
Standard F.TF.7 Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.	**SE/TE:** 638-640, 644-646, 727-729, 738-739, 792, 799-800
Standard F.TF.9 Prove the addition and subtraction formulas for sine, cosine, and tangent, and use them to solve problems.	**SE/TE:** 670-677, 678-680
GEOMETRY	
Geometric Measurement and Dimension (G.GMD)	
Standard G.GMD.2 Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.	For related content, please see: **SE/TE:** R171-R172, 1156-1166, 1167-1169
Expressing Geometric Properties With Equations (G.GPE)	
Standard G.GPE.2 Derive the equation of a parabola given a focus and a directrix.	**SE/TE:** 998-1008, 1009-1012, 1021-1022, 1023-1024, 1035-1042, 1043-1044

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Standard G.GPE.3 Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.	**SE/TE:** 968-979, 980-982, 983-994, 995-997, 1014, 1016, 1019, 1023-1024, 1035-1042, 1043-1044, 1201-1202
STATISTICS	
Conditional Probability and the Rules of Probability (S.CP)	
Standard S.CP.2 Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent.	**SE/TE:** 1131, 1132-1135
Standard S.CP.3 Understand the conditional probability of *A* given *B* as *P(A and B)/P(B)*, and interpret independence of *A* and *B* as saying that the conditional probability of *B* given *A* is the same as the probability of *B*.	For related content, please see: **SE/TE:** 1131, 1132-1135
Standard S.CP.7 Apply the Addition Rule, *P(A or B) = P(A) + P(B) – P(A and B)*, and interpret the answer in terms of the model.	**SE/TE:** 1126-1130, 1132-1135
Standard S.CP.8 Apply the general Multiplication Rule in a uniform probability model, *P(A and B) = P(A)P(B|A) = P(B)P(A|B)*, and interpret the answer in terms of the model.	**SE/TE:** 1130-1131, 1132-1135
Standard S.CP.9 Use permutations and combinations to compute probabilities of com- pound events and solve problems.	**SE/TE:** 1109-1119, 1125-1126, 1132-1135