Conceptual Activities

Use these interactive open education and/or Desmos resources to build conceptual understanding of mathematical ideas. (*Note*: Activity links will be monitored and repaired or replaced as necessary.)

Polynomial Relationships

- Illustrative Mathematics. "Computations with Complex Numbers."

  http://www.walch.com/ca/10004

  Students will practice operations on complex numbers using the fact that $i^2 = -1$. Encourage students to examine the structure of each expression and look for shortcuts (SMP 7), as this task allows for the shortening of some tedious calculations. This task is also an excellent candidate for comparison of different approaches to the same problem.

- Desmos. "Constructing Polynomials."

  http://www.walch.com/ca/01054

  In this activity, students will consider properties of polynomial functions such as end behavior, leading terms, and properties of roots. They will explore connections between those properties and the factored forms of the equations of the polynomials.

- Desmos. "Intro to Cubic Functions."

  http://www.walch.com/ca/10036

  This series of related activities provides an introduction to the structures behind cubic functions by relating a cubic to its linear factors. It also goes deeper by introducing some factorization patterns for cubic functions.

- Desmos. "Polygraph: Parabolas."

  http://www.walch.com/ca/01030

  In this paired game, one student picks a single parabola from a collection and the other student asks yes/no questions in an attempt to guess which parabola was chosen. The game provides students with a reason for noticing important features of parabolas, which in turn provides a need for words to name the features. "Does your graph cross the *x*-axis twice?" is a common question during play that leads to the naming roots, for example.

- Desmos. "Polygraph: Polynomial Functions."

  http://www.walch.com/ca/01055

  This activity is designed to spark vocabulary-rich conversations about polynomial functions. Key vocabulary terms that may appear in student questions include *degree*, *roots*, *end behavior*, *limit*, *quadrant*, *axis*, *increasing*, *decreasing*, *maximum*, *minimum*, *extrema*, *concave up*, and *concave down*.

- Desmos. "Polynomial Equation Challenges."

  http://www.walch.com/ca/01056

  In this activity, students will create polynomial equations (of degree 2, 3, and 4) to match given zeros and points. Students will explore how the factored form of the equations relates to the zeros and the order of those zeros.

- Illuminations. "Building Polynomial Functions."

  http://www.walch.com/ca/10037

  This lesson focuses on making connections among different classes of polynomial functions by exploring the graphs of the functions.

Rational and Radical Relationships

- Desmos. "Linear Systems Bundle."

  http://www.walch.com/ca/10029

  This site offers seven activities designed to develop students' conceptual understanding of systems of linear equations. The activities cover graphical, numerical (tabular), and algebraic methods to solve systems of equations.

- Desmos. "Marbleslides: Rationals."

  http://www.walch.com/ca/01057

  In this activity, students will transform rational functions to send marbles through stars.

- Desmos. "Polygraph: Rational Functions."

  http://www.walch.com/ca/01058

  This activity is designed to spark vocabulary-rich conversations about rational functions. Key vocabulary terms that may appear in student questions include *asymptote*, *vertical*, *horizontal*, *quadrant*, *axis*, *increasing*, *decreasing*, *discontinuity*, and *hole*.

- Illustrative Mathematics. "Graphing Rational Functions."

  http://www.walch.com/ca/10008

  This activity provides students the opportunity to observe the effects of changing constants in a pair of rational functions. In the second function, students will be able to see what happens to a graph when a discontinuity is introduced. This task is designed to highlight SMP 7 (look for and make use of structure) by allowing students to connect features of a graph with corresponding features in a formula.

- Illustrative Mathematics. "A Linear and Quadratic System."

  http://www.walch.com/ca/10030

  This task gives students the opportunity to make connections between equations and their graphs. Students must solve a system involving a quadratic function and linear function where the equation of the quadratic function is given and the equation of the linear function must be derived from the graph.

- Illustrative Mathematics. "Introduction to Polynomials—College Fund."

  http://www.walch.com/ca/10031

  In this task, students will create a polynomial function. They will solve systems of equations involving a polynomial function and a linear function using graphing technology and use the result to answer questions. Then, they will extend their reasoning into a more abstract problem. This task can be used to highlight SMPs 5 and 8.

Trigonometric Functions

- Desmos. "Burning Daylight."

  http://www.walch.com/ca/01059

  In this activity, students use sinusoids to model daylight data for two U.S. cities. They predict which city has more total daylight during a given year, and then use their model to calculate an answer to that question.

- Desmos. "Graphing the Sine Function Using Amplitude, Period, and Vertical Translation."

  http://www.walch.com/ca/01060

  Students will build a visual understanding of amplitude, period, and phase shift in this introduction to trigonometric graphing. They will use this understanding to find models for given graphs of the sine function.

- Desmos. "Marbleslides: Periodics."

  http://www.walch.com/ca/01061

  In this activity, students will transform periodic functions to send marbles through stars.

- Desmos. "Polygraph: Sinusoids."

  http://www.walch.com/ca/01062

  This activity is designed to spark vocabulary-rich conversations about sinusoids. Key vocabulary that may appear in student questions includes: amplitude, periods, maximum, minimum, and shift.

- Desmos. "Polygraph: Sinusoids with Vertical Transformations."

  http://www.walch.com/ca/01063

  This activity is designed to spark vocabulary-rich conversations about vertical transformations of sinusoids. Key vocabulary that may appear in student questions includes: translation, dilation, amplitude, midline, and sinusoidal axis.

- Desmos. "Trigonometric Graphing: Introduction to Amplitude and Vertical Shift."

  http://www.walch.com/ca/01064

  In this activity, students will informally explore range, midline, and amplitude of trigonometric functions. They'll use what they learn about the relationships to write equations of sine and cosine graphs.

Mathematical Modeling of Inverse, Logarithmic, and Trigonometric Functions

- Desmos. "Exponential Bundle."

  http://www.walch.com/ca/10032

  This website contains a collection of activities related to exponential functions. Activities will explore exponential growth, identify important properties of exponential graphs, relate graphs to the equations that generate them, and investigate modeling with exponential functions. All activities are related to a concrete scenario.

- Desmos. "Polygraph: Exponential & Logarithmic Functions."

  http://www.walch.com/ca/01045

  This activity is designed to spark vocabulary-rich conversations about exponential and logarithmic functions. Key vocabulary terms that may appear in student questions include *exponential*, *asymptote*, *logarithmic*, and *quadrant*.

Mathematical Modeling and Choosing a Model

- Desmos. "Card Sort: Exponentials."

  http://www.walch.com/ca/01044

  In this activity, students practice what they've learned about exponential functions by matching equations to properties of the graphs the functions will produce. Students will then use their knowledge of transforming exponential functions to pair equations with graphs.

- Desmos. "Domain and Range Introduction."

  http://www.walch.com/ca/01049

  In this activity, students practice finding the domain and range of piecewise functions. Students begin with an informal exploration of domain and range using a graph, and build up to representing the domain and range of piecewise functions using inequalities.

- Desmos. "Polygraph: Absolute Value."

  http://www.walch.com/ca/01050

  This activity is designed to spark vocabulary-rich conversations about transformations of the absolute value parent function. Key vocabulary terms that may appear in student questions include *translation*, *shift*, *slide*, *dilation*, *stretch*, *horizontal*, *vertical*, and *reflect*.

- Desmos. "Polygraph: Exponential Functions."

  http://www.walch.com/ca/01046

  This activity is designed to spark vocabulary-rich conversations about exponential functions. Key vocabulary terms that may appear in student questions include *increasing*, *decreasing*, *asymptote*, *quadrant*, and *axis*.

- Desmos. "Polygraph: Parent Functions."

  http://www.walch.com/ca/01051

  This activity is designed to spark vocabulary-rich conversations about graphs of parent functions. Key vocabulary terms that may appear in student questions include *increasing*, *decreasing*, *linear*, *quadratic*, *cubic*, *absolute value*, *exponential*, *logarithmic*, *rational*, *radical*, *axis*, *intercept*, and *coordinate*.

- Desmos. "Polygraph: Piecewise Functions."

  http://www.walch.com/ca/01052

  This activity is designed to spark vocabulary-rich conversations about piecewise functions. Key vocabulary terms that may appear in student questions include *piecewise*, *continuous*, and *interval*.

- Desmos. "Polygraph: Twelve Functions."

  http://www.walch.com/ca/01053

  This activity is designed to spark vocabulary-rich conversations about various functions. Key vocabulary terms that may appear in student questions include *linear*, *quadratic*, *exponential*, *cubic*, *absolute value*, *rational*, *radical*, *sinusoid*, and *step*.

- Desmos. "Writing Rules: Linear, Quadratic, and Exponential."

  http://www.walch.com/ca/01047

  In this activity, students have an opportunity to deepen their understanding of linear, quadratic, and exponential functions by making connections between their tables, graphs, and equations.

Inferences and Conclusions from Data

- Illustrative Mathematics. "Margin of Error for Estimating a Population."

  https://www.illustrativemathematics.org/content-standards/HSS/IC/B/4/tasks/1956

  This is a challenging task designed to help students understand why the margin of error statistic is important to consider when estimating a population mean from a sample. Students will use simulations to develop a margin of error and also learn to estimate the margin of error using a simgle sample.

- Illustrative Mathematics. "Should We Send Out a Certificate?"

  http://www.walch.com/ca/10006

  This task allows students to practice calculating normal distributions and further encourages them to draw conclusions from their results based on the properties of normal distributions. Students will communicate their findings in a narrative form within the context of the problem rather that reporting a simple computed number.

- Mathematics Assessment Resource Service, University of Nottingham. "Representing Conditional Probabilities 1."

  http://www.walch.com/ca/10007

  In this resource, students will use tables and tree diagrams to represent events as a subset of a sample space and answer questions involving conditional probabilities. This resource includes a diagnostic assessment, a learning task, and sample solutions that students will analyze and evaluate. Some extra materials are required.

Applications of Probability

- Desmos. "Chance Experiments."

  http://www.walch.com/ca/10033

  This activity introduces students to probability through a spinner game. Students will play the game and analyze the results to build an understanding of chance.

- Desmos. "Probability and 2-way Tables."

  http://www.walch.com/ca/10034

  Students will analyze a two-way frequency table to determine probabilities.

- Illustrative Mathematics. "Alex, Mel, and Chelsea Play a Game."

  http://www.walch.com/ca/10035

  In this activity, students will explore independent events using counting techniques for combinations.