

Domain: Algebra and Functions

Seeing Structure in Expressions:

HS.A-SSE.A Interpret the structure of expressions (A2M1T1)

- Use the structure of an expression to identify ways to rewrite it. (CCSS: A.SSE.A.2)
 - i) Tasks are limited to polynomial, rational, or exponential expressions.
 - ii) Examples: see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$. In the equation $x^2 + 2x + 1 + y^2 = 9$, see an opportunity to rewrite the first three terms as $(x+1)^2$, thus recognizing the equation of a circle with radius 3 and center $(-1, 0)$. See $(x^2 + 4)/(x^2 + 3)$ as $((x^2+3) + 1)/(x^2+3)$, thus recognizing an opportunity to write it as $1 + 1/(x^2 + 3)$.

HS.A-SSE.B Write expressions in equivalent forms to solve problems. (A2M2T1)

- Choose and produce an equivalent form of an expression to reveal and explain the properties of the quantity represented by the expression. (CCSS:HS.A-SSE.B.3)
- Use the formula for the sum of a finite geometric series (when the common ratio is not 1) to solve problems. For example, calculate mortgage payments. (CCSS: HS.A-SSE.B.4)

Arithmetic with Polynomials & Rational Expressions:

HS.A-APR.B Understand the relationship between zeros and factors of polynomials. (A2M2)

- Know and apply the Remainder Theorem. For a polynomial $p(x)$ and a number a , the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$. (Students need not apply the Remainder Theorem to polynomials of degree greater than 4.) (CCSS: HS.A-APR.B.2)
- Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. (CCSS: HS.A-APR.B.3)
 - i) Tasks include quadratic, cubic, and quartic polynomials and polynomials for which factors are not provided. For example, find the zeros of $(x^2 - 1)(x^2 + 1)$

HS.A-APR.D.6 Rewrite Rational Expressions (Located A2M2T3)

- Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x)+r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.

Reasoning with Equations & Inequalities

HS.A-REI.D Represent and solve equations and inequalities graphically. (Located in A2M1T2)

- **HS.A-REI.D.10:** Explain that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

Interpreting Functions:

HS.F-IF.B Interpret functions that arise in applications in terms of the context. (Located in A2M1)

- For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. (CCSS: HS.F-IF.B.4)
- Calculate and interpret the average rate of change presented symbolically or as a table of a function over a specified interval. Estimate the rate of change from a graph. (CCSS: HS.F-IF.B.6)

HS.F-IF.C.7: Graph functions expressed symbolically and show key features of the graph by hand in simple cases and using technology for more complicated cases.

- Graph linear and quadratic functions and show intercepts, maxima, and minima. (HS.F-IF.C.7.a)
- Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. (HS.F-IF.C.7.c)

HS.F-IF.C.8: Write a function defined by an expression in different but equivalent forms to reveal and explain the different properties of the function.

Building Functions:

HS.F-BF.A Build a function that models a relationship between two quantities. (Located in A2M1)

- Write a function that describes a relationship between two quantities (CCSS: HS.F-BF.A.1)

HS.F-BF.B Build a function from existing functions. (Located in A2M3)

- Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. (CCSS: HS.F-BF.B.3)

Linear, Quadratic, and Exponential Models

HS.F-LE.A.4: For exponential models, express as a logarithm the solution to $abct = d$ where $a, c,$ and d are numbers and the base b is 2, 10, or e ; evaluate the logarithm using technology. (Located in A2M3)

HS.F-LE.B.5: Interpret the parameters in a linear or exponential function in terms of context.

Domain: Statistics and Probability

Making Inferences and Justifying Conclusions:

HS.S-IC.A Understand And Evaluate Random Processes Underlying Statistical Experiments

- **HS.S-IC.A.1** Understand statistics as a process for making inferences about population parameters based on a random sample from that population. (Located in A2M5)
- **HS.S-IC.A.2** Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?

HS.S-IC.B Make inferences and justify conclusions from sample surveys, experiments, and observational studies. (Located in A2M5T2)

- **HS.S-IC.B.3:** Identify the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

- **HS.S-IC.B.4:** Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.
- **HS.S-IC.B.5:** Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
- **HS.S-IC.B.6:** Evaluate reports based on data. Define and explain the meaning of significance, both statistical (using p-values) and practical (using effect size).