# Unit 1: Relations & Functions  9 days

**1. Relations/Functions  3 days F. IF.1, F.IF.2**

a. Know and apply definitions of relations, functions, domain, and range

 through sets, equations and graphs. (Include interval notation)

 b. Applying the vertical/horizontal line tests.

c. Expressing functions algebraically, graphically, numerically, and verbally.

d. Evaluating functions using function notation and graphs. (Revisit in Trig)

e. Determine if a function is one to one, onto, or both [\*\*Gone]

1. **Composition & Inverses  4 days F.BF.4a, F.BF.1b**

a. Notation for composition of functions vs. [\*\*12]

b. Evaluating the composition of functions [\*\*12]

c. Write a composition of functions as a single function [\*\*12]

 (Rule of the function)

d. Find the inverse of a function algebraically

e. Reflection in the line *y=x* and how this relates to inverses



**3. Review and assessment**

**Unit 2: Rational Expressions and Equations  15 days**

 **1. Factoring** **3 days**

a. Rewriting in Standard form [\*\*Alg]

b. Identify and factor the difference of two perfect squares [\*\*Alg]

c. Factoring algebraic expressions using the GCF [\*\*Alg]

d. Factoring a trinomial into two binomials, a = 1[\*\*Alg]

e. Factoring a trinomial into two binomials, a >1[\*\*Alg]

f. Factoring a trinomial into binomials that involves factoring out a GCF first [\*\*Alg]

g. Factoring a trinomial into two binomials that involves factoring out the negative of the GCF first (Ex: -x2 – 3x – 4) [\*\*Alg]

h. Factoring by grouping [\*\*Gone]

**2. Operations With Rational Expressions**  **7 days** [\*\*??]

Not sure

a. Simplify a rational expression and identify when it is undefined. [\*\*??]

 b. Addition and subtraction [\*\*??]

1. Like denominators [\*\*??]

 2. Unlike denominators [\*\*??]

 3. Simplify, whenever possible – including factor of -1[\*\*??]

 c. Multiplying and dividing [\*\*??]

1. Factoring – including factor of -1[\*\*??]

 2. Simplify by removing common factors [\*\*??]

3. Multiply and divide by a polynomial where quotient has no remainder [\*\*??]

 d. Complex fractions [\*\*??]

1. Re-write as a division problem and use concepts from above to simplify; or [\*\*??]

 2. Multiply by the LCD of the numerator and denominator [\*\*??]

 **3. Solving equations** **3 days A.REI.11, A.CED.1**

 a. Rational equations – *linear only (quadratics addressed in its own unit)*

1. Solve by multiplying every term by the LCD

 2. Cross-multiply to solve a proportion (alternate method)

 3. Check solutions

 b. Rational inequalities - *linear only (quadratics addressed in its own unit)*

1. Solve by multiplying every term by the LCD

 2. Cross-multiply to solve a proportion (alternate method)

 3. Methods when *variable* is compared to 0

i. Sign analysis using critical values

 **4. Review and assessment**

A.APR.6 **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.

A.APR.2 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*).

**Unit 3: Radicals and Complex Numbers  13 days**

 **1. Operations with Radicals  5 days**

a. Simplifying radicals [\*\*Gone]

 1. Recognizing perfect squares, cubes, etc. (numeric and variable) [\*\*Alg]

 2. Factors of the radicand [\*\*Gone]

3. Determining n-th roots [\*\*Alg, ?Gone]

4. Simplifying radicals with fractions [\*\*Gone]

 b. Operations with radical expressions [\*\*Alg]

 1. Addition and subtraction [\*\*Alg]

i With irrational numbers in radical form [\*\*??] ii. With irrational expressions (variable expressions) [\*\*??]

2. Multiplication and division – same index [\*\*??]

 c. Rationalize a denominator [\*\*Gone]

 1. Conjugate Pairs

 2. Simplest radical form

**2. Radical Equations  2 days [\*\*Alg]**

 a. Solving radical equations

 1. Isolate radicals

 2. Square both sides of the equation – inverse operations

 *(note: resulting equation must be linear (or a factorable quadratic in this unit—if you choose to do this here))*

 3. Check for extraneous solutions/roots

4. Check/solve the equation using the graphing calculator –

 determine the intersection point after graphing each

 expression in the equation.

**3. Powers of i  4 days N.CN.1, N.CN. 2**

 a. Definition of *i*.

 b. Powers of *i* using exponent rules; cyclical nature of powers of *i*

 c. Definition of a complex number

 1. Include graphical representation as a vector **[\*\*12]**

i. 

 2. Standard form of a complex number ()

 d. Operations with complex numbers

 1. Addition and subtraction

 2. Multiplication

 i. Simplify powers of *i*

 ii. Multiplying a conjugate pair

 3. Division **[\*\*12]**

 i. Complex conjugate theorem

**4. Review and Assessment**

# Unit 4 : Quadratics  17 days

**1. Quadratic Formula  8 days A.RE1.4a, A.RE1.4b**

a. Solving a Quadratic Equation using factoring, **completing the square**, and the quadratic formula

b. Parts of the Quadratic Formula (a,b,c, the axis of symmetry, and the discriminant) **[\*\*Alg] – axis of symmetry only, discriminant gone**

c. Relate finding the roots algebraically to finding the roots graphically

d. Determining the nature of the roots using the discriminant or the graph (parabola) **[\*\*Gone]**

e. Writing a Quadratic Equation from given information (roots or sum and product) **[\*\*Gone]**



1. **Quadratic Equations & Inequalities  4 days A.REI.4b**

**[\*\*Gone] – radical equations resulting in quadratics**

a. Solving Quadratic Equations/Inequalities (incorporate radical and

 rational equations that result in quadratic equations to be solved)

1. Algebraically (Factoring by grouping)

2. Graphically

b. Checking equations for extraneous solutions

c. Solving polynomial equations of a degree higher than two, that can be

 solved with factoring and quadratic formula

1. Algebraically

2. Graphically

**3. Systems of Equations & Graphing  3 days A.REI.7**

a. Systems of Quadratic/Linear System of Equations

 1. Algebraically

 2. Graphically (review from algebra)

 3. Include word problems

b. *May* teach linear and power Regression Equations here (or wait until Stats unit)

c. Interpreting solutions from a graph

**4. Review & Assessment**

A.SSE.3b **Complete the square** in a quadratic expression to reveal the maximum or minimum value of the function it defines.

A.REI.4a Use the method of **completing the square** to transform any quadratic equation in *x* into an equation of the form (*x* – *p*)2 = *q* that has the same solutions. **Derive the quadratic formula** from this form.

F.IF.8a Use the process of **factoring** and **completing the square** in a quadratic function to show **zeros**, **extreme values**, and **symmetry** of the graph, and **interpret** these in terms of a context.

A.CED.1 **Create equations** and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. Are these word problems?

**Unit 5: Sequences and Series  10 days**

**1. Sigma notation  1 day**



**2. Sequences and Series  7 - 8 days**

 a. Recognize the common difference in arithmetic sequences and series.

b. Recognize the common ratio in a geometric sequence and series.

c. Determine the type of sequence or series.

d. Write the explicit formula for a sequence.

e. Find the terms in a sequence defined recursively.

f. Find the position of a term in a series or sequence.

g. Find any term in a sequence or series explicitly.

h. Recognize what information is needed to complete a sum of a series.

i. Determine the sum of finite arithmetic and geometric series using

 formulas.

j. Write a series using sigma notation.

k. Solve word problems involving sequences and series.

 **3. Review & Assessment**

F.BF.1a Determine an explicit expression, a **recursive** process, or steps for calculation from a context. (include word problems)

F.IF.3 Recognize that sequences are functions, sometimes defined recursively, whose **domain** is a subset of the integers. For example, the Fibonacci sequence is defined recursively by *f*(0) = *f*(1) = 1, *f*(*n* + 1) = *f*(*n*) + *f*(*n* – 1) for *n* ≥ 1.

A.SSE.4 **Derive the formula** for the sum of a **finite geometric series** (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.

F.LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

# Unit 6: Trigonometry Functions  8 - 10 days

 **1. The unit circle:  5 days F.TF.1, F.TF.2**

a. The unit circle

1. Quadrantal angles

2. Special angles (30 º, 45 º, 60 º) in all 4 quadrants

3. Sin, cos, tan of quadrantal angles and special angles (30 º,

 45 º, 60 º)

4. (x ,y)  (cos, sin)

5. Determine the sign of the trig values for each function in

 each quadrant

6. Evaluate using function notation (see Sample Test Question

 #27) f(x), f()

b. Co-terminal angles with positive and negative angle measures (clockwise and counter clockwise)

c. Convert between degrees and radians (refer back to unit circle); rounding to nearest degree in minute second

d. Reference Angles (refer back to unit circle)

F.TF.2 Explain how the **unit circle** in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

 **2. Co-Functions & Reciprocal Functions  2 days**

Not sure about co-functions; not sure which trig functions they will need to know.

a. Define co-functions & reciprocal functions

 b. Find all trig function values:

 1. given 1 trig function & a quadrant OR

2. given 2 trig functions

3. solve for simplest radical form or decimal equivalents, incorporating the use of the graphing calculator

c. Use inverse functions to find the measure of an angle given the sine,

 cosine, or tangent and a specific quadrant

1. **s =** **r 1 day [\*\*Geo]**

a. Use s =r, using degree and radian angle measure (convert degrees

 to radians)

 b. Arc lengths vs. arc measures

**4. Review & Assessment**

**Unit 7: Trigonometry Graphs**  **9 days**

**1. Graphing Sine and Cosine  4 days F.BF.3, F.IF.4, F.TF.5, F.IF.7e**

a. Graph y = sinx and y =cosx based on unit circle values

 b. Define and apply changes in amplitude, period, and frequency

c. Connect to concepts of domain & range (maximum and minimum)

d. Given a graph, write the equation

e. Given an equation, create the graph.

f. Explore y = AsinB(x+h)+C and y = AcosB(x+h)+C with vertical and horizontal phase shifts.

g. Apply concepts from trig graphs to real-life word problems

1. **Tangent Graph and Inverse Trig Functions  2 days**

a. Tangent curve:

1. Graph y=tan(x)

1. Discuss properties of the tangent curve

b. Inverse Trig Functions:

1. Graph the inverses of sin, cos, & tan. **[\*\*12 or gone]**

1. Use various inverse notations, such as arccos, Arccos, cos – 1 **[\*\*12]**
2. Discuss properties of inverse trig graphs **[\*\*Gone]**

4. Determine which inverse graphs are functions, and any

 necessary restrictions on domain to insure the existence of the

 inverse function. **[\*\*12]**

 **3. Reciprocal trig functions  1 day**

 a. Sketch , , and from unit circle values

Not sure if need to graph reciprocal functions; which functions?

 and/or using the graphing calculator.

 b. Compare and contrast the graphs, including discussion of asymptotes,

 domain, period, & cycles. Include comparisons between the original

 and reciprocal graphs

 **4. Review and Assessment**

**Using the vocabulary MIDLINE…**

# Unit 8: Trigonometry Equations and Identities  9 – 11 days

 **1. Apply the Pythagorean Identities  1 day**



 **2. Sum & Difference of angles formulas  1 day [\*\*12]**



 **3. Double-angle and Half-angle formulas  1 – 2 days [\*\*12]**



 **4. Equations with Trigonometry  4 - 5 days [\*\*12]**

a. Solve trigonometric equations

 1. Linear equations

 2. Quadratic equations (factoring and quadratic formula)

3. Equations with substitutions using Pythagorean and double

 angle formulas answers expressed in degrees and radians in a

 given interval

 **5. Review & Assessment**

A.APR.4 **Prove polynomial identities** and use them to describe numerical relationships. For example, the polynomial identity (*x*2 + *y*2)2 = (*x*2 – *y*2)2 + (2*xy*)2 can be used to generate **Pythagorean triples**.

\*G.SRT.7 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

F.TF.8 Prove the Pythagorean identity sin2 θ + cos2 θ = 1 and use it to calculate trigonometric ratios.

# Unit 9: Trigonometry Applications  8 - 9 days [\*\*12?]

 **1. Area of a Triangle or Parallelogram  1 day**

a. Area of a triangle = ½ *ab*sin*C*

1. **Law of Sines & Law of Cosines  5 days**

a. Law of Sines: 

1. Find a missing side given 2 angles and a side

2. Find a missing angle given 2 sides and a corresponding angle

b. Law of Cosines:

1. Find an angle given 3 sides

 2. Find a side given 2 sides and an included angle

 c. Forces and Vectors (application of law of cosines)

1. Find resultant force given 2 forces

 2. Find the angle between two forces given the resultant

d. Angles of Elevation and Depression (application of law of sines)

**3. Ambiguous Case  1 day**

**4. Review & Assessment**

# Unit 10: Exponents 10 days

**1. Properties (such that x and y are any real number)  1 days**

a. Product of Powers ax۰ay = ax + y

b. Power to a Power (ax)y = axy

c. Quotient of Powers ax ÷ ay = ax - y, a ≠ 0

d. Zero Power a0 = 1, a ≠ 0

e. Power of a Product (ab)x = axbx

f. Power of a Quotient (a/b)x = ax/bx, b ≠ 0

g. Negative Exponents a-x = 1/ax, a ≠ 0

**2. Fractional Exponents  2 days N.RN.1**

a. Basic operations using radicals (Review)

 b. Converting between fractional exponents and radical form

c. Evaluate an expression/solve an equation with fractional exponents without the use of a calculator (where the answer is a rational number)

d. Evaluate an expression/solve an equation with fractional exponents with

 the use of a calculator **[\*\*Gone]**

**3. Exponential Expressions/Functions  3 days F.IF.7e, F.LE.5, A.SSE.3c**

a. Review the definition of a function

Are these the only bases they need to know?

b. Evaluate exponential expressions

c. Introduce base e, base 2

d. Evaluate exponential expressions involving base e

e. Graph exponential functions in the form , including base e

f. Solve an application involving an exponential function that does not

 require logarithms

**4. Exponential Equations  2 days**

a. Review property of raising a power to a power

b. Express both sides of an equation in terms of the same base

c. Solve the resulting equation (linear or quadratic) when the exponents are

 set equal to each other

**5. Review & Assessment**

\*F.IF.4 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 given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

F.LE.1a **Prove** that **linear functions grow by equal differences** over equal intervals, and that **exponential functions grow by equal factors** over equal intervals.

F.BF.3 **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.

F.LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

## Unit 11: Logarithms 10 days

**1. Introduction to Logs and Natural Logs  2 days F.BF.5, F.IF.7e, F.IF.8b**

a. Convert between exponential and logarithmic form

b. Solve basic equations by converting to exponential form

c. Graph logarithmic functions as the inverse of an exponential function

**2. Properties of Logs and Natural Logs  2 days F.BF.5**

a. Review the properties of exponents

b. Product Property logbmn = logbm + logbn

c. Quotient Property logb= logbm - logbn

d. Power Property logbmn = nlogbm

e. Change of Base Formula logbm = 

**3. Equations and Applications  4 days F.BF.5, A.SSE.3c, F.IF.8b, F.LE.1c**

a. Solve exponential equations without common bases

b. Solve logarithmic equations using the properties of logarithms (Include equations with coefficients)

c. Solve application problems that require the use of logarithms (ex. Half-life, growth/decay, compound interest)

d. Model data with an exponential/logarithmic regression equation and use this equation to make predictions Base Formula logbm = 

 **4. Review and Assessment**

F.LE.4 For **exponential models**, express as a logarithm the solution to *ab*ct = *d* where *a*, *c*, and *d* are numbers and the base b is 2, 10, or *e*; **evaluate the logarithm** using technology. Base 2 is NEW (being emphasized)

**Unit 12. Probability  11 - 12 days**

1. **Binomial Probabilities  5 days**

a. Determine the probability of independent events **[\*\*Gone]**

b. Expand binomial using the binomial theorem and find specific terms of the expansion **[\*\*Gone]**

c. Find the probability of exactly, at least, at most of r success in n-trials **[\*\*Gone]**

d. Binomial probabilities based on geometric relationships (i.e. area) **[\*\*12?]**

 e. Determine theoretical, empirical, and geometric probabilities **[\*\*Gone]**

**2. Combinatorics  4 days**

a. Determine a sample space S.CP.1

b. Determine the number of permutations with and without repetition **[\*\*12?]**

c. Determine the number of events in which order matters or does not

 matter **[\*\*12?]**

d. Determine the number of permutations with identical objects, such as

 the number of different arrangements of the letters in the word bubble. **[\*\*12?]**

e. Understand the formula notation and apply formulas **[\*\*12?]**

f. Use permutations and combinations of compound events **[\*\*12?]**

g. Analyze and solve verbal problems **[\*\*12?]**

**3. Review & Assessment**

S.CP.1 Describe events as **subsets** of a **sample space** (the set of outcomes) using characteristics (or categories) of the outcomes, or as **unions**, **intersections**, or **complements** of other events (“or,” “and,” “not”).

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.

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 A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.

S.CP.4 **Construct** and **interpret two-way frequency tables** of data when two categories are associated with each object being classified. Use the two-way table as a sample space to **decide if events are independent** and to **approximate conditional probabilities**. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.*

S.CP.5 Recognize and explain the concepts of **conditional probability** and **independence** in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.

S.CP.6 Find the **conditional probability** of A given B as the fraction of B’s outcomes that also belong to A, and **interpret the answer** in terms of the model.

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.

S.IC.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

S.IC.6 Evaluate reports based on data.

**Unit 13. Statistics  10 days**

**1. Studies and Surveys  1 day**

a. Define:

 (1) Survey

 (2) Observation

 (3) Controlled Experiment

b. Determine the factors which may affect the outcome of a survey

**2. Statistical measures  2 days S.ID.2, S.ID.3**

a. Median

b. Mode

c. Quartiles

d. Range

e. Standard Deviation [sample vs. population]

f. Variance [sample vs. population]

g. Interquartile range

**3. Normal Distribution  2 days S.ID.4**

1. Standard deviation & Mean
2. The percentages under the curve
3. Percentiles

d. Apply the normal distribution curve, and its properties, to word

 problems involving real-life data.

e. Use the normal distribution as an approximation for binomial

 probabilities **[\*\*Gone]**

**4. Regression Models  3 days S.ID.1, S.ID.6a, S.ID.6c, S.ID.7, S.ID.8**

a. Construct a scatter plot using a given table of data without the use of a

 calculator

b. Determine the appropriate regression model from a scatter plot (linear,

 exponential, power, logarithmic)

c. Use the graphing calculator to determine the function for the regression

 model

d. Use the regression function to evaluate and predict real world

 situations

e. Determine the correlation coefficient using the graphing calculator

 f. Determine the type of correlation (positive, negative, none)

g. Use the correlation coefficient to determine the strength of a linear

 relationship

 **5. Review & Assessment**

S.ID.1 Represent data with plots on the real number line (**dot plots**, **histograms**, and **box plots**).

S.ID.3 Interpret differences in **shape**, **center**, and **spread** in the **context of the data sets**, accounting for possible effects of extreme data points (**outliers**).

S.IC.6 Evaluate reports based on data.

S.ID.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

S.ID.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

S.ID.6b Informally assess the fit of a function by plotting and analyzing residuals.

S.ID.9 Distinguish between **correlation** and **causation**.

S.IC.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.

**Isolated Topics - NOT Optional**

 **1. Absolute Value** **~ 2 days A.REI.11**

 a. Absolute value equations

Not sure about algebraic solutions

 1. Definition of absolute value

2. Algebraic and graphic solutions

 b. Absolute value inequalities

 1. “and” vs. “or”

 2. Algebraic and graphic solutions

 Graph in 2 variables

 **2. Circles  2 days G.GPE.1**

 a. The center of a circle is an ordered pair

b. Convert an equation of a circle in general form to center-radius form

 (by completing the square) and determine the center and radius.

c. Write the equation of a circle (Center-radius form and standard form)

 given the graph, the center and radius, or the center and point on the

 circle

 d. Given the center and radius, write the equation of a circle in general

 form.

 **3. Transformations ~ 1 day F.BF.3**

Perform transformations with f(x+a), f(x) + a, f (– x), – f(x), af(x) question 26 in sample test (see example in sample tasks [ A2.A.46] & sample test)

**4. Direct vs. Inverse variation  1 day [\*\*9th or Gone]**

**REGENTS REVIEW**

# Color Key:

Red: Not in the course after 2011-2012

Blue: New Standards (CCLS)

Green: New to the course after 2011-2012

NOTE: Regional team suggests for 2011-2012 do NOT teach the green. No course after this course will be impacted.

We will reassess order once we know when/what the quarterly PARCC assessments will cover.