

Lesson	Title	Primary Activities	Assessments
1	The Language of Cryptology & the Shift is On!	<ul style="list-style-type: none"> <li>• Student as Agent-in-training</li> <li>• The importance of secrecy</li> <li>• Career opportunities</li> <li>• The terminology of codes</li> <li>• Deciphering a shift cipher</li> <li>• Introducing the cast of characters</li> </ul>	<ul style="list-style-type: none"> <li>• Survey of prior knowledge and opinions</li> <li>• Caesar shift enciphering/deciphering</li> <li>• Vocabulary check</li> </ul>
2	Agent Training in Basic Arithmetic	<ul style="list-style-type: none"> <li>• Multiplication algorithms/arrays</li> <li>• Distributive property</li> <li>• Division/remainders</li> <li>• Tests for divisibility</li> <li>• Parity and primeness</li> </ul>	<ul style="list-style-type: none"> <li>• Interpreting and making arrays</li> <li>• Vocabulary of multiplication and division</li> <li>• Solving for partial products and remainders</li> <li>• Recognizing factors</li> <li>• Recognizing parity and primeness</li> </ul>
3	Codes That Use Keywords & Factoring	<ul style="list-style-type: none"> <li>• De Vigenère ciphers</li> <li>• The method of public key</li> <li>• Squares and square roots</li> <li>• Trial division and spreadsheet</li> <li>• Prime factorization</li> </ul>	<ul style="list-style-type: none"> <li>• Keyword encoding and decoding</li> <li>• Factoring using trial division</li> <li>• Procedure writing</li> </ul>
4	Cipher Formulas & Modular Arithmetic	<ul style="list-style-type: none"> <li>• Atbash spreadsheet and formula</li> <li>• Clock arithmetic</li> <li>• Shift cipher formula</li> <li>• A need for modular arithmetic</li> <li>• Negative integers in mod 26</li> </ul>	<ul style="list-style-type: none"> <li>• Writing modular notation</li> <li>• Caesar shift enciphering/deciphering using modulo 26</li> <li>• Solving time problems in mod 12</li> <li>• Performing arithmetic in other modular bases</li> </ul>

Lesson	Title	Primary Activities	Assessments
5	Digital Roots & the Secret Digit Trick	<ul style="list-style-type: none"> <li>• Learning and explaining a number trick</li> <li>• Problem constraints</li> <li>• Casting out nines (modulo 9 congruence)</li> <li>• Applying expanded notation and the distributive property</li> <li>• Error trapping/computer bugs</li> </ul>	<ul style="list-style-type: none"> <li>• Performing a subtraction trick</li> <li>• Explaining the trick using expanded form and distribution</li> <li>• Writing a script</li> <li>• Modeling constraints</li> <li>• Catching math errors</li> </ul>
6	Affine Ciphers & Modular Inverses	<ul style="list-style-type: none"> <li>• Affine enciphering</li> <li>• Mathematical limitations</li> <li>• Pigeonhole principle</li> <li>• Solving affine ciphers</li> <li>• Inverses in modular form</li> <li>• The inverse of composite operations</li> </ul>	<ul style="list-style-type: none"> <li>• Application of common factors and transforming the alphabet</li> <li>• Finding modular multiplicative inverses</li> <li>• Comparing multiplicative inverse forms</li> <li>• Enciphering and deciphering with affine formulas</li> <li>• Assessing affine weaknesses</li> </ul>
7	Random Substitution & Cryptograms	<ul style="list-style-type: none"> <li>• Permutations of the alphabet</li> <li>• Crypto-analysis using statistics; English language structures; frequency counts of letters; common words/phrases</li> <li>• A further weakness in shift ciphers</li> </ul>	<ul style="list-style-type: none"> <li>• Solving puzzles as an entry into cryptanalysis</li> <li>• Solving cryptograms and codeword puzzles</li> <li>• Making and analyzing frequency histograms</li> <li>• Using technology to aid in analysis</li> <li>• Comparing shift ciphers and the alphabet profile</li> </ul>

Lesson	Title	Primary Activities	Assessments
8	Prime Secrets & Patterns Beware!	<ul style="list-style-type: none"> <li>• Patterns in the square numbers</li> <li>• Counting prime frequencies</li> <li>• Investigating Euclid's proof</li> <li>• The Multiplication Race</li> <li>• Fermat's factoring method</li> <li>• Investigations into pattern breakers</li> </ul>	<ul style="list-style-type: none"> <li>• Pattern recognition and extension</li> <li>• Detecting pattern breaking</li> <li>• Paraphrasing Euclid's proof</li> <li>• Mental calculation—sums and differences of squares</li> <li>• Variable representation of differences of squares</li> <li>• Performing and reporting investigations</li> <li>• Factoring and prime detecting</li> </ul>
9	An Abundance of Factors or Not!	<ul style="list-style-type: none"> <li>• Factor lists</li> <li>• Prime factorization</li> <li>• Factor counts by formula</li> <li>• Factor sums</li> <li>• Factor abundance and deficiency</li> <li>• Perfect numbers</li> <li>• Geometric dissections</li> <li>• Odd abundant numbers</li> <li>• A number trick with 1001</li> </ul>	<ul style="list-style-type: none"> <li>• Investigation into a perfect number pattern—report of findings</li> <li>• Finding odd abundant numbers—report of findings</li> <li>• Review of prime factorization</li> <li>• Unit Review, Part I – The Math</li> </ul>
10	Strengthening the Ciphers	<ul style="list-style-type: none"> <li>• Summary and Reflections; Cryptarithms</li> <li>• Cipher variations and security comparisons</li> <li>• Parting puzzles</li> <li>• Exit project—Ethics in cryptology</li> </ul>	<ul style="list-style-type: none"> <li>• Unit Review, Part II – The Codes</li> <li>• Final skill and vocabulary check (Unit Test)</li> <li>• Post survey of knowledge and opinions</li> <li>• Writing assignment—acceptable use policy for codes</li> </ul>