

## Essential Concepts and Skills That Students Need To Be Successful In High School Mathematics

Number & Computation: Skills & Concepts	Assessment	Rationale
Able to estimate with and recognize size of rational numbers and square roots	$1\frac{5}{6} + 2\frac{1}{9} \approx 4$ $\sqrt{14}$ is between 3 and 4, closer to 4	Helps students recognize appropriateness of answers and build confidence in computation
Able to solve multi-step problems with whole and rational numbers	Gloria spent half her money on books, she spent a $\frac{1}{3}$ of what was left on supplies. She had \$8 left, how much did she start with?	Fluency with rational #'s enables understanding of rate, and is required to manipulate equations
Able to move easily between fractions, decimals and percent	<ul style="list-style-type: none"> <li>• What is the price if it is 25% off of \$1200?</li> <li>= <math>\frac{3}{4}(1200)</math></li> <li>• Which is larger <math>\frac{5}{8}</math> or <math>66\frac{2}{3}\%</math>?</li> </ul>	Know equivalent forms for computing and able to compute mentally
Perform all four operations with integers, including a model to represent them such as directionality or opposites	$-13 - (-27) = \underline{\quad}$ ( 14 since finding the difference between -27 and -13 is moving 14 in a positive direction.)	Necessary to solve equations and understand functions and their behaviors
Compute mentally with whole numbers using distributive and associative properties	<ul style="list-style-type: none"> <li>• <math>23 \times 24 = (20 \times 24) + (3 \times 24)</math></li> <li>• <math>5 \times 26 \times 2 = 10 \times 26</math></li> </ul>	Use these properties to manipulate equations and develop confidence in mental computation
Find common factors and multiples of any two numbers under 100	<ul style="list-style-type: none"> <li>• What are common factors of 18 and 30?</li> <li>• What is the smallest number of band members that can be arranged in rows of either 1,2,3,4,5 or 6?</li> </ul>	Necessary to manipulate expressions, equations, and functions

Algebra: Skills & Concepts	Assessment	Rationale
Recognize, use and write a rule to generate patterns, especially commonly seen ones such as squares numbers, consecutive counting numbers etc.	<ul style="list-style-type: none"> <li>• Write the rule for this number sequence: 1,4,9,16..</li> <li>• What will the 10<sup>th</sup> number be in this sequence: 1,3,6,10...?</li> </ul> Write an expression to describe this number series: 1,2,4,8,16...	Recognizing patterns is an essential concept necessary to understand functions and solve problems
Represent a situation using a variable including an unknown, a relationship and a formula, and use algebraic notation appropriately, especially the following examples: $5n$ $5n^2$ $\frac{5}{n}$ $-n$ $-n^2$ $n$	Jose bought five concert tickets and a lunch for \$117. If lunch cost 7 dollars, write an expression to describe the cost of one ticket.  In a triangle, one angle is twice as big as the smallest angle. The largest angle is 3 times as big as the smallest angle, write an equation and solve for the size of the largest angle.	<ul style="list-style-type: none"> <li>• Students need to be able to use algebraic notation to model situations and to write equations to solve problems</li> <li>• They must recognize that symbols such as <math>n</math>, <math>x</math>, or <math>A</math>, stand for quantities that can change or that represent an unknown quantity</li> </ul>
Solve 1 and 2 step equations, including variables on both sides	$2x - 5 = 15$ $4x/3 = 36$ $x + 2x = 180 - 3x$	Necessary for solving more sophisticated equations in first year algebra.
Evaluate an expression using order of operations such as: $2(x + 5)$ for $x = 7$ or $-n^2 + 3n$ , when $n = 3$	What is the Fahrenheit temperature if it is 30 C ( $F=9/5C + 32$ )? Find the 100 <sup>th</sup> term of these series, 1,3,6,10, if it can be expressed as $n(n+1)/2$	Necessary skill in algebra, for solving equations, describing functions, and interpreting data
Set up proportional relationships to solve for an unknown	Orange juice cost \$2.50 for 64oz, how much does a 6 oz. glass cost?	Critical for solving for unknowns
Match a graphical representation to a situation or function	<ul style="list-style-type: none"> <li>• Match the graph to <math>y=-2x</math>.</li> <li>• Which graph represents the cooling of a teapot after it has boiled?</li> </ul>	Necessary to understand various representations of functions

Use table, graph, and equation to model a linear relationship	<ul style="list-style-type: none"> <li>• Compare the distance of a runner at 7 mph with a bike rider at 15 miles per hour, if the runner starts one hour earlier. Use a table, graph, and write equations to model this.</li> <li>• In <math>y = 2x - 5</math>, what are the coordinates of the y intercept?</li> </ul>	Students must recognize that tables, graphs and equations are used to model and analyze relationships between two variables to work with functions
Recognize non linear functions	Compare the graph and table of the relationship between the radius and the circumference of a circle with the graph and table of the relationship between the radius and the area of a circle.	Students will be working with a variety of functions including quadratics and exponential functions
Able to use a graphing calculator to represent functions as table and graph. (Also knowing when it is appropriate to use a calculator and when it is not.)	<ul style="list-style-type: none"> <li>• Use a calculator to determine the effects of changing the coefficient on a linear equation.</li> <li>• Why doesn't the graph of <math>y = 2x + 1000</math> show up on the standard window?</li> </ul>	Students will routinely use graphing calculators appropriately in studying algebra in high school.

In addition, fostering the following attitudes will increase confidence and success in high school:

- Persist at working a problem, even a difficult one
- Math requires thinking, not just memorization
- Math can be interesting, even fun, and relevant