

SUCCESS

The Key Elements to Mathematics Success

Teacher's Edition

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National Training Network

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Table of Contents

Lessons

Teacher Note: When student pairs are using manipulatives to model concepts, they will need to use both partner books. Many times students need the concrete model to answer questions or bridge to the pictorial model on the following page.

	Lesson	Pages	Manipulatives	Word Wall Words	Foldable
			Problem Solving		
1	SOLVE S and O	Teacher pages T1 – T19 Student pages S1 – S7	Paper for foldable (3 sheets – different colors) Stapler "S" and "O" Posters Index cards ("N" and "U")	S – Study the Problem O – Organizer the Facts	
2	SOLVE L	Teacher pages T20 – T38	Foldable from Lesson 1 Index cards (operations words)	L – Line Up a Plan addition, subtraction, multiplication, division, equals, together, add, plus, and, incline, increase,	
		Student pages S8 - S17		deposit, sum, total, rises, grow, above, take away, difference, decline, minus, withdraw, write a check, subtract, fewer, decrease, left over, "How many?", "How much more?", below, all together, times, product, each, of, groups, items, per, double, triple, multiplied, quotient, per equal groups, cut into, divvy, split, is, same, balanced, equivalent, is equal to, altogether, divide	SOLVE
3	SOLVE V and E	Teacher pages T39 – T58	Foldable from Lesson 1 "V" and "F" posters	V – Verify Your Plan with Action E – Examine Your Results	
		Student pages S18 – S28			
			The Number System	1	
4	Rational Numbers	Teacher pages T59 – T82	Algebra tiles (16 yellow unit tiles per	rational numbers, square roots, perfect squares,	
	in the Real Number	Student pages S29 – S40	student pair) Sticky notes Colored paper Painter's tape Calculators	natural numbers, whole numbers, integers, terminating decimals.	
System	Activity page T972 Chain Reaction	Painter's tape Calculators		repeating decimals, counting numbers, radical symbols	
5	5 Identify, Compare	Teacher pages T83 – T118	Algebra tiles (red and yellow units –	square root, rational approximation, radical,	
	and Order Irrational	and Order Student page 25 yello Irrational S41 – S54 per stud	25 yellow and 5 red per student pair)	irrational numbers, approximate, terminating decimal repeating decimal	
Number	NumbersActivity page T973Nur Cal not Chain Reaction	Number line Calculator Sticky notes Ordering Number Cards Pages (T114 – T116)	decimal, repeating decimal, perfect squares		

	Lesson Pages		Manipulatives	Word Wall Words	Foldable
6	Cube Roots	Teacher pages T119 – T151	Centimeter cubes (91 per student	three-dimensional figures, radical symbol, cube	
		Student pages S55 – S70	Calculator f	factorization, factor tree	
		Activity page T974 Chain Reaction	(optional)		
7	Properties of	Teacher pages T152 - T186	Pull a Power Card Pages 1 and 2	base, exponent, raising a power to a power, laws	
	Exponents	Student pages S71 - S89	(1 copy of each per student pair)	of exponents, product of powers, zero power, quotient of powers	
		Activity page T975 Scavenger Hunt	Number Tiles (1 copy per student pair) Calculator Scissors	quotient of powers	
8	Scientific Notation	Teacher pages T187 – T216	Calculator	scientific notation, standard form	
	and Powers of Ten	Student pages S90 - S103			
		Activity page T976 Chain Reaction			
9	Application of Laws of	Teacher pages T217 – T243	Calculator	scientific notation, decimal notation, calculator notation, exponent, coefficient	
	Exponents and Scientific	Student pages S104 – S118			
	Notation	Activity page T977 Scavenger Hunt			
		E	xpressions and Equati	ons	
10	Solving Linear	Teacher pages T244 – T274	Algebra tiles Index cards or	coefficients, constants, distributive property, like	
	Equations with One Variable	Student pages S119 – S133	Sticky notes (if needed)	terms, variable, expression	
		Activity page T978 Scavenger Hunt			
11	Analyzing Solutions	Teacher pages T275 – T307	Algebra tiles	linear equations, no solution, infinite solutions, one solution, constants, coefficient, variable	
	to Linear Equations with One	Student pages S134 – S148			
	Variable	Activity page T979 Chain Reaction			

	Lesson	Pages	Manipulatives	Word Wall Words	Foldable
12	Similar Triangles as	Teacher pages T308 – T330	Rulers Colored pencils	corresponding, proportion, similar triangles, ratios,	
	Slope	Student pages S149 – S160	n v	vertical, horizontal, slope, means, extremes, y-axis, x-axis, hypotenuse	
		Activity pages T980 – T983 Scavenger Hunt			
13	Unit Rate as Slope	Teacher pages T331 – T355	Rulers Colored pencils (red and blue for each student pair)	unit rate, rate of change, slope, independent	
		Student pages S161 – S174		variable, dependent variable, horizontal,	
		Activity pages T984 – T987 Scavenger Hunt			
14	Comparing Proportional Relationships	Teacher pages T365 – T378	Graph paper or gridded index cards Plain paper	slope, unit rate, proportional relationship	
	Relationships	Student pages S175 – S184			
		Activity pages T988 – T991 Scavenger Hunt			
15	Deriving the	Teacher pages T379 – T407	Ruler or straight- edge Colored paper (1 sheet per student for foldable)	y-intercept, equation of a line: $y = mx$, $y = mx +$ b, undefined slope, zero slope, horizontal, vertical	
	Equation of a Line	Student pages S185 – S197			Slope
		Activity pages T992 – T995 Chain Reaction			and Equ
16	Modeling Lines with	Teacher pages T408 – T428	Ruler or straight- edge	point-slope form	ation
	Slope and a Point	Student pages S198 – S206			of a L
		Activity page T996 Scavenger Hunt			ine
17	Solving Systems by	Teacher pages T429 – T455	Rulers	system of linear equations, graphs,	
	Graphing	Student pages S207 – S220		solution, intersection, no solution, parallel lines, one solution, infinite solutions, y-intercept, slope, slope intercept form	
		Activity pages T997 – T1000 Scavenger Hunt			

	Lesson	Pages	Manipulatives	Word Wall Words	Foldable
18	Solving Systems	Teacher pages T456 – T482	Two different colored pencils	system of linear equations, substitution	
	Algebraically	Student pages S221 – S235			
		Activity page T1001 Chain Reaction			
19	Real World Problems	Teacher pages T483 – T511		systems of linear equations	
	with Systems of	Student pages S236 – S252			
	Equations	Activity pages T1002 – T1005 Scavenger Hunt			
			Functions		
20	Functions	Teacher pages T512 – T537	Red and yellow algebra unit tiles	input (x-values), output (y-values), function, variable, vertical line test, function machine	
		Student pages S253 – S264	Uverhead algebra		
		Activity page T1006 Scavenger Hunt			
21	Comparing Functions	Teacher pages T538 – T562	Colored pencils (red, blue and green for each student pair)	function, function table, rate of change, linear, non-linear, ratio, coefficient, slope, constant rate of change	
		Student pages S265 – S278			
		Activity pages 1007 – T1010 Scavenger Hunt			
22	Analyzing Functions	Teacher pages T563 – T588		function, function table, rate of change,	
		Student pages S279 – S291		y-intercept, slope, slope-intercept form	
		Activity pages T1011 – T1014 Chain Reaction			
23	Graphing and	Teacher pages T589 – T615	Colored pencils: (green and red for	constant rate of change, linear, decreasing,	
	Interpreting Functions Modeling	Student pages S292 – S306	each student pair)	increasing, non-linear, function, <i>x</i> -axis, <i>y</i> -axis,	
Modeling Real World Situations	Activity pages T1015 – T1018 Scavenger Hunt		qualitative relationship, subjective, decline		

	Lesson	Pages Manipulatives		Word Wall Words	Foldable
			Geometry		
24	Angle Relationships	Teacher pages T616 – T633	Plain paper Ruler or Straight-	interior angles, exterior angles, supplementary,	
		Student pages S307 – S314	edge Tape or glue Protractor	adjacent interior angles, non-adjacent interior angles	
		Activity page T1019 Chain Reaction	Scissors	angles	
25	Angle Relationships	Teacher pages T634 – T659	Ruler Protractor	parallel lines, transversal, corresponding angles,	
	Part 2	Student pages S315 - S325	Sticky notes Colored pencils	alternate interior angles, alternate exterior angles, vertical angles	
		Activity pages T1020 – T1023 Scavenger Hunt			
26	Rigid Transformations	Teacher pages T660 – T694	Sticky notes Scissors	rigid transformation, translation, reflection,	
		Student pages S326 – S343	Marker or pen Ruler – Protractor	rotation, vertices, pre-image, image, prime	
		Activity pages T1024 – T1027 Scavenger Hunt			
27	27 Transformations and	Teacher pages T695 – T725	Sticky notes Scissors	congruence, translation, reflection, rotation	
	Congruence	Student pages S344 – S358			
		Activity pages T1028 – T1031 Scavenger Hunt			Transfor
28	The Effects of Transformations	Teacher pages T726 – T764	Ruler Protractor Colored pencils	rotation, reflection, translation, dilation, similar,	-matic
		Student pages S359 – S377		scale factor, non-rigid, rigid	SUIC
		Activity pages T1032 – T1035 Chain Reaction			
29	Transformations and Similarity	Teacher pages T765 – T790	Ruler Colored pencils	similar figures, proportional, congruent	
		Student pages S378 – S389		angles, corresponding angles, corresponding side	
		Activity pages T1036 - T1039 Chain Reaction	factor, rotation factor, rotation translation, co figure	factor, rotation, reflection, translation, congruent figure	

	Lesson	Pages	Manipulatives	Word Wall Words	Foldable
30	Pythagorean Theorem - Part 1	Teacher pages T791 – T826	Calculators Scissors	Pythagorean Theorem, Pythagorean triple,	
		Student pages S390 - S404	Giue	hypotenuse	
		Activity page T1040 Chain Reaction			
31	Pythagorean Theorem -	Teacher pages T821 – T847	Calculators Scissors	Pythagorean Theorem, coordinate grid, square,	
	Part 2	Student pages S405 – S415		legs, hypotenuse, vertices, horizontal distance,	
		Activity pages T1041 – T1044 Scavenger Hunt			
32	Volume of Cylinders,	Teacher pages T848 – T878	Beans Scissors	volume, cylinder, cone, base, base area, radius, sphere, hemisphere, rectangular prism	Volur
	Cones and Spheres	Student pages S416 - S429	Calculator Colored paper Rectangular examples/objects Cylinder examples/ objects		ne
		Activity pages T1045 – T1048 Scavenger Hunt			
			Statistics and Probabil	ity	
33	Bivariate Data and	Teacher pages T879 – T907	Calculators	frequency, relative frequency, two-way table, univariate, bivariate, survey	
	Frequency	Student pages S430 - S444			
		Activity pages T1049 – T1052 Chain Reaction			
34	Create and Interpret a	Teacher pages T908 –T935	Tape measure (one per student pair) Graphing calculators (optional) Tape (optional for	scatter plot, positive association, negative association, no association, slope, linear, non-linear, cluster, outlier	
	Scatter Plot	Student pages S445 – S458			
		Activity pages T1053 – T1056 Chain Reaction	wall scatter plot) Sticky notes (optional for wall scatter plot		
35	Scatter Plots and	Teacher pages T936 – T961	Rulers, Graphing	line of best fit, y-intercept, y = mx + b, slope	
	Line of Best Fit	Student pages S459 - S471	calculators (optional)		
		Activity pages T1057 – T1060 Scavenger Hunt			



The Key Elements to Mathematics Success Description of Teacher's Guide



SOLVE

SOLVE is a 5-step problem-solving paradigm taught in the first three lessons of *The Key Elements to Mathematics Success* and throughout the program. SOLVE is an acronym which gives students step-by-step strategies for finding the solutions to word problems. The ultimate goal of teaching SOLVE is to provide students with a problem-solving strategy that can be applied to any concept they will encounter in mathematics. The steps are as follows:

Study the Problem

Underline the question. This problem is asking me to find _____

Organize the Facts

Identify the facts. Eliminate the unnecessary facts. List the necessary facts.

Line up a Plan

Write in words what your plan of action will be. Choose an operation or operations.

Verify Your Plan with Action

Estimate your answer. Carry out your plan.

Examine Your Results

Does your answer make sense? (Compare your answer to the question.) Is your answer reasonable? (Compare your answer to the estimate.) Is your answer accurate? (Check your work.) Write your answer in a complete sentence.

Cooperative Pairs

Working in cooperative pairs is a vital part of *The Key Elements to Mathematics Success*. Cooperative learning allows students at various performance levels to work together, using a variety of learning activities, to improve their understanding. Communication about the learning process is an essential element of working in cooperative pairs. This dialogue enhances student learning and creates a sense of responsibility on the part of the students. Cooperative learning can be a catalyst in creating an atmosphere of achievement and a sense of accomplishment on the part of the students when the task is successfully completed.

Levels of Teacher Support

The lessons are carefully designed with opportunities for modeling, guided practice, and independent practice.

Modeling:

Each lesson contains "modeling boxes" which list step by step instructions on how to model each concept. Modeling steps are provided for concrete, pictorial, and procedural steps of the lesson.

Guided Practice:

Detailed instructions about how to structure guided practice are given in each lesson. Guided practice is led and closely monitored by the teacher. Students may work individually or in pairs during the guided practice.

Independent Practice:

Independent practice is provided through practice problems and homework in each lesson. Independent practice is structured to take place in the lesson following modeling and guided practice sections. Teachers can use the independent practice as a tool for informal formative assessment.

Word Problem Closure

At the end of the lesson, the SOLVE problem introduced at the beginning of the lesson is revisited. The student completes the additional steps of SOLVE, applying the lesson concept in a problem-solving situation.

Closure

Closure is a crucial part of every lesson and provides the teacher an opportunity to evaluate if the lesson objectives have been met. Teachers use the essential questions to reinforce the concept from the lesson, help organize the learning, and bring the lesson to its conclusion. A brief discussion of the essential questions will allow the teacher to informally assess student understanding of the material.

Homework

Homework is provided at the end of each lesson to give students ample opportunity to practice the lesson concept.

Quizzes

The lesson quizzes consist of 10 multiple-choice questions. These 10 questions cover the material taught in the lesson. The quizzes can also be used as homework, class work, review for a test, or as warm-ups.

Review Activities

Review activities are provided for many lessons. There are a variety of engaging activities including scavenger hunts and chain reactions. The activities are designed to provide multiple practice opportunities for the students in puzzle and game formats. The review activities incorporate the essential elements of cooperative learning and communication about the concepts.

The Key Elements to Mathematics Success – English Language Learner (ELL)

 SOLVE – A step-by-step procedure to attack word problems, dissecting the English language by identifying key words needed to solve the problem, and mapping out a plan with pictures and phrases to ultimately arrive at a well thought out answer. Steps can be written in students' native language while they are still becoming familiar with the process of SOLVE and gradually transitioning to English only. The steps of SOLVE have been modified slightly for use with ELL students. The modified steps provide additional support and involve verbal communication about the process, which is a vital link for the ELL student.

S - Underline the question. TPIAMTF (this problem is asking me to find) – **THE** ______. The students cannot just restate the question if they are made to start a sentence with *the*.

O - Circle the necessary facts. When writing out the necessary facts, be as brief as possible and teach the students abbreviations right away (\$, #, lb, cm, pkg. etc.).

L - Choose an operation and discuss a plan out loud. – +, •, \div

<u>number of nuts</u> + <u>number of bolts</u> = <u>total</u>

total • number of boxes = answer

V - Estimate the answer out loud. Then use the set-up created in the L step to carry out the plan.

E - Choose your answer.

- **Cooperative Pairs** Working, questioning, and communicating with others regarding mathematics at all stages of learning. Activities are completed in an interactive setting, encouraging language and mathematical development. This includes the pairing of ELL students who speak the same language(s) with others who may be at varying stages of their English language development.
- **Modeling with Manipulatives** Students participate in activities leading to the discovery of on-grade-level mathematical concepts. Through this process, they develop mathematical understanding while exploring ways of expressing their discoveries in English. Manipulative use is consistent throughout the program. The appearance of each manipulative, its meaning, as well as the language used to describe the actions of these manipulatives remain the same throughout.
- Word Walls Updated through the use of KEMS lessons, new math vocabulary words (and their meaning/pictorial representation) are added for every new concept as it is discovered. The Word Wall is an interactive tool for all learners and provides an additional language resource for ELL students. Additionally an Operation Word Wall is created by each class and used for solving word problems throughout the year. As an added resource, words can be written in both English and the native language of the learner. Pictures/descriptions are also encouraged next to words wherever appropriate.
- Video Clips of Each Lesson Available for use in class at <u>www.KEMSmath.com</u>, the video clips can help overcome the significant classroom language barriers ELL students face. These video clips, though in English, show key vocabulary words as a way of familiarizing students with appropriate vocabulary used to build a concept.

SOLVE Rubric

Solve	Considerations
S Underline the question(s). (1 pt) Answered the question "What is the problem asking me to find?" (2 pt)	
Total of 3 points	
O All math facts are identified. (2 pts) Unnecessary facts are eliminated. (2 pts) Necessary facts are listed. (1 pt)	All facts get 2 points. Majority of facts get 1 point.
Total of 5 points	
L No numbers used. (1 pt) Written as a phrase or sentence. (2 pts) Explained in a logical, sequential order. (2 pts) Use of correct operation(s). (2 pts) Total of 7 points	Logical, sequential order would include correct order of operations.
V Make estimation. (2 pts) Number sentence matches plan from L. (2 pts) Computation is correct. (2 pts) Total of 6 points	
E Sentence matches S. (1 pt) Estimate was reasonable for the answer. (1 pt) Answer is correct. (1 pt) Written in a complete sentence. (1 pt)	Credit is given for writing the answer in a complete sentence, even if it is not the correct answer.
iotal of 4 points	

Characters		
_		
Setting _		
Action		
Fact # 1		
Fact # 2		
Other Facts _		
_		
Outcome (Mai	n Question)	
The Problem:		

PROBLEM - SOLVING STORY FRAME

Total (max 10)

Points

Problem Writing Rubric

Characters	1 point: Has a character 2 points: Has characters and uses them in problem	
Scene	1 point: Has a general scene 2 points: Has a scene in which the action takes place	
Action (Facts)	1 point: Has basic needed facts (min 2) 2 points: Includes more than 2 facts 3 points: Also includes unnecessary facts	
Outcome (Question)	1 point: Has very simple question 2 points: Has more complex 1 step question 3 points: Has a multi-step question	

Problem Writing Rubric

		Points
Characters	1 point: Has a character 2 points: Has characters and uses them in problem	
Scene	1 point: Has a general scene 2 points: Has a scene in which the action takes place	
Action (Facts)	1 point: Has basic needed facts (min 2) 2 points: Includes more than 2 facts 3 points: Also includes unnecessary facts	
Outcome (Question)	1 point: Has very simple question 2 points: Has more complex 1 step question 3 points: Has a multi-step question	
	Total (max 10)	

Planning for your Key Elements to Mathematics Success Class

Materials Needed: materials needed for both the teacher and the students including items from the manipulative kit, activities to prepare for pairs on cardstock, and/or pages to copy for class

Objective: (from teacher lesson notes)

Essential Questions: (from teacher lesson notes)

Word Wall Words: (from teacher lesson notes)

Agenda: Consider the following when planning each component of the lesson.

Activity	Time Frame	Notes/Details
Environment	N/A	 Groupings used today - seating arrangements needed? Word Wall updates for this lesson? Agenda, Objective & Essential Questions posted? Needed technology set up?
Warm-up	minutes	What are some great questions to ask during the warm-up?How does this warm-up relate to the lesson?
Lesson	minutes	 What is the goal for today's lesson? What materials are needed? Is there an activity from the activities section of my TE that I will use to support this lesson? How does the flow of this lesson encourage student discovery of the concept being covered? What questions need to be asked to guide the discovery of today's concept? How does this lesson fit in with my district pacing guide? How will this concept be enhanced with the traditional textbook? How will I instruct partners to work? Pages being covered today Complete SOLVE Problem ASK: What is the question asking me to find? (beginning of class) What are my facts? What is my plan? What operation is needed? Estimate an answer. Work out the answer. Check over work, choose answer. What graphic organizer/foldable will be made/referenced? If time permits Will this section be used today? If so, how? How will I use the quiz for this lesson?
Closure	minutes	Essential QuestionsHomework assigned

Notes:

Planning for your Key Elements to Mathematics Success Class

Materials Needed:

Objective: Essential Questions: Word Wall Words: Agenda:

Activity	Time Frame	Notes/Details
Environment	N/A	
Warm-up	minutes	
Lesson	minutes	
Closure	minutes	

Notes:

X