## Integrated Math III

The purpose of this document is to provide teachers with guidance to help them connect the Tennessee mathematics standards with the performance levels of our statewide assessment. The document provides evidence of learning to help teachers determine how a student is progressing toward grade-level expectations. Additionally, instructional guidance is provided to clarify the types of instruction that will help a student progress along the continuum of learning.

	Level 1	Level 2	Level 3	Level 4
	Performance at this	Performance at this	Performance at this	Performance at this
	level demonstrates	level demonstrates	level demonstrates	level demonstrates that
	that the student has a	that the student is	that the student has a	the student has an
	minimal understanding	approaching	comprehensive	extensive
Standards	and has a nominal	understanding and has	understanding and	understanding and
	ability to apply the	a partial ability to apply	thorough ability to	expert ability to apply
	grade/course level	the grade/course level	apply the grade/course	the grade/course level
	knowledge and skills	knowledge and skills	level knowledge and	knowledge and skills
	defined by the	defined by the	skills defined by the	defined by the
	Tennessee academic	Tennessee academic	Tennessee academic	Tennessee academic
	standards.	standards.	standards.	standards.
M3.G.MG.A.2	Students with a level	Students with a level	Students with a level	Students with a level
Apply geometric	1 understanding of	2 understanding of	3 understanding of	4 understanding of
methods to solve real-	this standard will	this standard will	this standard will	this standard will
world problems.	most likely be able to:	most likely be able to:	most likely be able to:	most likely be able to:
Scope and	Choose which	Identify which	Apply geometric	Create a variety of real-
Clarification:	geometric attribute(s)	geometric attribute(s)	methods to solve real-	world problems whose
Geometric methods may	need(s) to be	need(s) to be	world problems.	solutions require the
include but are not	calculated in order to	calculated in order to		application of
limited to using	solve a real-world	solve a real-world	Instructional Focus:	geometric methods.
geometric shapes, the	geometric problem.	geometric problem.	Students are applying	
probability of a shaded			geometric concepts	Instructional Focus:
			learned in previous	



	1	1	1	
region, density, and	Solve mathematical	Solve real-world and	grades in order to	Students should be
design problems.	problems involving	mathematical	solve real-world	formulating a strategy
	area, volume, and	problems involving	geometric application	to solve the problem
There are no assessment	surface area of two-	area, volume, and	problems. Students	based on a
limits for this standard.	and three-dimensional	surface area of two-	should have familiarity	mathematical
The entire standard is	objects composed of	and three-dimensional	with not only how to	understanding of the
assessed in this course.	triangles,	objects composed of	calculate area, volume,	situation, computing
	quadrilaterals,	triangles,	and surface area, but	solutions, interpreting
Note: This is a major	polygons, cubes, and	quadrilaterals,	also the hallmark	findings, and validating
work of the grade	right prisms when a	polygons, cubes, and	attributes of each.	their thinking and the
standard.	visual representation is	right prisms.		reasonableness of
Note: This is a modeling	provided.			attained solutions in
standard		Solve real-world and		order to justify
	Solve mathematical	mathematical		solutions to real-world
	problems involving	problems involving		geometric problems,
	volume of cones,	surface area of cones,		with increased rigor
	cylinders, and spheres	cylinders, and spheres.		over the course.
	when a visual			
	representation is			
	provided.			
M3.A.SSE.A.1	Students with a level	Students with a level	Students with a level	Students with a level
Use the structure of an	1 understanding of	2 understanding of	3 understanding of	4 understanding of
expression to identify	this standard will	this standard will	this standard will	this standard will
ways to rewrite it.	most likely be able to:	most likely be able to:	most likely be able to:	most likely be able to:
Scope and	Choose a polynomial,	Rewrite polynomial,	Rewrite polynomial,	Generate multiple
Clarifications:	rational, or exponential	rational, and	rational, and	forms of a single
For example, see	expression that is	exponential	exponential	polynomial, rational, or
$2x^4 + 3x^2 - 5$ as its factors	equivalent to a given	expressions into a	expressions into a	exponential expression
(x <sup>2</sup> – 1) and (2x <sup>2</sup> + 5); see	expression.	given form.	different form and	and explain in both
$x^{4} - y^{4} as (x^{2})^{2} - (y^{2})^{2}$			explain why rewriting	verbal and written

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thus recognizing it as a	the expression in that for	orm the mathematics
difference of squares	form is beneficial.	hat was employed to
that can be factored as	tr	ransform the
$(x^2 - y^2) (x^2 + y^2)$ ; see $(x^2 + y^2)$	Instructional Focus: e	expression.
4)/( $x^2$ + 3) as (( $x^2$ + 3) + 1	Seeing structure in A	dditionally, explain
$)/(x^2 + 3)$ , thus	expressions involves w	vhich form is most
recognizing an	critically examining an u	iseful and provide
opportunity to write it as	algebraic expression in n	nathematical
$1 + 1/(x^2 + 3).$	which potential ju	ustification.
	rearrangements and	
Tasks are limited to	manipulations are li	nstructional Focus:
polynomial, rational, or	present. An important S	tudents need to be
exponential expressions.	skill for college c	hallenged to write
	readiness is the ability p	olynomial, rational,
Note: This is a major	to try possible a	nd exponential
work of the grade	manipulations mentally e	xpressions in multiple
standard.	without having to carry for	orms where the initial
	them out, and to see e	xpressions increase in
	which ones might be d	lifficulty over time.
	fruitful and which T	he hallmark of this
	might not. s	tandard is students
	D	eing able to
	Students should be c	ommunicate the
	able to provide a lin	mportance and benefit
	mathematical	ained from writing
	Justification for when e	xpressions in various
	different forms of to	orms. Students
	expressions are more s	nould be able to
	Deneticiai. e	xpress what the
		ha expression most
		ne expression mean

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			As polynomials overlap integrated math II and integrated math III, the focus for integrated III needs to be placed on non-quadratic polynomials.	and how they relate to terms in the other various representations of the same expression.
			Much of the ability to see and use structure in transforming expressions comes from learning to fluently recognize certain fundamental algebraic situations.	
M3.A.SSE.B.2	Students with a level	Students with a level	Students with a level	Students with a level
Choose and produce	1 understanding of	2 understanding of	3 understanding of	4 understanding of
an equivalent form of	this standard will	this standard will	this standard will	this standard will
an expression to reveal	most likely be able to:	most likely be able to:	most likely be able to:	most likely be able to:
and explain properties				
of the quantity	Recognize an	From a real-world	From a real-world	From a real-world
represented by the	exponential	context, choose an	context generate an	context, generate
expression.	expression.	equivalent form of an exponential expression	equivalent form of an exponential expression	equivalent forms of an exponential
M3.A.SSE.B.2a	Recognize properties	and choose the	and identify the	expression, justify each
Use the properties of	of exponents.	properties used to	properties of	transformation with a
exponents to rewrite		transform the	exponents used to	property, and explain
exponential	Without context,	expression.	generate the	the benefits of the
expressions.	choose an equivalent		expression.	equivalent expression.



Scope and	form of an exponential	Instructional Focus:	Instructional Focus:
Clarifications:	expression.	The introduction of	Students should
For example, the		rational exponents and	continue to
expression 1.15 <sup>t</sup> can be		practice with the	demonstrate an
<i>rewritten as ((1.15)<sup>1/12</sup>)<sup>12t</sup></i>		properties of	understanding of
$\approx$ 1.012 <sup>12t</sup> to reveal that		exponents in high	seeing structure in
the approximate		school further widens	expressions by not only
equivalent monthly		the field of operations	being able to rewrite
interest rate is 1.2% if		students will be	exponential
the annual rate is 15%.		manipulating. In	expressions in various
		integrated math III,	forms, but also in both
i) Tasks have a real-		focus should be placed	mathematically
world context. As		on exponential	justifying the steps to
described in the		expressions with	reach the desired
standard, there is an		rational or real	rewritten form and
interplay between the		exponents, furthering	describing when and
mathematical structure		the real word contexts	why the rewritten form
of the expression and		that can be used as a	would be beneficial.
the structure of the		backbone for this	Students should
situation such that		modeling standard. As	encounter exponential
choosing and producing		this is a modeling	expressions of
an equivalent form of		standard, it is	increasing difficulty in
the expression reveals		important to	increasingly more
something about the		emphasize that the	complex real-world
situation.		exponential	situational problems.
		expressions should be	
ii) Tasks are limited to		embedded in real-	
exponential expressions		world situations. This	
with rational or real		provides a context for	
exponents.		seeing structure in the	
		expression and allows	

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Note: This is a major			students to see when	
work of the grade			and why it is beneficial	
standard.			to view them in	
			different forms.	
Note: This is a modeling				
standard			Additionally, it's	
			important to note that	
			the focus is not on	
			writing expressions in	
			simplest form as there	
			really is no simplest	
			form. The form that	
			expressions are written	
			in should be driven by	
			what is being done	
			with the expression in	
			the first place.	
M2.A.APR.A.1	Students with a level	Students with a level	Students with a level	Students with a level
Know and apply the	1 understanding of	2 understanding of	3 understanding of	4 understanding of
Remainder Theorem:	this standard will	this standard will	this standard will	this standard will
For a polynomial $p(x)$	most likely be able to:	most likely be able to:	most likely be able to:	most likely be able to:
and a number <i>a</i> , the	,			,
remainder on division	Define factor.	Choose the remainder	For a polynomial $p(x)$	Find all factors for a
by $x - a$ is $p(a)$ , so $p(a) =$		when a polynomial $p(x)$	and a number <i>a</i> ,	polynomial $p(x)$ .
0 if and only if $(x - q)$ is		is divided by <i>x</i> – <i>a</i> .	determine if $x - q$ is a	
a factor of $p(x)$ .		<b>j</b>	factor of $p(x)$ .	Explain the Remainder
		Determine if a given		Theorem using
Scope and		number <i>a</i> is a possible	Identify the remainder	appropriate
Clarifications:		factor for a polynomial	when a polynomial $p(x)$	mathematical
		p(x).	is divided by <i>x</i> – <i>a</i> .	vocabulary in both



There are no assessment limits for this standard. The entire standard is assessed in this course.

Note: This is a major work of the grade standard. Identify all possible factors of a polynomial *p(x)*.

Instructional focus: A particularly important application of polynomial division is the case where a polynomial p(x) is divided by a linear factor of the form *x* – *a*. for a real number *a*. In this case, the remainder is a value *p(a)* of the polynomial at x = a. It is important that this topic not be reduced to simply "synthetic division," which reduces the method to a matter of carrying numbers between registers, something easily done by a computer, and

prevents students from developing conceptual understanding of the Remainder Theorem. It verbal and written form.

Instructional focus: Students with a deep conceptual understanding of the Remainder Theorem can explain the equivalence between linear factors and zeros. This is the basis of much work with polynomials in high school: the fact that  $p(\alpha)=0$  if and only if x - a is a factor of p(x). They can deduce that if x - q is a factor then p(a)=0. But the **Remainder Theorem** tells us that p(x)=(x - a)q(x) + p(a) for some polynomial q(x). In particular, if p(a)=0then p(x)=(x-a)q(x), so x - a is a factor of p(x).



			is important for students to see the Remainder Theorem as	
			technique.	
M3.A.APR.A.2	Students with a level	Students with a level	Students with a level	Students with a level
Identify zeros of	1 understanding of	2 understanding of	3 understanding of	4 understanding of
polynomials when	this standard will	this standard will	this standard will	this standard will
suitable factorizations are available, and use	most likely be able to:	most likely be able to:	most likely be able to:	most likely be able to:
the zeros to construct a	Factor a quadratic	Factor a quadratic	Factor a quadratic,	Explain the process for
rough graph of the	polynomial with a lead	polynomial with a lead	cubic, or quartic	generating a rough
function defined by the	coefficient of 1.	coefficient of 1, identify	polynomial, identify the	sketch of any
polynomial.		the zeros, and	zeros, and construct a	factorable polynomial
Coope and	Choose the zeros for a	construct a rough	rough graph of the	function using accurate
Scope and	given quadratic	graph of the function	nunction defined by the	mainemalical
Tasks include quadratic	coefficient of 1		polynomiai.	writton and vorbal
cubic and quartic			Generate a rough	form
polynomials and	Choose a graph to	Explain the	graph to represent a	
polynomials for which	represent a given	mathematical term	given non-guadratic	Instructional Focus:
factors are not provided.	quadratic polynomial	zero using appropriate	polynomial function	At this level of
For example, find the	in factored form.	mathematical	presented in factored	understanding,
zeros of $(x^2 - 1)(x^2 + 1)$ .		vocabulary in both	form.	students should be
		verbal and written		demonstrating strong
Note: This is a major		form.	Instructional Focus:	understanding of the
work of the grade			Polynomial functions	relationship that exists
standard.		Choose a graph to	are, on the one hand,	between an algebraic
		represent a given	very elementary, in	representation that



	polynomial presented	that they are built up	elicits zeros of a
	in factored form.	out of the basic	polynomial function
		operations of	and the graphical
	Generate a rough	arithmetic. On the	representation of
	graph to represent a	other hand, they turn	zeros, moving fluidly
	given quadratic	out to be amazingly	between the two.
	polynomial presented	flexible and can be	Additionally, they
	in factored form.	used to approximate	should be able to
		more advanced	provide a mathematical
		functions such as	explanation of the
		trigonometric and	relationship between
		exponential functions	algebraic and graphical
		in later courses.	representations of
		Experience with	zeros.
		constructing	
		polynomial functions	
		satisfying given	
		conditions is useful	
		preparation not only	
		for calculus, but for	
		understanding the	
		mathematics behind	
		curve-fitting methods	
		used in applications to	
		statistics and computer	
		graphics.	
		The first step in	
		developing this	
		understanding is to	
		construct a rough	



	graph for polynomial functions by using their zeros. Eventually, this progression will lead to constructing polynomial functions	
	through any specified set of points in the plane.	
	students in this early stage continue to develop an understanding of the	
	connection that exists between the graphical and algebraic representation of zeros and that they are not	
	simply following a rote procedure but provide evidence of an understanding of this connection.	
	In integrated math III, students are focusing on quadratic, cubic,	

			and quartic polynomials when factors are not provided. Quadratic polynomials were also a focus for integrated math II. Thus in integrated math III, when quadratics are the focus, they should be of appropriate difficulty.	
M3.A.APR.B.3 Know and use polynomial identities to describe numerical	Students with a level 1 understanding of this standard will most likely be able to:	Students with a level 2 understanding of this standard will most likely be able to:	Students with a level 3 understanding of this standard will most likely be able to:	Students with a level 4 understanding of this standard will most likely be able to:
Scope and Clarifications: For example, compare (31)(29) = (30 + 1) (30 - 1) = 302 - 12 with $(x + y)(x - y) = x^2 - y^2$ . There are no assessment limits for this standard. The entire standard is assessed in this course.	Match polynomial identities with numerical relationships that are examples of the polynomial identity.	Given a polynomial identity, use it to describe a given numerical relationship.	Identify an appropriate polynomial identity and use it to describe a given numerical relationship. Instructional Focus: Polynomials form a rich ground for mathematical explorations that reveal relationships in	Identify an appropriate polynomial identity, use it to describe a given numerical relationship, and explain the benefit of using that particular polynomial identity to describe the numerical relationship.

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			Instruction should be focused on looking at a wide variety of numerical relationships that are intentionally connected to a polynomial identity. Instruction should not focus simply on the rewriting of numerical relationships, but instead on why it is beneficial to do so.	As students master this standard, they show the most conceptual understanding when they are able to explain the benefit of rewriting numerical relationships in multiple ways. Students should experience numerical relationships that can be rewritten using polynomial identities with increasing variance and difficulty over time.
M3.A.APR.C.4 Rewrite rational expressions in different forms.	Students with a level 1 understanding of this standard will most likely be able to:	Students with a level 2 understanding of this standard will most likely be able to:	Students with a level 3 understanding of this standard will most likely be able to:	Students with a level 4 understanding of this standard will most likely be able to:
Scope and Clarifications: There are no assessment limits for this standard. The entire standard is assessed in this course.	Rewrite a polynomial division expression as rational expression and vice versa.	Given a rational expression, choose equivalent forms to represent the expression.	Rewrite rational expressions involving addition, subtraction, multiplication, and/or division in different forms. Instructional Focus: This standard serves a dual purpose. First, it	Explain the mathematical relationship that exists between the Remainder Theorem and rewriting rational expressions with a polynomial numerator and a first degree binomial denominator.

<b>Education</b>		
	provides the	
	opportunity for	Rewrite complicated
	students to interact	rational expressions
	with long division,	involving addition,
	which is similar to	subtraction,
	integer long division.	multiplication and/or
	When connected to	division in different
	standard M3.A.APR.A.1,	forms.
	it helps support	
	students developing an	Instructional Focus:
	understanding of the	The focus of instruction
	Remainder Theorem.	should emphasize the
		discovery of the
	Second, it offers	connections that exist
	students the	between the
	opportunity to connect	Remainder Theorem
	operations on rational	and rational division so
	numbers to operations	that students can
	with rational	explain the
	expressions. Particular	relationship.
	attention should be	Additionally, they
	paid to this connection	should encounter and
	as opposed to a rote	work with simplifying
	series of steps without	rational expressions
	any conceptual	involving all operations
	understanding.	with increased rigor
		over time.

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M3.A.CED.A.1	Students with a level	Students with a level	Students with a level	Students with a level
Create equations and	1 understanding of	2 understanding of	3 understanding of	4 understanding of
inequalities in one	this standard will	this standard will	this standard will	this standard will
variable and use them	most likely be able to:	most likely be able to:	most likely be able to:	most likely be able to:
to solve problems.				
	Identify if a real-world	Solve a one variable	Create and solve a one-	Create a real-world
Scope and	situation can be	rational equation or	variable polynomial,	situational problem to
Clarification:	represented by a	inequality.	absolute value, or	represent a given
i)Tasks are limited to	polynomial, rational,		logarithmic equation	polynomial, rational,
polynomial, rational,	absolute value,	Solve a one-variable	that represents a real-	absolute value,
absolute value,	exponential, or	polynomial equation or	world situation.	exponential, or
exponential, or	logarithmic equation.	inequality.		logarithmic equation or
logarithmic functions.			Create and solve a one-	inequality.
	Determine if the	Solve a one-variable	variable polynomial,	
ii)Tasks have a real-	solution to a real-world	absolute value	absolute value, or	
world context.	situation requires a	equation or inequality.	logarithmic inequality	
	one-variable or two-		that represents a real-	Instructional Focus:
Note: This is a major	variable equation or	Solve a one-variable	world situation.	When given an
work of the grade	inequality.	logarithmic equation or		equation or inequality,
standard.		inequality.	Instructional Focus:	students can generate
	Solve a simple one-		In integrated math III,	a real-world situation
Note: This is a modeling	variable polynomial	Choose a polynomial,	the variety of function	that could be solved by
standard.	(quadratic) equation or	absolute value, or	types that students	a provided equation or
	inequality.	logarithmic equation to	encounter allow	inequality
		represent a simple,	students to create even	demonstrating a deep
	Solve a simple one-	real-world situation.	more complex	understanding of the
	variable exponential		equations and work	interplay that exists
	equation or inequality.	Choose a polynomial,	within more complex	between the situation
		absolute value, or	situations than what	and the equation or
		logarithmic inequality	has been previously	inequality used to solve
			experienced.	the problem.

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Solve a simple one-	to represent a simple,		
variable rational	real-world situation.	As this is a modeling	Additionally, students
equation or inequality.		standard, students	should continue to
	Create and solve a	need to encounter	encounter real-world
Choose a simple	one-variable simple	equations and	problems that are
polynomial (quadratic),	polynomial (quadratic),	inequalities that evolve	increasingly more
rational or exponential	rational, or exponential	from real-world	complex. Students
equation to represent	equation that	situations. Students	should be using the
a simple, real-world	represents a real-world	should be formulating	modeling cycle to solve
situation.	situation.	equations and	real-world problems.
		inequalities, computing	
Choose a simple		solutions, interpreting	
polynomial (quadratic),		findings, and validating	
exponential, or rational		their thinking and the	
inequality to represent		reasonableness of	
a simple, real-world		attained solutions in	
situation.		order to justify	
		solutions to real-world	
		problems. Real-world	
		situations should elicit	
		equations and	
		inequalities from	
		situations which are	
		polynomial, absolute	
		value, rational,	
		exponential and	
		logarithmic in nature.	
		As quadratic and	
		simple exponential	
		functions are a focus in	
		previous courses, it is	



			imperative that	
			students have the	
			opportunity to work	
			with polynomials with	
			degree greater than 2.	
			rational. logarithmic.	
			and complex	
			exponential equations	
			and inequalities in	
			integrated math III.	
M3.A.CED.A.2	Students with a level	Students with a level	Students with a level 3	Students with a level 4
Create equations in	1 understanding of	2 understanding of	understanding of this	understanding of this
two or more variables	this standard will	this standard will	standard will most	standard will most
to represent	most likely be able to:	most likely be able to:	likely be able to:	likely be able to:
relationships between				
quantities; graph	Create and graph a two	Create and graph a	Create and graph a two-	Create a real-world
equations with two	variable linear	quadratic, square root,	variable equation that	situational problem to
variables on coordinate	equation that	cube root, or simple	represents a real-world	represent a given
axes with labels and	represents a real-world	piecewise equation to	or mathematical	equation for a wide
scales.	or mathematical	represent a real-world	situation for a wide	variety of function types
	situation.	or mathematical	variety of function types	including non-linear,
Scope and		situation.	including non-linear,	non-quadratic
Clarifications:	Choose a quadratic,		non-quadratic	polynomial, absolute
There are no assessment	square root, cube root,	Choose an equation to	polynomial, absolute	value, exponential,
limits for this standard.	or simple piecewise	represent a real-world	value, exponential,	logarithmic, step, and
The entire standard is	equation to represent	or mathematical	logarithmic, step, and	more complex
assessed in this course.	a real-world or	situation for a wide	more complex	piecewise functions.
	mathematical situation.	variety of function	piecewise functions.	
Note: This is a major		types including non-		Create and graph a two-
work of the grade	Choose a quadratic,	linear, non-quadratic	Instructional Focus:	variable equation that
standard.	square root, cube root,	polynomial, absolute		represents a complex

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	or piecewise graph to	value, exponential,	In integrated math III,	real-world or
Note: This is a modeling	represent a real-world	logarithmic, step, and	students should	mathematical situation
standard.	or mathematical	more complex	continue to build their	for a wide variety of
	situation.	piecewise functions.	understanding of how	function types
			real-world and	including non-linear,
	Determine if the	Choose a graph to	mathematical	non-quadratic
	solution to a real-world	represent a real-world	situations can elicit a	polynomial, absolute
	or mathematical	or mathematical	wide variety of	value, exponential,
	situation requires a	situation for a wide	equations and graphs.	logarithmic, step, and
	one-variable or two	variety of function	Students should	more complex
	variable equation.	types including non-	encounter real-world	piecewise functions.
		linear, non-quadratic	problems that are	
		polynomial, absolute	increasingly more	Instructional Focus:
		value, exponential,	complex over time.	One of the most
		logarithmic, step, and	They should be	natural situations for
		more complex	creating more complex	students to create an
		piecewise functions.	equations and working	equation or graph from
			within more complex	is a real-world
			situations than what	situation. Students
			had been previously	need to be exposed to
			experienced.	variety of real-world
				situations that illicit the
			As this is a modeling	wide variety of function
			standard, it is	types embedded within
			important for students	the integrated math III
			to encounter equations	course. They should be
			that evolve from both	using the modeling
			mathematical and real-	cycle in order to
			world situations.	develop and provide
			Students should be	justification for their
			formulating equations,	solutions.



	computing solutions, interpreting findings, and validating their thinking and the reasonableness of attained solutions in order to justify solutions to mathematical and real- world problems. The problems encountered should elicit equations from situations which represent a wide variety of function types including non- linear, non-quadratic polynomial, absolute value, exponential, logarithmic, step, and more complex piecewise functions. It is imperative that students be exposed to creating and graphing each of these function types equally.	Additionally, students should be posed with an equation and then asked to generate a real-world situation that could be solved by a provided equation. Students with this capability are demonstrating a deep understanding of the interplay that exists between the situation and the equation used to solve the problem.



highlight a quantity of interest, using the same reasoning as inthis standard will most likely be able to:this standard will most likely be able to:this standard will most likely be able to:	be able to: most likely be able
solving equations.Choose equivalent forms of a given linear or quadratic real-world formula.Rearrange real-world quadratic formulas to highlight a quantity of interest.Rearrange real-world quadratic po formulas to highlight a quantity of interest.i)Tasks have a real- world context.Formula.Choose equivalent formula.Rearrange real-world quadratic po formulas to highlight a quantity of interest.Rearrange real-world quadratic po formulas to highlight a quantity of interest.Rearrange real-world quadratic po formulas to highlight a quantity of interest.ii)Tasks are limited to polynomial, rational, absolute value, exponential, or logarithmic functions.Choose equivalent forms of a given rational real-world formula.Rearrange real-world quantity of in rational real-world formula.Note:This is a major work of the grade standard.Choose equivalent forms of a given absolute value real- world formula.Rearrange real-world polynomial, rational real-world formula.Rearrange real-world polynomial, rational real-world formula.Note:This is a modeling standard.Choose equivalent forms of a given absolute value real- world formula.Rearrange real- absolute value real- world formula.Note:This is a modeling standard.Choose equivalent forms of a given absolute value real- world formula.Rearrange real- exponential real-world formula.Note:This is a modeling standard.Rearrange real- world formula.Rearrange real- vorld formula.Note:This is a modeling standard.	eal-worldRearrange real-world non-linear, non- quadratic polynomial highlight a nterest.Rearrange real-world non-linear, non- quadratic polynomial rational, absolute value, exponential, or logarithmic formulas and explain the bene of solving the formula for the various variables.eal-world uantity ofInstructional Focus: Students need to be exposed to a wide variety of real-world formulas increasing i complexity over time Additionally, it is imperative that they are able to explain wi formulas might need be expressed in different ways and th benefit that each form provides.

Choose equivalent	Instructional Focus:	
forms of a given	In previous grades and	
logarithmic real-world	courses, students have	
formula.	focused on rearranging	
	linear, quadratic,	
	square root and cube	
	root formulas to	
	highlight a quantity of	
	interest. In integrated	
	math III, students	
	should be working with	
	non-linear, non-	
	quadratic polynomial,	
	rational, absolute	
	value, exponential, or	
	logarithmic formulas.	
	As this is a modeling	
	standard, student	
	should be	
	encountering formulas	
	that come from real-	
	world situations.	
	Additionally, students	
	need to be deepening	
	their conceptual	
	understanding of why	
	they might need to	
	write formulas in	
	different ways and	
	what the benefit would	
	be to these various	

			representations of the	
			formula.	
M3.A.REI.B.3	Students with a level	Students with a level 2	Students with a level	Students with a level
Explain why the <i>x</i> -	1 understanding of	understanding of this	3 understanding of	4 understanding of
coordinates of the	this standard will	standard will most	this standard will	this standard will
points where the	most likely be able to:	likely be able to:	most likely be able to:	most likely be able to:
graphs of the				
equations $y = f(x)$ and $y$	Given two linear	Given two equations <i>f</i> ( <i>x</i> )	Given two equations <i>f</i> ( <i>x</i> )	Explain why the <i>x</i> -
= g(x) intersect are the	equations <i>f(x)</i> and <i>g(x)</i> ,	and g(x) embedded in a	and g(x) embedded in a	coordinates of the
solutions of the	identify the solution of	real-world situation,	real-world situation,	points where the
equation $f(x) = g(x)$ ; find	the equation $f(x)=g(x)$ .	approximate the	approximate the	graphs of the
the approximate		solution(s) for <i>f(x)=g(x)</i>	solution(s) for <i>f(x)=g(x)</i>	equations $y = f(x)$ and $y$
solutions using		using technology when	using technology when	= g(x) intersect are the
technology.		<i>f(x)</i> and <i>g(x)</i> are absolute	<i>f(x)</i> and <i>g(x)</i> are	solutions of the
		value functions.	polynomial, rational,	equation <i>f(x)</i> = <i>g(x)</i> and
Scope and			exponential, or	explain the meaning of
Clarifications:		Given graphs of 2	logarithmic functions.	the solution in terms of
Tasks may include cases		equations <i>f(x) and g(x)</i> ,		a real-world context.
where f(x) and/or g(x)		identify the solution(s)	Explain why the <i>x</i> -	
are linear, polynomial,		for $f(x)=g(x)$ when $f(x)$	coordinates of the	Instructional Focus:
rational, absolute value,		and <i>g(x)</i> are polynomial,	points where the	Students should
exponential, or		rational, exponential, or	graphs of the equations	continue to be exposed
logarithmic functions.		logarithmic functions	y = f(x) and $y = g(x)$	to a wide variety of
			intersect are the	linear, polynomial,
Note: This is a major			solutions of the	rational, absolute
work of the grade			equation $f(x) = g(x)$ .	value, exponential, or
standard.				logarithmic functions
			Instructional Focus: In	with increasing
Note: This is a modeling			continuing to develop	difficulty embedded in
standard.			an	real-world situations.



Eddedtoll			
		understanding of what	Additionally, they need
		it means to find the	to explain the meaning
		solution to two	of the solution in terms
		equations using	of the real-world
		graphing, it is very	context.
		important that just as	
		we did not want	
		algebraically solving	
		equations to become a	
		series of steps	
		unsupported by	
		reasoning, we want to	
		make sure that	
		graphically solving	
		them the reasoning	
		piece is not left out	
		either. The simple idea	
		that an equation can be	
		solved (approximately)	
		by graphing can often	
		lead to a rote series of	
		steps involving simply	
		finding the intersection	
		point(s) without	
		employing the	
		reasoning of what is	
		actually occurring.	
		Explaining why the <i>x</i> -	
		coordinates of the	
		points where the	



	graphs of the	
	equations <i>y</i> = <i>f</i> ( <i>x</i> ) and <i>y</i>	
	= g(x) intersect are the	
	solutions of the	
	equation $f(x) = g(x)$	
	involves a rather	
	sophisticated series of	
	thinking as students	
	must connect the idea	
	of two equations in two	
	variables and how that	
	relates to a single	
	equation in one	
	variable and then	
	understand how both	
	connect to a point(s) on	
	a coordinate plane	
	which is built around	
	two variables. Thus, it	
	is imperative that	
	students reason	
	through this process	
	without being given a	
	truncated set of	
	meaningless steps to	
	follow.	
	As this is a modeling	
	standard, students	
	should be formulating	
	equations, computing	



	colutions interpreting	
	Solutions, interpreting	
	findings, and validating	
	their thinking and the	
	reasonableness of	
	attained solutions in	
	order to justify	
	solutions built out of	
	real-world situations.	
	In integrated math III,	
	students are focusing	
	on linear, polynomial,	
	rational, absolute	
	value, exponential, or	
	logarithmic functions.	
	It is important to note	
	that students have	
	already worked on	
	developing an	
	understanding of this	
	standard with linear	
	and absolute value	
	functions in previous	
	courses. Students need	
	the opportunity to	
	interact with all of	
	these function types	
	Additionally they need	
	to encounter situations	
	where $f(x)$ and $\sigma(x)$ are	
	different function	

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	types. These should increase in difficulty over time.