

<p>Claim 1: Concepts and Procedures Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency.</p>	
<p>Content Domain: Number and Quantity</p>	
<p>Target B [m]: Use properties of rational and irrational numbers.</p> <p>Tasks for this target will require students to demonstrate understanding of operations with rational and irrational numbers. Tasks that ask students to explain why operations with rational and irrational numbers lead to either rational or irrational numbers will contribute evidence to Claim 3.</p>	
<p>Standards: N-RN.B, N-RN.B.3</p>	<p>N-RN.B Use properties of rational and irrational numbers. N-RN.B.3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.</p>
<p>Related below Grade Standards for Purposes of Planning for Vertical Scaling: 8.NS.A, 8.NS.A.1</p>	<p>Related Grade 8 Standards 8.NS.A Know that there are numbers that are not rational, and approximate them by rational numbers. 8.NS.A.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.</p>
<p>DOK Level(s):</p>	<p>1, 2, 3</p>
<p>Achievement LEVEL Descriptors:</p>	
<p>RANGE Achievement Level Descriptor (Range ALD) Target B: Use properties of rational and irrational numbers</p>	<p>Level 1 students should be able to identify the difference between a rational and an irrational number.</p>
	<p>Level 2 students should be able to perform operations on rational and irrational numbers.</p>
	<p>Level 3 students should be able to understand and explain that the sum and product of a rational number and a nonzero irrational number are irrational.</p>
	<p>Level 4 students should be able to provide a specific example given a generalization statement, such as the sum of a rational number and an irrational number is irrational.</p>
<p>Evidence Required:</p>	<ol style="list-style-type: none"> 1. The student provides examples of addition or multiplication problems that will have sums or products of a specified type (either rational or irrational). 2. The student determines whether the sum of two numbers is a rational number or an irrational number. 3. The student determines whether the product of two numbers is a rational number or an irrational number. 4. The student provides an abstract generalization that the sum or product of any two rational numbers is rational, the sum of a rational number and an irrational number is irrational, and

	the product of a nonzero rational number and an irrational number is irrational.
Allowable Item Types:	Multiple Choice, multiple correct response; Matching Tables; Hot Spot
Allowable Stimulus Materials:	products or sums of rational and irrational numbers, number type (rational or irrational)
Construct-Relevant Vocabulary:	rational number, irrational number, real number
Allowable Tools:	None
Target-Specific Attributes:	Only sums and products of two numbers are used.
Non-Targeted Constructs:	
Accessibility Guidance:	<p>Item writers should consider the following Language and Visual Element/Design guidelines¹ when developing items.</p> <p>Language Key Considerations:</p> <ul style="list-style-type: none"> • Use simple, clear, and easy-to-understand language needed to assess the construct or aid in the understanding of the context • Avoid sentences with multiple clauses • Use vocabulary that is at or below grade level • Avoid ambiguous or obscure words, idioms, jargon, unusual names and references <p>Visual Elements/Design Key Considerations:</p> <ul style="list-style-type: none"> • Include visual elements only if the graphic is needed to assess the construct or it aids in the understanding of the context • Use the simplest graphic possible with the greatest degree of contrast, and include clear, concise labels where necessary • Avoid crowding of details and graphics <p>Items are selected for a student’s test according to the blueprint, which selects items based on Claims and targets, not task models. As such, careful consideration is given to making sure fully accessible items are available to cover the content of every Claim and target, even if some item formats are not fully accessible using current technology.²</p>
Development Notes:	None

¹ For more information, refer to the General Accessibility Guidelines at: <http://www.smarterbalanced.org/wordpress/wp-content/uploads/2012/05/TaskItemSpecifications/Guidelines/AccessibilityandAccommodations/GeneralAccessibilityGuidelines.pdf>

² For more information about student accessibility resources and policies, refer to http://www.smarterbalanced.org/wordpress/wp-content/uploads/2014/08/SmarterBalanced_Guidelines.pdf

<p>Task Model 1</p> <p>Response Type: Hot Spot</p> <p>DOK Level 2</p> <p>N-RN.B.3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.</p> <p>Evidence Required: 1. The student provides examples of addition or multiplication problems that will have sums or products of a specified type (rational or irrational).</p> <p>Tools: None</p>	<p>Prompt Features: The student gives an example of either an addition or multiplication problem with either a rational or irrational product or sum.</p> <p>Stimulus Guidelines:</p> <ul style="list-style-type: none"> • Four or more numbers are given, of which <ul style="list-style-type: none"> ○ two are rational numbers and ○ two are irrational numbers. • The irrational numbers can be π or of the form $a\sqrt[n]{b}$ where: <ul style="list-style-type: none"> ○ a is rational; ○ b is an integer such that <ul style="list-style-type: none"> ▪ b is positive when n is even, and ▪ b may be negative when n is odd; and ○ n is a whole number such that $2 \leq n \leq 9$. • Item difficulty can be adjusted via these example methods, but are not limited to these methods: <ul style="list-style-type: none"> ○ radicands lead to roots that do or do not simplify to rational numbers ○ sum/product of the radicands does or does not lead to roots that simplify to a rational number ○ integer or fraction coefficients may be added in front of the radicals ○ radicands can be whole numbers or fractions <p>TM1 Stimulus: The student is presented with rational and irrational numbers.</p> <p>Example Stem 1: Click on two numbers whose sum, when added, would be irrational.</p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 15%;">Numbers</td> <td style="width: 15%;">-5</td> <td style="width: 15%;">$3\sqrt{2}$</td> <td style="width: 15%;">$\frac{2}{3}$</td> <td style="width: 15%;">$\frac{1}{3}$</td> <td style="width: 15%;">$\sqrt{8}$</td> </tr> </table> <p>Example Stem 2: Click on two numbers whose sum, when added, would be rational.</p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 15%;">Numbers</td> <td style="width: 15%;">-5</td> <td style="width: 15%;">$3\sqrt{2}$</td> <td style="width: 15%;">$\frac{2}{3}$</td> <td style="width: 15%;">$\frac{1}{3}$</td> <td style="width: 15%;">$\sqrt{7}$</td> </tr> </table> <p>Example Stem 3: Click on two numbers whose product, when multiplied, would be irrational.</p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 15%;">Numbers</td> <td style="width: 15%;">-5</td> <td style="width: 15%;">$3\sqrt{2}$</td> <td style="width: 15%;">$\frac{2}{3}$</td> <td style="width: 15%;">$\frac{1}{3}$</td> <td style="width: 15%;">$\sqrt{8}$</td> </tr> </table>	Numbers	-5	$3\sqrt{2}$	$\frac{2}{3}$	$\frac{1}{3}$	$\sqrt{8}$	Numbers	-5	$3\sqrt{2}$	$\frac{2}{3}$	$\frac{1}{3}$	$\sqrt{7}$	Numbers	-5	$3\sqrt{2}$	$\frac{2}{3}$	$\frac{1}{3}$	$\sqrt{8}$
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<p>Task Model 3</p> <p>Response Type: Multiple Choice, multiple correct response</p> <p>DOK Level 1</p> <p>N-RN.B.3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.</p> <p>Evidence Required: 3. The student determines whether the product of two numbers is a rational number or an irrational number.</p> <p>Tools: None</p>	<p>Prompt Features: Identify which factors would result in a rational product when multiplied by a given a rational or irrational number.</p> <p>Stimulus Guidelines:</p> <ul style="list-style-type: none"> • The irrational numbers can be π or of the form $a^{\frac{n}{b}}$ where: <ul style="list-style-type: none"> ○ a is rational; ○ b is an integer such that <ul style="list-style-type: none"> ▪ b is positive when n is even, and ▪ b may be negative when n is odd; and ▪ n is a whole number such that $2 \leq n \leq 9$. • Item difficulty can be adjusted via these example methods, but is not limited to these methods: <ul style="list-style-type: none"> ○ radicands lead to roots that do/do not simplify to rational numbers ○ sum/product of the radicands does/does not lead to roots that simplify to a rational number ○ integer or fraction coefficients may be added in front of the radicands ○ radicands can be whole numbers or fractions <p>TM3c Stimulus: The student is presented with a rational or irrational number. Example Stem: Select all numbers that will produce a rational number when multiplied by $7\sqrt{5}$.</p> <p>A. $-\frac{1}{5}$ B. $7\sqrt{125}$ C. $5 + \sqrt{5}$ D. $3\sqrt{\frac{9}{5}}$</p> <p>Rubric: (1 point) The student correctly identifies the products as rational (e.g., B, D).</p> <p>Response Type: Multiple Choice, multiple correct response</p>
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<p>Task Model 3</p> <p>Response Type: Matching Tables</p> <p>DOK Level 1</p> <p>N-RN.B.3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.</p> <p>Evidence Required: 2. The student determines whether the sum of two numbers is a rational number or an irrational number. 3. The student determines whether the product of two numbers is a rational number or an irrational number.</p> <p>Tools: None</p>	<p>Prompt Features: The student will be prompted to identify sums and products as rational or irrational.</p> <p>Stimulus Guidelines:</p> <ul style="list-style-type: none"> • The irrational numbers can be π or of the form $a\sqrt[n]{b}$ where: <ul style="list-style-type: none"> ○ a is rational; ○ b is an integer such that <ul style="list-style-type: none"> ▪ b is positive when n is even, and ▪ b may be negative when n is odd; and ○ n is a whole number such that $2 \leq n \leq 9$. • Item difficulty can be adjusted via these example methods, but is not limited to these methods: <ul style="list-style-type: none"> ○ radicands lead to roots that do/do not simplify to rational numbers ○ sum/product of the radicands does/does not lead to roots that simplify to a rational number ○ integer or fraction coefficients may be added in front of the radicands ○ radicands can be whole numbers or fractions <p>TM3d Stimulus: The student is presented with expressions that contain the sums and products of rational and/or irrational numbers.</p> <p>Example Stem: Select the appropriate box to identify the value of each expression as being rational or irrational.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th style="text-align: center;">Rational</th> <th style="text-align: center;">Irrational</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$5\sqrt{7} + \frac{1}{7}$</td> <td style="width: 50px;"></td> <td style="width: 50px;"></td> </tr> <tr> <td style="text-align: center;">$12.4 \cdot (-11)$</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">$\sqrt{4} + 17$</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">$(-10\sqrt{10}) \cdot 10\sqrt{10}$</td> <td></td> <td></td> </tr> </tbody> </table> <p>Rubric: (1 Point) Student correctly identifies all sums and products correctly (e.g., Irrational, Rational, Rational, Rational).</p> <p>Response Type: Matching Tables</p>		Rational	Irrational	$5\sqrt{7} + \frac{1}{7}$			$12.4 \cdot (-11)$			$\sqrt{4} + 17$			$(-10\sqrt{10}) \cdot 10\sqrt{10}$		
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