HS Target B

Domain, Target, Standards, DOK, Vertical Alignments, Achievement Levels, Evidence Required, Vocabulary, Response Types, Materials, Attributes, Question Types, and Question Banks (Examples)

Content Domain: Number and Quantity
Target B [s]: N-RN.B Use properties of rational and irrational numbers.
Standards included in Target B: N-RN.B, N-RN.B.3
Vertical Alignment
Achievement Level Descriptors
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Claim 1: Concepts and Procedures (DOK 1, 2, 3) Question Banks
Claim 3 Communicating Reasoning Question Banks

Content Domain: Number and Quantity

Target B [s]: N-RN.B Use properties of rational and irrational numbers.

Standards included in Target B: N-RN.B, N-RN.B.3

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.

Vertical Alignment

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.

Achievement Level Descriptors

Level 1 Students should be able to identify the difference between a rational and an irrational number.

Level 2 Students should be able to identify the difference between a rational and an irrational number.

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.

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.

Evidence Required

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.

Vocabulary
rational number, irrational number, real number

Response Types
Multiple Choice, multiple correct response; Matching Tables; Hot Spot

Materials
products or sums of rational and irrational numbers, number type (rational or irrational)

Attributes
Only sums and products of two numbers are used.

Claim 1: Concepts and Procedures (DOK 1, 2, 3) Question Banks
Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.

Claim 1 N-RN.B.3 DOK Level 2

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.

Evidence Required
The student provides examples of addition or multiplication problems that will have sums or products of a specified type (rational or irrational).

Question Type 1: The student is presented with rational and irrational numbers.

1. Click on two numbers whose sum, when added, would be irrational.

Numbers	-5	$3\sqrt{2}$	$\frac{2}{3}$	$\frac{1}{3}$	$\sqrt{8}$

2. Click on two numbers whose sum, when added, would be rational.

Numbers	-5	$3\sqrt{2}$	$\frac{2}{3}$	$\frac{1}{3}$	$\sqrt{7}$

3. Click on two numbers whose product, when multiplied, would be irrational.

Numbers	-5	$3\sqrt{2}$	$\frac{2}{3}$	$\frac{1}{3}$	$\sqrt{8}$

4. Click on two numbers whose product, when multiplied, would be rational.

Numbers	-5	$3\sqrt{2}$	$\frac{2}{3}$	$\frac{1}{3}$	$\sqrt{8}$

Rubric: (1 point) The student selects two numbers that satisfy the given conditions. Multiple correct responses are possible and will all need to be included in the scoring rubric. Only example responses are shown below.

Example Stem 1:

Numbers	-5	$3\sqrt{2}$	$\frac{2}{3}$	$\frac{1}{3}$	$\sqrt{8}$

Example Stem 2:

Numbers	-5	$3\sqrt{2}$	$\frac{2}{3}$	$\frac{1}{3}$	$\sqrt{7}$

Example Stem 3:

Numbers	-5	$3\sqrt{2}$	$\frac{2}{3}$	$\frac{1}{3}$	$\sqrt{8}$

Example Stem 4:

Numbers	-5	$3\sqrt{2}$	$\frac{2}{3}$	$\frac{1}{3}$	$\sqrt{8}$

Response Type: Hot Spot

Claim 1 N-RN.B.3 DOK Level 2

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.

Evidence Required:
The student determines whether the sum of two numbers is a rational number or an irrational number.

Question Type 1: The student is presented with a list of expressions that contain the sums of rational and/or irrational numbers.

1. Select the appropriate box to identify each expression as having either a rational or irrational sum.

	Rational	Irrational
$5\sqrt{7} + \frac{1}{7}$		
$\sqrt{4} + 17$		
$12.4 + (-11)$		
$-\frac{4}{5} + (-10\sqrt{10})$		

Rubric: (1 Point) The student correctly identifies the sum as rational or irrational (e.g., Irrational, Rational, Rational, Irrational).

Question Type 2: The student is presented with a table of numbers.

1. Select each box in the table where the numbers from corresponding rows and columns will have a rational sum.

	4	$\frac{1}{3}$	$\sqrt{3}$	π
4				
$\frac{1}{3}$				
$\sqrt{3}$				
π				

Rubric: (1 Point) The student correctly identifies the sum as rational or irrational (e.g., see below).

	4	$\frac{1}{3}$	$\sqrt{3}$	π
4				
$\frac{1}{3}$				
$\sqrt{3}$				
π				

Response Type: Matching Tables

These pages were adapted from open source documents available on the Smarter Balanced Website: http://www.smarterbalanced.org/assessments/development/ August 2016

Claim 1 N-RN.B.3 DOK Level 2

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.

Evidence Required:
The student determines whether the product of two numbers is a rational number or an irrational number.

Question Type 1: The student is presented with a list of expressions that contain the product of rational and/or irrational numbers.

1. Select the appropriate box to identify each expression as having either a rational or irrational product.

	Rational	**Irrational**
$5\sqrt{7} \cdot \frac{1}{7}$		
$\sqrt{4} \cdot 17$		
$12.4 \cdot (-11)$		
$-\frac{4}{5} \cdot (-10\sqrt{10})$		

Rubric: (1 Point) The student correctly identifies the product as rational or irrational (e.g., Irrational, Rational, Rational, Irrational).

Question Type 2: The student is presented with a table of numbers.

1. Select each box in the table where the numbers from corresponding rows and columns will have a rational product.

	4	$\frac{1}{3}$	$\sqrt{3}$	$-\sqrt{3}$
4				
$\frac{1}{3}$				
$\sqrt{3}$				
$-\sqrt{3}$				

These pages were adapted from open source documents available on the Smarter Balanced Website: http://www.smarterbalanced.org/assessments/development/ August 2016

Rubric: (1 Point) The student correctly identifies the product as rational or irrational (e.g., see below).

	4	$\frac{1}{3}$	$\sqrt{3}$	$-\sqrt{3}$
4				
$\frac{1}{3}$				
$\sqrt{3}$				
$-\sqrt{3}$				

Response Type: Matching Tables

Claim 1 N-RN.B.3 DOK Level 1

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.

Evidence Required:
The student is presented with a rational or irrational number.

Question Type 1: Select all numbers that will produce a rational number when multiplied by $7^{\sqrt{5}}$.

A. $-\frac{1}{5}$
B. $7\sqrt{125}$
C. $5+\sqrt{5}$
D. $3\sqrt{\frac{9}{5}}$

Rubric: (1 point) The student correctly identifies the products as rational (e.g., B, D).

Response Type: Multiple Choice, multiple correct response

Claim 1 N-RN.B.3 DOK Level 1

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.

Evidence Required:

The student determines whether the sum of two numbers is a rational number or an irrational number.

The student determines whether the product of two numbers is a rational number or an irrational number.

Question Type 1: The student is presented with expressions that contain the sums and products of rational and/or irrational numbers.

1. The student is presented with expressions that contain the sums and products of rational and/or irrational numbers.

	Rational	Irrational
$5\sqrt{7} + \frac{1}{7}$		
$12.4 \cdot (-11)$		
$\sqrt{4} + 17$		
$(-10\sqrt{10}) \cdot 10\sqrt{10}$		

Rubric: (1 Point) Student correctly identifies all sums and products correctly (e.g., Irrational, Rational, Rational, Rational).

Response Type: Matching Tables

<u>Claim 3 Communicating Reasoning Question Banks</u>

Claim Descriptors and Targets

Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.

<u>Example 1</u>

Consider the two numbers a and b as well as their sum and product. Drag values for a and b into the boxes to make the paired statements true for both $a \cdot b$ and $a+b$. If none of the values make both statements true, leave the boxes empty for that pair of statements.

	Statements	Example
3 5 $\sqrt{3}$	$a \cdot b$ is an irrational number $a + b$ is a rational number	$a =$ ☐ $b =$ ☐
$\sqrt{5}$ $3\sqrt{5}$	$a \cdot b$ is a rational number $a + b$ is an irrational number	$a =$ ☐ $b =$ ☐
$5 - \sqrt{3}$	$a \cdot b$ is an irrational number $a + b$ is an irrational number	$a =$ ☐ $b =$ ☐

Rubric: (1 point) The student drags correct combinations of values that result in the indicated rational and irrational perimeters and areas of the rectangle. (e.g., see one possible solution at right). Other correct responses are possible.

Response Type: Drag and Drop

Statements	Example
$a \cdot b$ is an irrational number $a + b$ is a rational number	$a =$ $\sqrt{3}$ $b =$ $5 - \sqrt{3}$
$a \cdot b$ is a rational number $a + b$ is an irrational number	$a =$ $\sqrt{5}$ $b =$ $3\sqrt{5}$
$a \cdot b$ is an irrational number $a + b$ is an irrational number	$a =$ $\sqrt{5}$ $b =$ $\sqrt{3}$