Slide 1 / 206

Slide 2 / 206

NEW JERSEY CENTER
FOR TEACHING & LEARNING

8th Grade

The Number System and Mathematical Operations - Part 1

2015-11-20

www.njctl.org

Slide 3 / 206

Table of Contents

Click on a topic to go to that section.

Table of Contents

Teacher Notes

Vocabulary Words are bolded in the presentation. The text box the word is in is then linked to the page at the end of the presentation with the word defined on it.

Click on a topic to go to that section.

Slide 3 (Answer) / 206

Addition, Natural Numbers & Whole Numbers

Return to Table of Contents

Slide 4 / 206

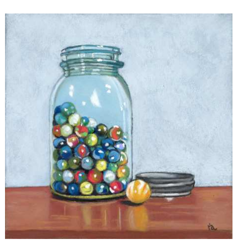
Natural Numbers

The first numbers developed were the **Natural Numbers**, also called the Counting Numbers.

1, 2, 3, 4, 5, ...

The three dots, (...), means that these numbers continue forever: there is no largest counting number..

Think of counting objects as you put them in a container those are the counting numbers.



Slide 5 / 206

Natural Numbers

Natural numbers were used before there was history.

All people use them.

This "counting stick" was made more than 35,000 years ago and was found in Lebombo, Swaziland.

The cuts in this bone record the number "29."

http://www.taneter.org/math.html

Natural Numbers and Addition

They were, and are, used to count objects
- > goats,
- > bales,
- > bottles,
- > etc.

Drop a stone in a jar, or cut a line in a stick, every time a goat walks past.

That jar or stick is a record of the number.

Numbers versus Numerals

Numbers exist even without a numeral, such as the number indicated by the cuts on the Lebombo Bone.

A numeral is the name we give a number in our culture.

Numbers versus Numerals

If asked how many tires my car has, I could hand someone the above marbles.

That number is represented by:

- 4 in our Base 10 numeral system
- IV in the Roman numeral system
- 100 in the Base 2 numeral system

Slide 9 / 206

Whole Numbers

Adding zero to the Counting Numbers gives us the **Whole Numbers**.

0, 1, 2, 3, 4, ...

Counting numbers were developed more than 35,000 years ago.

It took 34,000 more years to invent zero.

This the oldest known use of zero (the dot), about 1500 years ago.

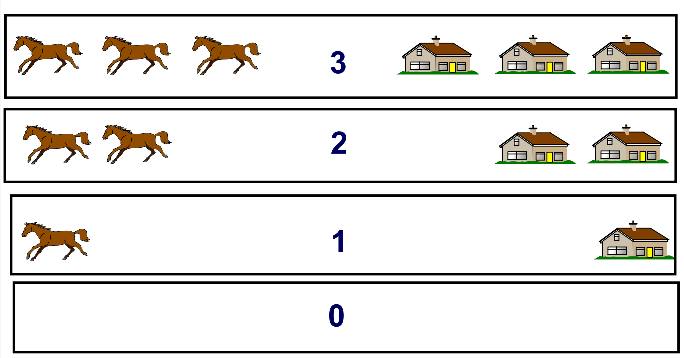
It was found in Cambodia and the dot is for the zero in the year 605.

http://www.smithsonianmag.com/history/origin-number-zero-180953392/?no-ist

Slide 10 / 206

Why zero took so long to Invent

Horses versus houses.



zero horses = zero houses

Slide 11 / 206

Why zero took so long

Would I tell someone I have a herd of zero goats?

Or a garage with zero cars?

Or that my zero cars have zero tires?

Zero just isn't a natural number, but it is a whole number.

Addition, Subtraction and Integers

Return to Table of Contents

Addition and Subtraction

The simplest mathematical operation is addition.

The inverse of addition is subtraction.

Two operations are inverses if one "undoes" the other.

Inverse operations is a very important concept, and applies to all mathematics.

Additio

The simplest mathem

The inverse of additio

Two operations are r

Inverse operations i o
all mathematics.

Math Practice

MP.5: Use appropriate tools strategically.

When reviewing addition, subtraction, multiplication, and division, number lines will be used to aid the students.

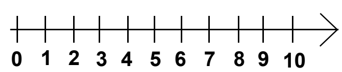
If they ever get stuck, ask: How could you use a number line to show your thinking?

Addition and Subtraction

Each time a marble is dropped in a jar we are doing addition.

Each time a marble is removed from a jar, we are doing subtraction.

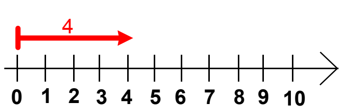
A number line allows us to think of addition in a new way.



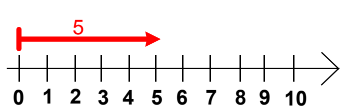
Adding Whole Numbers

Let's find the sum of 4 and 5 on a number line.

The number +4 is four steps to the right. Starting at 0, takes you to 4.



The number +5 is five steps to the right. Starting at 0, takes you to 5.

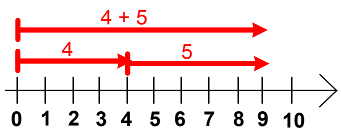


Adding Whole Numbers

To find the sum "4 + 5" start at zero and take four steps to the right for the first number.

Then, starting where you ended after those first steps, take five more steps to the right, to represent adding five.

If we were walking, we could look down and see we are standing at 9.



Therefore, 4 + 5 = 9.

Slide 17 / 206

The Commutative Property of Addition

A mathematical operation is commutative if the order doesn't matter.

In this case, addition would be commutative if 4 + 5 = 5 + 4

Let's test that.

We found that 4 + 5 = 9

How about 5 + 4?

Slide 18 / 206

The Commutative Property of Addition

A mathematica ... 't matter.

In this case, a

Let's test tha

We found tha

How about 5

Math Practice

This slide and the next 3 slides are a proof of the commutative property through the use of number lines.

MP.2: Reasoning quantitatively and abstractly.

MP.3: Construct viable arguments and critique the reasoning of others.

Ask on the 3rd slide: Can you create your own pair of numbers and prove that a + b = b + a?

Slide 18 (Answer) / 206

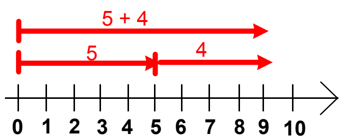
Slide 19 / 206

The Commutative Property of Addition

First, take five steps to the right.

Then, starting where you ended, take four more steps to the right.

Once more, we could look down and see we are standing at 9.



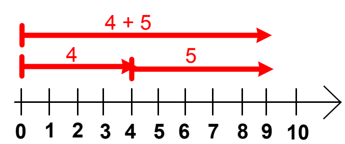
5 + 4 = 9

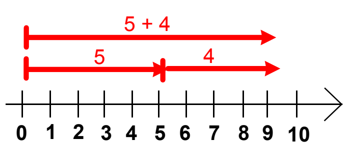
Slide 20 / 206

The Commutative Property of Addition

So, 4 + 5 = 5 + 4

Addition is commutative in this case.





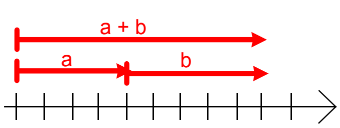
Slide 21 / 206

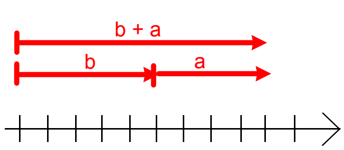
The Commutative Property of Addition

But there's nothing special about these numbers.

This is true for any numbers:

a + b = b + a





Inverse Operations

Operations are "inverses" when one of them undoes what the other does.

What would undo adding 5?

click

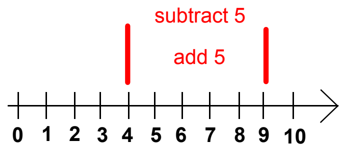
Addition and Subtraction are Inverses

Addition and subtraction are inverses.

Adding a number and then subtracting that same number leaves you where you started.

Starting at 4, add 5 and then subtract 5.

You end up where you started.

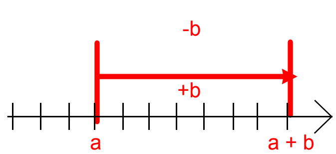


Addition and Subtraction are Inverses

This is true for any two numbers.

Start with a, then add b, then subtract b.

You end up with the number you began with: a.



Inverse Operations

We started with the addition question: what number results when we add 5 and 4? The answer is 9.

$$5 + 4 = 9$$

That leads to two new related subtraction questions.

Starting with 9, what number do we get when we subtract 5?

$$9 - 5 = 4$$

Starting with 9, what number do we get when we subtract 4.

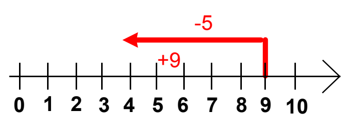
$$9 - 4 = 5$$

Subtraction was invented to undo addition, but it now can be used to ask new questions.

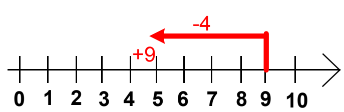
Slide 25 / 206

Subtracting Whole Numbers

Here's what 9-5 looks like on the number line



And, here's 9-4



Slide 26 / 206

We Need More Numbers

Subtraction was invented to undo addition.

But this new operation allows us to ask new questions.

And, the number system to that point couldn't provide answers.

For example:

What is the result of subtracting 7 from 4?

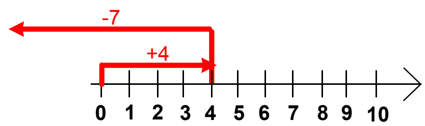
4 - 7 = ?

Slide 27 / 206

Subtracting Whole Numbers

Slide 28 / 206

4 - 7 = ?



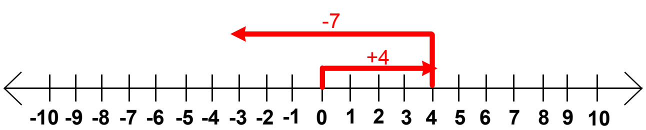
There was no answer to questions like this in the whole number systems.

Which was all there was until about 500 years ago.

Negative Numbers

Slide 29 / 206

4 - 7 = ?



This led to the invention of negative numbers.

They were called negative from the Latin "negare" which means "to deny," since people denied that such numbers could exist.

They weren't used much until the Renaissance, and were only fully accepted in the 1800's.

If you had trouble with negative numbers, so did most everyone else.

Integers

Slide 30 / 206

Adding the negative numbers to the whole numbers yields the **Integers**.

...-3, -2, -1, 0, 1, 2, 3, ...

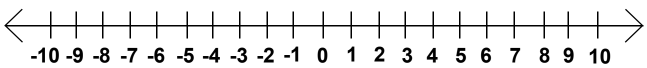
In this case, "..." at the left and right, means that the sequence continues in both directions forever.

There is no largest integer...nor is there a smallest integer.

Slide 31 / 206

Integers

The below number line shows only the integers.



Slide 32 / 206

Adding and Subtracting Integers

Now that we have a new operation (subtraction) and new numbers (integers), we need new rules.

The new rules are based on the old ones.

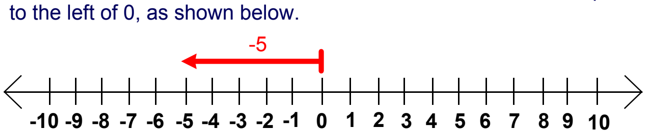
We have to show how to do addition and subtraction with our newly invented negative integers.

Slide 33 / 206

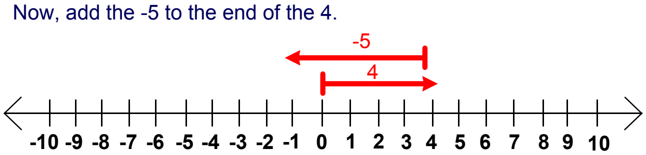
Adding Integers

First, let's add a positive and negative integer: 4 + (-5) = ?

Before we start, we must understand that -5 means to move 5 spaces to the left of 0, as shown below.



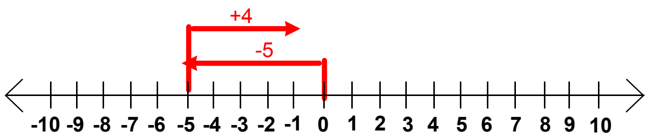
Now, add the -5 to the end of the 4.



Therefore, 4 + (-5) = -1.

Adding Integers

Addition is commutative, so we get the same answer for (-5) + 4 = ?



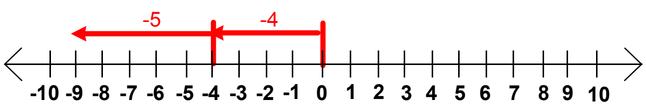
Therefore, (-5) + 4 = -1.

Slide 34 / 206

Adding Integers

Now let's add two negative integers: (-4) + (-5) = ?

Like the last example, we start off going to the left 4 spaces, but then we continue to the left 5 spaces.



Therefore, (-4) + (-5) = -9.

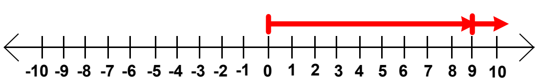
Don't memorize "rules" to add positive & negative numbers.

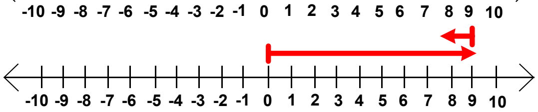
Instead, sketch the number line to perform each addition problem.

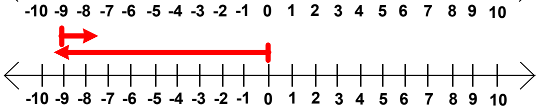
That way you know that you are correct every time.

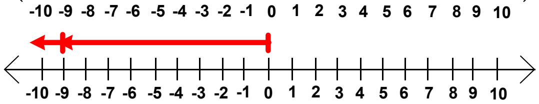
Slide 35 / 206

1 Which number line would be used to show 9 + (-1)?

○ A


○ B


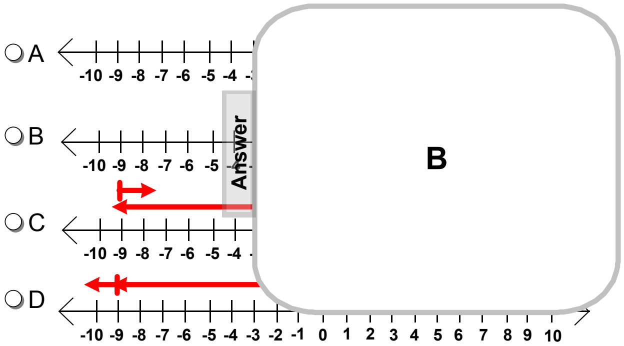
○ C


○ D


Slide 36 / 206

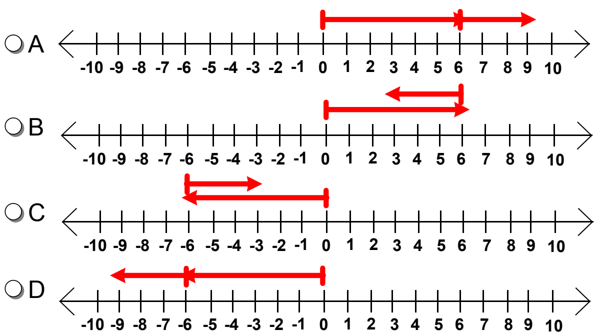
Slide 36 (Answer) / 206

1 Which number line would be used to show 9 + (-1)?



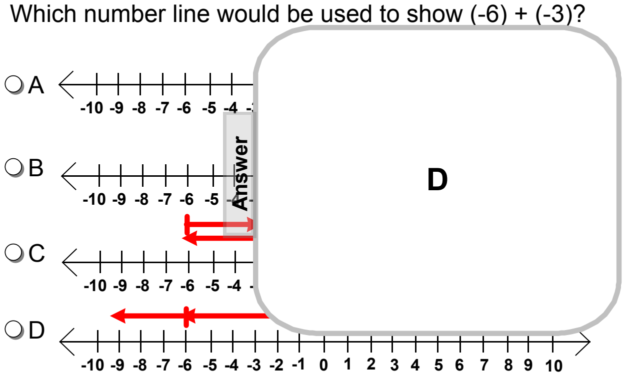
Slide 37 / 206

2 Which number line would be used to show (-6) + (-3)?



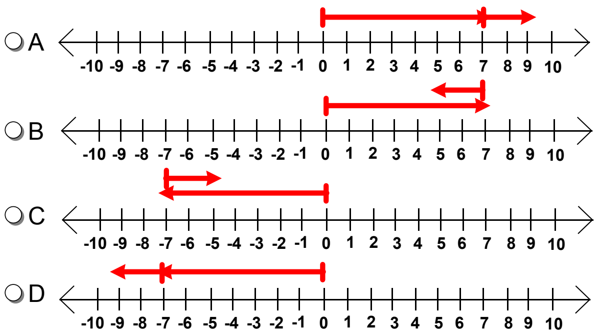
Slide 37 (Answer) / 206

2 Which number line would be used to show (-6) + (-3)?



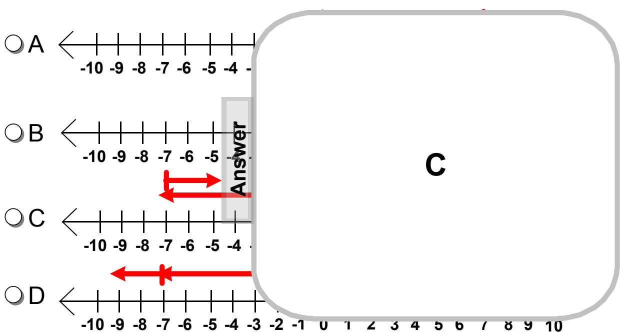
Slide 38 / 206

3 Which number line would be used to show (-7) + 2?



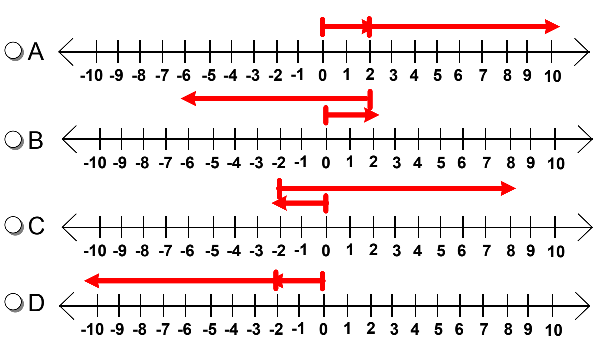
Slide 38 (Answer) / 206

3 Which number line would be used to show (-7) + 2?



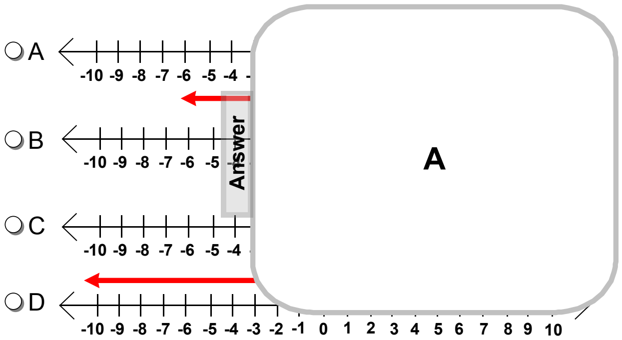
Slide 39 / 206

4 Which number line would be used to show 2 + 8?



Slide 39 (Answer) / 206

4 Which number line would be used to show 2 + 8?



Slide 40 / 206

5) 11 + (-4) =

Slide 40 (Answer) / 206

5) 11 + (-4) =

Answer

7

6) -4 + (-4) =

6) -4 + (-4) =

Answer

-8

7) 17 + (-20) =

7) 17 + (-20) =

Answer

-3

Slide 42 (Answer) / 206

8) -15 + (-30) =

Slide 43 / 206

8) -15 + (-30) =

Answer

-45

Slide 43 (Answer) / 206

9) -5 + 10 =

Slide 44 / 206

9) -5 + 10 =

Answer

5

Slide 44 (Answer) / 206

10) 11 + (-4) =

Slide 45 / 206

Slide 45 (Answer) / 206

10) 11 + (-4) =

Answer

7

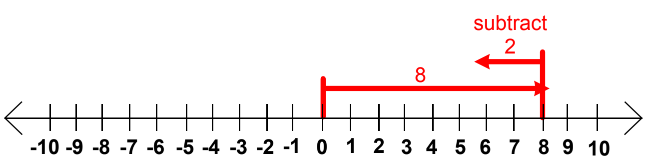
Slide 46 / 206

Subtracting Integers

8 - 2 = 6

Since 8 is positive, we need to travel to the right 8 steps.

Next, instead of moving to the right 2 spaces, as in addition, subtraction moves in the opposite direction, which means we move 2 spaces to the left.



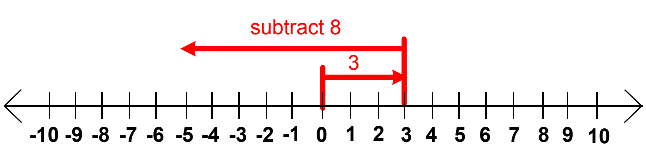
Our answer is 6.

Slide 47 / 206

Subtracting Integers

How would we show 3 - 8?

As in the last example, we would start off going right 3 and then left 8.



Therefore, 3 - 8 = -5

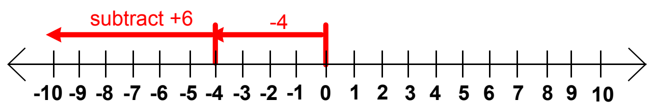
Slide 48 / 206

Adding & Subtracting Integers

How would we show (-4) - 6?

Remember that (-4) is shown by going 4 spaces to the left.

Subtracting 6, take us 6 more spaces to the left.



Therefore, (-4) - 6 = -10

Slide 49 / 206

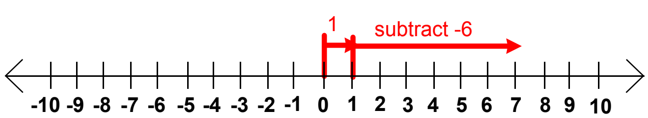
Adding & Subtracting Integers

The most potentially confusing case is subtracting a negative integer.

How would we show 1 - (-6)?

First, we would go 1 space to the right, because of the 1.

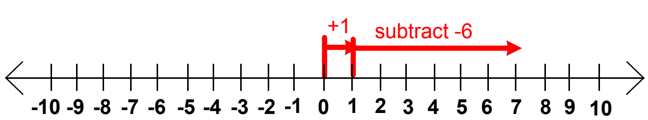
Adding -6 spaces would take us to the left, but we must do the opposite since we are subtracting, moving 6 steps to the right.



Therefore, 1 - (-6) = 7

Slide 50 / 206

Adding & Subtracting Integers



Therefore, 1 - (-6) = 7

When we subtracted -6, it was the same as adding +6.

This is because -6 is six spaces to the left, and so when you go in the opposite direction, you go 6 spaces to the right.

The same as adding 6.

Subtracting a negative number is the same as adding a positive one: "two minuses make a plus".

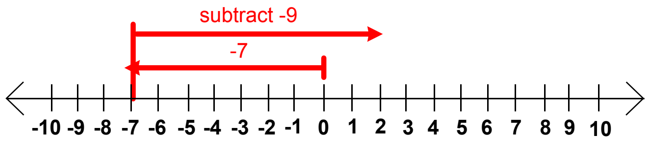
Slide 51 / 206

Adding & Subtracting Integers

How would we show -7 - (-9)?

First, go 7 spaces to the left, because we're adding -7.

If we were adding -9 we would go 9 spaces to the left, but since we are subtracting -9, we must go in the opposite direction, 9 to the right.



Therefore, -7 - (-9) = 2

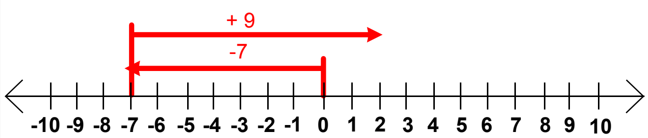
Let's look at this another way.

Slide 52 / 206

Adding & Subtracting Integers

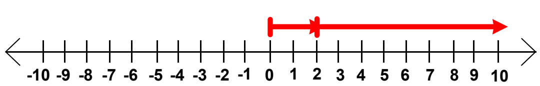
We could rewrite -7 - (-9) to be -7 +9, since subtracting a negative number is the same as adding a positive one.

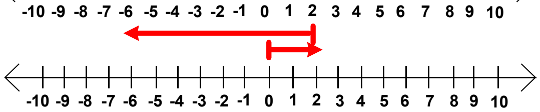
That yields the same answer: +2

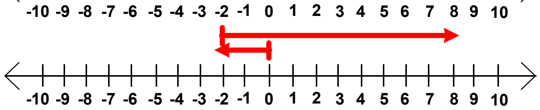


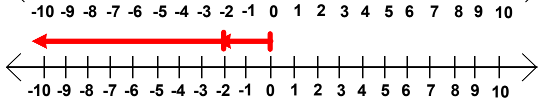
Slide 53 / 206

11 Which number line would be used to show 2 - 8?

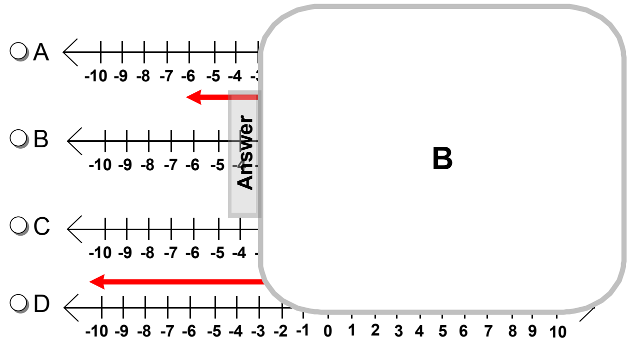
A


B


C


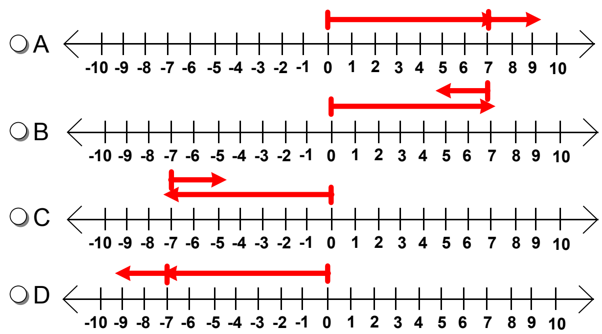
D


11 Which number line would be used to show 2 - 8?



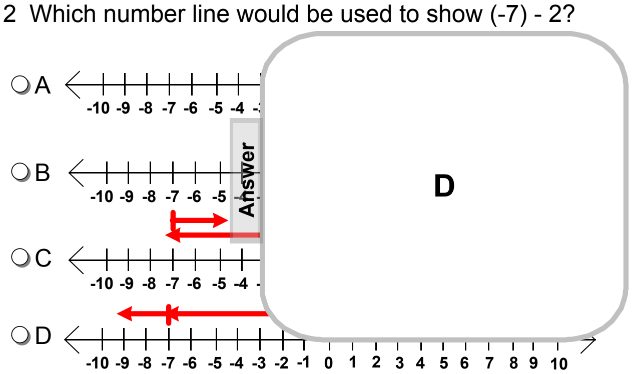
Slide 53 (Answer) / 206

12 Which number line would be used to show (-7) - 2?



Slide 54 / 206

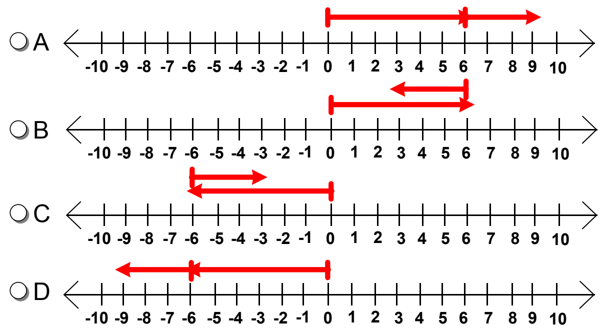
12 Which number line would be used to show (-7) - 2?



Slide 54 (Answer) / 206

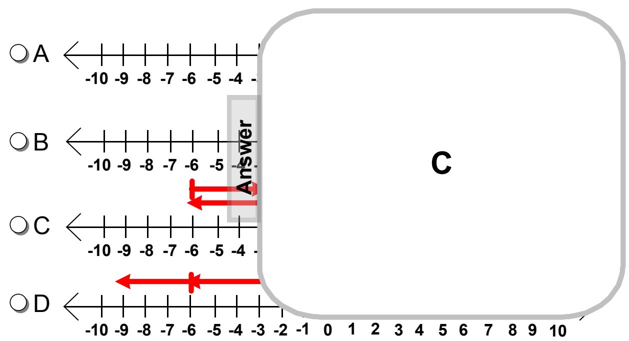
Slide 55 / 206

13 Which number line would be used to show (-6) - (-3)?



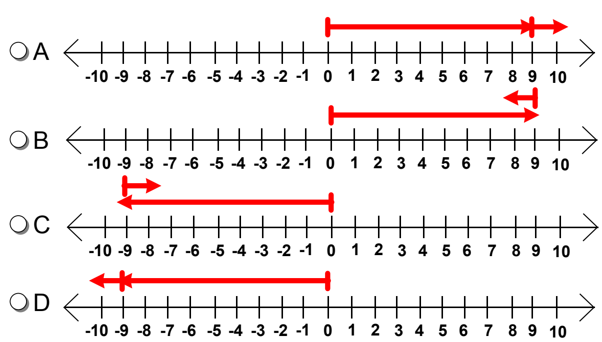
Slide 55 (Answer) / 206

13 Which number line would be used to show (-6) - (-3)?

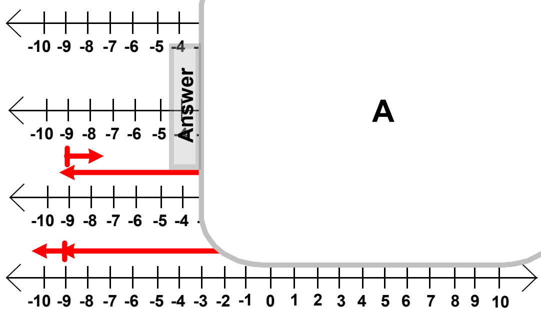


Slide 56 / 206

14 Which number line would be used to show 9 - (-1)?



14 Which number line would be used to show 9 - (-1)?



A

B

C

D

Answer

A

Slide 56 (Answer) / 206

15) -2 - 6 =

Slide 57 / 206

15) -2 - 6 =

Answer

-8

Slide 57 (Answer) / 206

16) 4 - 10 =

Slide 58 / 206

16) 4 - 10 =

Answer

-6

Slide 58 (Answer) / 206

17) 3 - (-8) =

Slide 59 / 206

17) $3 - (-8) =$

Answer

11

Slide 59 (Answer) / 206

18) $-5 - (-3) =$

Slide 60 / 206

18) $-5 - (-3) =$

Answer

-2

Slide 60 (Answer) / 206

19) -7 - 8 =

19) -7 - 8 =

Answer

-15

20) -7 - 2 =

20) -7 - 2 =

Answer

-9

21 Convert the subtraction problem into an addition problem.
-8 - (-4)

- A 8 + 4
- B 8 + (-4)
- C -8 + 4
- D -8 + (-4)

21 Convert the subtraction problem into an addition problem.
-8 - (-4)

- A 8 + 4
- B 8 + (-4)
- C -8 + 4
- D -8 + (-4)

Answer

C

22 Convert the subtraction problem into an addition problem.
-1 - 9

- A -1 + 9
- B -1 + (-9)
- C 1 + 9
- D 1 + (-9)

22 Convert the subtraction problem into an addition problem.
-1 - 9

- A -1 + 9
- B -1 + (-9)
- C 1 + 9
- D 1 + (-9)

Answer

B

23 Convert the subtraction problem into an addition problem.
12 - (-5)

- A 12 + 5
- B 12 + (-5)
- C -12 + 5
- D -12 + (-5)

23 Convert the subtraction problem into an addition problem.

12 - (-5)

- A 12 + 5
- B 12 + (-5)
- C -12 + 5
- D -12 + (-5)

Answer

A

Is Subtraction Commutative?

Subtraction would be commutative if a - b = b - a

Let's test that with some numbers

4 - 5 = -1

5 - 4 = 1

Since -1 ≠ 1, then 4 - 5 ≠ 5 - 4

In general, a - b ≠ b - a

Subtraction is not commutative.

Multiplication and Division of Integers

Return to Table of Contents

Multiplication

Multiplication can be indicated by putting a dot between two numbers, or by putting the numbers into parentheses.

(We won't generally use "x" to indicate multiplication since that letter is used a lot in algebra for variables.)

So multiplying 3 times 2 will be written as:

$3 \cdot 2$

or

$(3)(2)$

Slide 68 / 206

Multiplication

Multiplication can be indicated by putting a dot between two numbers, or by puttin

(We won't general that letter is used a lot

So multiplying 3

Math Practice

MP.7: Look for and make use of structure.

Ask: How is multiplication related to addition?

Note: answer to this question is shown on the next slide.

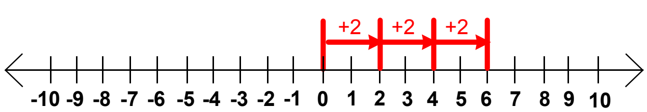
Slide 68 (Answer) / 206

Multiplication

Multiplication is repeated addition.

So, to find the product of $3 \cdot 2$ we would add the number 2 to itself three times:

$3 \cdot 2 = 2 + 2 + 2$



Slide 69 / 206

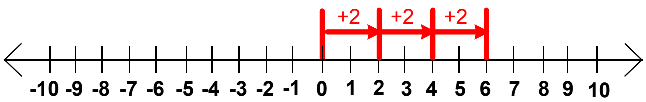
Multiplication is Commutative

Since addition is commutative...

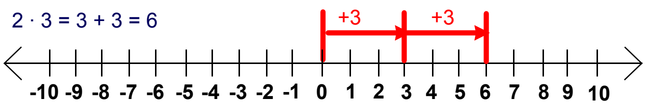
And multiplication is just repeated addition,

multiplication is commutative:

3 · 2 = 2 + 2 + 2 = 6



2 · 3 = 3 + 3 = 6



Multiplic

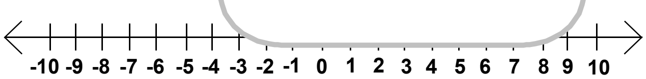
Since addition is comm

And multiplication is ju

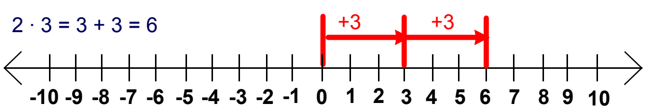
multiplication is commu

Teacher's Note

3 · 2 = 2 + 2 + 2 = 6



2 · 3 = 3 + 3 = 6

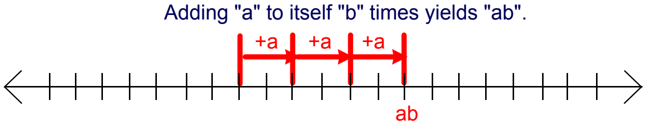


Multiplication is Commutative

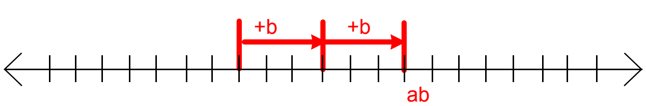
a · b = b · a

Adding a number "a" to itself "b" times yields the same result as adding a number "b" to itself "a" times.

Adding "a" to itself "b" times yields "ab".



Adding "b" to itself "a" times also yields "ab".

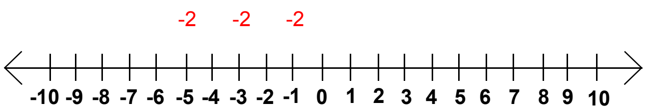


Multiplying Negative Integers

It works the same way when you multiply a negative number by a positive number.

So, 3 · (-2) just indicates to add -2 to itself three times:

3 · (-2) = (-2) + (-2) + (-2) = -6



Would (-3) · 2 give us the same answer of -6? Explain your answer.

Slide 72 / 206

Multiplying Negative Integers

It works the same w... r by a positive number.

So, 3 · (-2) just indic...

Answer

Yes, in multiplication, the order in which you multiply numbers does not matter. Therefore,
3 ·(-2) = (-3) · 2
= (-3) + (-3)
= -6

Would (-3) · 2 give us the same answer of -6? Explain your answer.

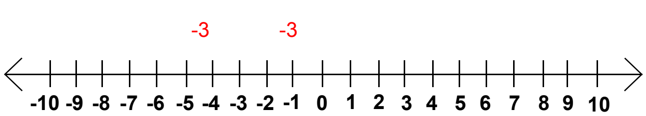
Slide 72 (Answer) / 206

Multiplying Negative Integers

Since multiplication is commutative,

(-3) · 2 = 2 · (-3) = (-3) + (-3) = -6

So, this just becomes adding -3 to itself 2 times.



Multiplying a positive and negative integer results in a negative integer:

(a)(-b) = (-a)(b) = -ab

Slide 73 / 206

Multiplying Positive & Negative Integers

When multiplying two numbers, if both are positive, the answer is positive.

If one is negative and the other is positive, the answer is negative.

How about if both numbers being multiplied are negative?

Multiplying Positive & Negative Integers

How do we interpret (-3)(-2)?

Since, (3)(-2) means to add -2 to itself 3 times

We could interpret (-3)(-2) to mean to subtract (-2) from itself three times.

We already learned that addition and subtraction are inverses, so subtracting -2 is the same as adding 2.

So, (-3)(-2) indicates to add 2 to itself 3 times.

So, (-3)(-2) = (3)(2) = 6

Multiplying & Dividing Integers

While showing how to multiply integers, we have come across some "shortcuts" for determining the sign of our product.

What generalizations can you make about the sign of your product?

Multiplying & Dividing Integers

While showing ho
across some "sho
product.

What generaliz r
product?

Answer & Math Practice

+ times + = +
+ times - = -
- times + = -
- times - = +

The question on this slide addresses MP8: Look for and express regularity in repeated reasoning.

24 What will be the sign of the product (-6) · 8?

- Positive
- Negative

24 What will be the sign of the product (-6) · 8?

- Positive
- Negative

Answer

B

25 What will be the sign of the product (-4) (-9)?

- Positive
- Negative

25 What will be the sign of the product (-4) (-9)?

- Positive
- Negative

Answer

A

26 Find the product: $9 \cdot (-11)$

26 Find the product: $9 \cdot (-11)$

Answer

-99

27 Find the product: $(-12)(-11)$

27 Find the product: $(-12)(-11)$

Answer

132

28 Find the product: (-7) · 9

Slide 81 / 206

28 Find the product: (-7) · 9

Answer

-63

Slide 81 (Answer) / 206

29 Find the product: (-3) · (-9)

Slide 82 / 206

29 Find the product: (-3) · (-9)

Answer

27

Inverse Operations

7(4) = 28

This equation provides the answer "28" to the multiplication question "what is the product of 7 and 4".

What are the two inverse questions that can be asked and answered based on the above multiplication fact?

Which mathematical operation is the inverse of multiplication?

DISCUSS!

In

This equation provi... ...uestion "what is the product...

What are the two inve... ...swered based on the above r...

Which mathematical opera... ...ion?

DISCUSS!

Math Practice

MP.1: Make sense of problems & persevere in solving them.

Ask: What information are you given?

What are the questions asking?

How can the equation given help you determine the inverse operation of multiplication?

Inverse Operations

7(4) = 28

There are two division questions are the inverse of this are:

28÷4 = 7

This provides the answer "7" to the question "what is 28 divided by 4".

28÷7 = 4

This provides the answer "4" to the question "what is 28 divided by 7".

Inverse Operations

Division asks:

If I divide something into pieces of equal size, what will be the size of each piece?

For instance, 15÷3 asks if I divide 15 into 3 pieces, what will be the size of each piece?

The answer is 5, since 5 + 5 + 5 = 15

Three equal pieces of 5 will add to equal 15.

Multiplying & Dividing Integers

Since multiplication and division are so closely related, we can get the rules for division using the rules of multiplication.

For example, $\frac{30}{6} = 5$ because 5 is the number you multiply by 6 to get 30.

In turn, $30 = 6 \cdot 5$, so $\frac{30}{6} = 5$

Multiplying & Dividing Integers

...are so closely related, we can get the ...f multiplication.

...the number you multiply by 6 to

...5 because -5 is the number you ...ultiply by 6 to get 30.

...turn, -30 = 6 · (-5), so $\frac{-30}{6} = -5$

...e questions on this slide address ...P6 & MP7.

Slide 86 (Answer) / 206

Multiplying & Dividing Integers

What is $\frac{30}{-6}$? Why?

What is $\frac{-30}{-6}$? Why?

Slide 87 / 206

Multiplying & Dividing Integers

Wha...

Answer

-5 because -5 is the number you multiply by -6 to get 30.

In turn, 30 = (-6) · (-5), so $\frac{30}{-6} = -5$

5 because 5 is the number you multiply by -6 to get -30.

In turn, -30 = (-6) · (5), so $\frac{-30}{-6} = 5$

Wha...

Slide 87 (Answer) / 206

Multiplying & Dividing Integers

What generalizations can you make about the sign of the quotient?

Multiplying & Dividing Integers

What generalizations can you make about the sign of the quotient?

Answer

+ over + = +
+ over - = -
- over + = -
- over - = +

The question on this slide addresses MP8

30 What is the sign of the quotient of -69 ÷ (-3)?

- Positive
- Negative

30 What is the sign of the quotient of -69 ÷ (-3)?

- Positive
- Negative

Answer

A

Slide 89 (Answer) / 206

31 What is the sign of the quotient of 52 ÷ (-4)?

- Positive
- Negative

Slide 90 / 206

31 What is the sign of the quotient of 52 ÷ (-4)?

- Positive
- Negative

Answer

B

Slide 90 (Answer) / 206

32 Find the quotient of -65 ÷ (-5).

32 Find the quotient of -65 ÷ (-5).

Answer

13

33 Find the quotient of -126 ÷ (-3).

33 Find the quotient of -126 ÷ (-3).

Answer

42

34 Find the quotient of 104 ÷ (-4).

34 Find the quotient of 104 ÷ (-4).

Answer

-26

35 Find the quotient of -88 ÷ (11).

35 Find the quotient of -88 ÷ (11).

Answer

-8

Operations with Rational Numbers

Return to Table of Contents

New Numbers: Fractions

Just as subtraction led to a new set of numbers: negative integers.

Division leads to a new set of numbers: **fractions**.

This results when you ask questions like:

1÷2 = ?

1÷3 = ?

2÷3 = ?

1÷1,000,000 = ?

New Numbers: Fractions

1÷2 = ? asks the question:

If I divide 1 into 2 equal pieces, what will be the size of each?

The answer to this question cannot be found in the integers.

New numbers were needed.

Fractions

The space between any two integers can be divided by any integer you choose...as large a number as you can imagine.

There are as many fractions between any pair of integers as there are integers.

Fractions can be written as the ratio of two numbers:

$$\frac{2}{3}, \frac{1}{4}, \frac{1}{8}, \frac{1}{3}, \frac{4}{5}, \frac{7}{5}, \frac{80}{4} \text{ etc.}$$

Or in decimal form by dividing the numerator by the denominator:

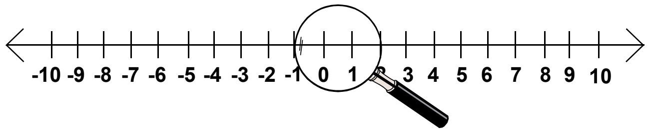
$-0.\overline{666}$, -0.25, -0.125, $0.\overline{333}$, 0.8,1.4, 20, etc.

The bar over "666" and "333" means that pattern repeats forever.

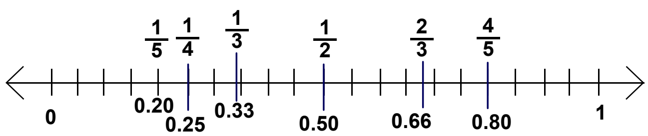
Fractions

There are an infinite number of fractions between each any integers.

Looking closely between 0 and 1, we can locate a few of them.



It's easier to find their location when they are in decimal form since it's clear which integers they're between...and closest to.



Rational Numbers

Rational Numbers are numbers that can be expressed as a ratio of two integers.

This includes all the fractions, as well as all the integers.

What are a few ways you could write 5 as a ratio of two integers?

Rational Numbers

Rational Numb... d as a ratio of two integers

This includes ... rs.

What are a ... o integers?

Math Practice

MP6 - Attend to precision.

Ask:

- What mathematical terms apply in this situation?
- How are you showing the meaning of the terms with your representation?

Rational Numbers

Fractions can be written in "fraction" form or decimal form.

When written in decimal form, rational numbers are either:

Terminating, such as

$-\frac{1}{2} = -0.500000000000 = -0.5$

Repeating, such as

$\frac{1}{7} = 0.142857142857142857... = 0.\overline{142857}$

Or,

$\frac{1}{3} = 0.333333333333333333... = 0.\overline{33}$

Fractions and the Negative Sign

When we have a negative fraction, the negative sign can be in different places.

The following all are negative one-half.

$\frac{-1}{2}$ $-\left(\frac{1}{2}\right)$

$-\frac{1}{2}$ $\frac{1}{-2}$ $\left(-\frac{1}{2}\right)$

Why are they all negative?

Fractions and the Negative Sign

When we have a ne... ...n be in

The f...

Answer

Because the fraction bar signifies division. When dividing a positive by a negative, or a negative by a positive, your answer is negative. A number is also negative if you perform the operation of division and then make the fraction negative.

Note: This topic is new to 7th Grade.

$-\frac{1}{2}$ ...2)

Why are they all negative?

Fractions and the Negative Sign

These two fractions equal positive one-half.

$\frac{-1}{-2}$ $-\left(-\frac{1}{2}\right)$

Why are they both positive?

Slide 103 / 206

Fractions and the Negative Sign

These

Answer

Because the fraction bar signifies division. When dividing a negative by a negative, your answer is positive.

A negative can also be considered the opposite sign of the original number, so the opposite of negative one half is positive one half.

Slide 103 (Answer) / 206

Dividing by Zero

One number that is not defined by our numbers and mathematical operations is dividing any number by zero.

The result of that division is "undefined."

This will be critical later when we are working with equations or simplifying fractions.

Dividing by zero is undefined since there is no way to say how many times zero can go into any number.

Slide 104 / 206

Review of Operations with Rational Numbers

The following formative assessment questions are review from 7th grade. If further instruction is need, see the presentation at:

http://njctl.org/courses/math/7th-grade/numbers-and-operations-7th-grade/

36 Convert the subtraction problem into an addition problem.

-3.7 - (-10.1)

- A -3.7 + 10.1
- B 3.7 + (-10.1)
- C -3.7 + (-10.1)
- D 3.7 + 10.1

36 Convert the subtraction problem into an addition problem.

-3.7 - (-10.1)

- A -3.7 + 10.1
- B 3.7 + (-10.1)
- C -3.7 + (-10.1)
- D 3.7 + 10.1

Answer

A

37 Convert the subtraction problem into an addition problem.

$-9-3\frac{1}{2}$

- A $-9+3\frac{1}{2}$
- B $9+(-3\frac{1}{2})$
- C $-9+(-3\frac{1}{2})$
- D $9+3\frac{1}{2}$

37 Convert the subtraction problem into an addition problem.

$-9-3\frac{1}{2}$

- A $-9+3\frac{1}{2}$
- B $9+(-3\frac{1}{2})$
- C $-9+(-3\frac{1}{2})$
- D $9+3\frac{1}{2}$

Answer

C

38 Convert the subtraction problem into an addition problem.

6.5 - (-3.2)

- A -6.5 + (-3.2)
- B -6.5 + 3.2
- C 6.5 + (-3.2)
- D 6.5 + 3.2

38 Convert the subtraction problem into an addition problem.

6.5 - (-3.2)

- A -6.5 + (-3.2)
- B -6.5 + 3.2
- C 6.5 + (-3.2)
- D 6.5 + 3.2

Answer

D

39) -10.5 + 6.2 =

39) -10.5 + 6.2 =

Answer

-4.3

40) -7.3 - (-4) =

40) -7.3 - (-4) =

Answer

11.3

41) $4\frac{1}{2} - 7\frac{2}{3}$

42) 9.27 + (-8.38) =

42) 9.27 + (-8.38) =

Answer

0.89

43) $-4.2 + (-5.9) =$

Slide 113 / 206

43) $-4.2 + (-5.9) =$

Answer

-10.1

Slide 113 (Answer) / 206

44) $-2 - (-3.95) =$

Slide 114 / 206

44) -2 - (-3.95) =

Answer

1.95

45) 5 - 6 + (-7.5) =

Hint: Remember addition and subtraction is solved left to right in the order of operations!

45) 5 - 6 + (-7.5) =

Answer

-8.5

Hint: Remember addition and subtraction is solved left to right in the order of operations!

46) 19 + (-12) - 11 =

Slide 116 / 206

46) 19 + (-12) - 11 =

Answer

-4

Slide 116 (Answer) / 206

47) -2.3 + 4.1 + (-12.7) =

Slide 117 / 206

47) -2.3 + 4.1 + (-12.7) =

Answer

-10.9

Slide 117 (Answer) / 206

48) -8.3 - (-3.7) + 5.2 =

Slide 118 / 206

48) -8.3 - (-3.7) + 5.2 =

Answer

0.6

Slide 118 (Answer) / 206

49) $16\frac{1}{2}-(-9)-21\frac{2}{5}$

49) $16\frac{1}{2}-(-9)-21\frac{2}{5}$

Answer

$4\frac{1}{10}$

50) 5(-4.82) =

50) 5(-4.82) =

Answer

-24.10

Slide 120 (Answer) / 206

51) (3.2)(-6.4) =

Slide 121 / 206

51) (3.2)(-6.4) =

Answer

20.48

Slide 121 (Answer) / 206

Slide 122 / 206

52) (-5.12)(-9) =

52) (-5.12)(-9) =

Slide 122 (Answer) / 206

Answer

46.08

Slide 123 / 206

53) $4\frac{1}{3}\left(-2\frac{2}{5}\right)=$

54) (-2)(-7.5)(-4) =

54) (-2)(-7.5)(-4) =

Answer

-60

Slide 125 / 206

55) $4\frac{1}{2}(-2)(5\frac{1}{4})$

Slide 125 (Answer) / 206

Slide 126 / 206

56) (-2.5)(-4.1)(3) =

56) (-2.5)(-4.1)(3) =

Answer

30.75

Slide 126 (Answer) / 206

57 Jane has entered a baking contest. Jane uses 3.1 ounces of flour to make one cinnamon roll. How many ounces of flour does Jane need to make 7 cinnamon rolls?

Slide 127 / 206

57 Jane has entered a baking contest. Jane uses 3.1 ounces of flour to make one cinnamon roll. How many ounces of fl... cinnamon rolls?

Answer & Math Practice

21.7 ounces

MP.4: Model with mathematics.

Ask: What connections do you see?

Write a number sentence to describe this situation.

Slide 127 (Answer) / 206

58 Timmy is shipping 4 boxes of shirts. Each box weighs 6.3 pounds. If it cost 5.20 per pound to ship. How much does Timmy have to spend to ship them?

58 Timmy is shipping 4 boxes of shirts. Each box weighs 6.3 pounds. If it cost 5.20 per pound to ship. How much does Timmy have to spend to ship them?

Answer & Math Practice

$131.04

MP.4: Model with mathematics.

Ask: What connections do you see?

Write a number sentence to describe this situation.

59 Find the value of:

$$\frac{-25.5}{5}$$

59 Find the value of:

$$\frac{-25.5}{5}$$

Answer

-5.1

60 Find the value of:

$$-7 \div \frac{1}{3}$$

60 Find the value of:

$$-7 \div \frac{1}{3}$$

Answer

-21

62 Find the value of:

$$-\frac{21}{8} \div -\frac{1}{4}$$

62 Find the value of:

$$-\frac{21}{8} \div -\frac{1}{4}$$

Answer

$$10\frac{1}{2}$$

63 Find the value of:

$$19.375 \div (-6.25)$$

63 Find the value of:

$$19.375 \div (-6.25)$$

Answer

-3.1

64 Find the value of:

$$\frac{45}{-3} \div (-5)$$

64 Find the value of:

$$\frac{45}{-3} \div (-5)$$

Answer

3

65 Kobe put 8 toy cars in a row. The line of cars was 16.4 meters long. How long was each car?

Slide 135 (Answer) / 206

65 Kobe put 8 toy cars in a row. The line of cars was 16.4 meters long. How long was each car?

Answer

2.05 meters

Slide 136 / 206

66 Olivia squeezed $^3/_4$ of a gallon of orange juice. She split the orange juice equally into 6 cups. How many gallons was in each cup?

Slide 136 (Answer) / 206

66 Olivia squeezed $^3/_4$ of a gallon of orange juice. She split the orange juice equally into 6 cups. How many gallons was in each cup?

Answer

1/8 of a gallon

Converting Repeating Decimals to Fractions

Return to
Table of
Contents

How can you convert Rational Numbers into Decimals?

Use long division!

Divide the numerator by the denominator.

If the decimal terminates or repeats, then you have a rational number.

If the decimal continues forever, then you have an irrational number.

Converting Fractions to Repeating Decimals

Example 1: $\frac{7}{33}$

Long Division Review

```
      .2121...
  33)7.0000
    - 66
       40
     - 33
        70
      - 66
         40
       - 33
          7
```

Slide 140 / 206

67 Determine the decimal equivalent of $\frac{8}{11}$

- A $0.\overline{8}$
- B $0.7\overline{2}$
- C $0.\overline{72}$
- D .1375

Slide 140 (Answer) / 206

67 Determine the decimal equivalent of $\frac{8}{11}$

- A $0.\overline{8}$
- B $0.7\overline{2}$
- C $0.\overline{72}$
- D .1375

Answer

C

Slide 141 / 206

68 Determine the decimal equivalent of $\frac{23}{33}$

- $0.1\overline{43}$
- $0.\overline{143}$
- $0.6\overline{9}$
- $0.\overline{69}$

68 Determine the decimal equivalent of $\frac{23}{33}$

- $0.1\overline{43}$
- $0.\overline{143}$
- $0.6\overline{9}$
- $0.\overline{69}$

Answer

D

69 Determine the decimal equivalent of $\frac{5}{111}$

- A $0.\overline{045}$
- B $0.0\overline{45}$
- C 0.222
- D $0.\overline{2}$

69 Determine the decimal equivalent of $\frac{5}{111}$

- A $0.\overline{045}$
- B $0.0\overline{45}$
- C 0.222
- D $0.\overline{2}$

Answer

A

Slide 143 / 206

70 Determine the decimal equivalent of $\frac{80}{333}$

- A 0.41625
- B $0.2\overline{40}$
- C $0.\overline{240}$
- D $0.\overline{41625}$

Slide 143 (Answer) / 206

70 Determine the decimal equivalent of $\frac{80}{333}$

- A 0.41625
- B $0.2\overline{40}$
- C $0.\overline{240}$
- D $0.\overline{41625}$

Answer

C

Slide 144 / 206

71 What decimal is the equivalent of $\frac{6}{11}$?

- $0.18\overline{3}$
- $0.1\overline{83}$
- $0.5\overline{4}$
- $0.\overline{54}$

From PARCC EOY sample test non-calculator #2

71 What decimal is the equivalent of $\frac{6}{11}$?

- 0.18$\overline{3}$
- 0.$\overline{183}$
- 0.5$\overline{4}$
- 0.$\overline{54}$

Answer

D

From PARCC EOY sample test non-calculator #2

Slide 144 (Answer) / 206

Repeating Decimals to Fractions

A rational number is a number that can be written as a simple fraction.

The decimal expansion of a rational number either terminates or repeats.

A repeating decimal is written using a "bar line". The bar line appears over the digit(s) that repeat.

Ex: $0.\overline{3}$ = 0.333333..., $0.\overline{12}$ = 0.121212..., $1.8\overline{3}$ = 1.833333...

Since a repeating decimal is a rational number, it can be written as a fraction.

But how do we do that?

Slide 145 / 206

Repeating Decimals to Fractions

In groups, write $0.\overline{15}$ as a fraction.

Slide 146 / 206

Steps to Convert a Decimal to a Fraction

1. Set x equal to the repeating decimal.
2. Determine how many digits repeat.
3. Multiply both sides of the equation by 10 to that power.
4. Rewrite the equation in partially expanded form.
5. Replace the repeating decimal with x.
6. Solve the 2-step equation.
7. Simplify.

Convert $0.\overline{15}$ to a Fraction

Steps

1. Set x equal to the repeating decimal.
2. Determine how many digits repeat.
3. Multiply both sides of the equation by 10 to that power.
4. Rewrite the equation in partially expanded form.
5. Replace the repeating decimal with x.
6. Solve the 2-step equation.
7. Simplify.

1. x = 0.151515...
2. x = 0.151515... (2 digits repeat)
3. $10^2x = 10^2(0.151515...)$
   100x = 100(0.151515...)
   100x = 15.1515...
4. 100x = 15 + 0.1515...
5. 100x = 15 + x
6. $100x - x = 15 + x - x$; $\frac{99x}{99} = \frac{15}{99}$
7. $x = \frac{15}{99} = \frac{5}{33}$

Convert $0.\overline{4}$ to a Fraction

Steps

1. Set x equal to the repeating decimal.
2. Determine how many digits repeat.
3. Multiply both sides of the equation by 10 to that power.
4. Rewrite the equation in partially expanded form.
5. Replace the repeating decimal with x.
6. Solve the 2-step equation.
7. Simplify.

1. x = 0.444...
2. x = 0.444... (1 digit repeats)
3. 10x = 10(0.444...)
   10x = 4.444...
4. 10x = 4 + 0.444...
5. 10x = 4 + x
6. $10x - x = 4 + x - x$; $\frac{9x}{9} = \frac{4}{9}$
7. $x = \frac{4}{9}$

Fraction Form

Write 0.5050... as a fraction.

Slide 150 / 206

Fraction Form

Write 0.5050... as a fraction.

Answer

$$\frac{50}{99}$$

Slide 150 (Answer) / 206

Fraction Form

Write 0.2727... as a fraction.

Slide 151 / 206

Fraction Form

Write 0.2727... as a fraction.

Answer

$$\frac{27}{99} = \frac{3}{11}$$

72 What is the fraction form of $0.\overline{8}$?

72 What is the fraction form of $0.\overline{8}$?

Answer

$$\frac{8}{9}$$

73 What is the fraction form of $0.\overline{26}$?

73 What is the fraction form of $0.\overline{26}$?

Answer

$$\frac{26}{99}$$

74 What is the fraction form of $0.\overline{3}$?

Slide 154 (Answer) / 206

75 What is the fraction form of $0.\overline{41}$?

Slide 155 / 206

75 What is the fraction form of $0.\overline{41}$?

Answer

$\frac{41}{99}$

Slide 155 (Answer) / 206

76 What is the fraction form of $0.\overline{534}$?

76 What is the fraction form of $0.\overline{534}$?

Answer

$$\frac{534}{999}$$

Patterns

Look over your answers for the last several questions. Do you notice any patterns?

Patterns

Look over
questi

Answer

The digits that repeat will become the numerator. The number of digits that repeat will become the number of 9's in the denominator.

Convert $0.\overline{9}$ to a Fraction

Interesting Example:

1. x = 0.999...
2. x = 0.999...
   1 digit repeats
3. 10x = 10(0.999...)
   10x = 9.999...
4. 10x = 9 + 0.999...
5. 10x = 9 + x
6. 10x = 9 + x
   $\underline{-x \quad -x}$
   $\frac{9x}{9} = \frac{9}{9}$
7. x = 1

Exponents, Squares, Square Roots & Perfect Squares

Return to Table of Contents

Powers of Integers

Just as multiplication is repeated addition, exponents are repeated multiplication.

For example, 3^5 reads as "3 to the fifth power" = $3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$

In this case "3" is the base and "5" is the exponent.

The base, 3, is multiplied by itself 5 times.

Powers of Integers

When evaluating exponents of negative numbers, keep in mind the meaning of the exponent and the rules of multiplication.

For example, $(-3)^2 = (-3)(-3) = 9$,

is the same as $(3)^2 = (3)(3) = 9$.

However, $(-3)^2 = (-3)(-3) = 9$

is NOT the same as $-3^2 = -(3)(3) = -9$,

Similarly, $(3)^3 = (3)(3)(3) = 27$

is NOT the same as $(-3)^3 = (-3)(-3)(-3) = -27$,

Powers of Integers

When evaluati... mind
the meaning...

For example...

is the sam...

However,...

is NOT the s...

Similarly,

is NOT the same as $(-3)^3 = (-3)(-3)(-3) = -27$,

Math Practice

MP.6: Attend to precision.

Emphasize the difference between -4^2 and $(-4)^2$ w/ even powers. In -4^2, only the 4 is getting squared and the negative stays in front, whereas in $(-4)^2$, -4 is being multiplied by itself, making the answer positive.

Ask: What does the exponent (which ever number it is) mean?

How do you know the sign of your answer?

77 What is $(-7)^2$?

- 49
- -49

77 What is $(-7)^2$?

- 49
- -49

Answer

A

78 What is -8^2?

- 64
- -64

78 What is -8^2?

- 64
- -64

Answer

B

79 What is -2^4?

- 16
- -16

79 What is -2^4?

- 16
- -16

Answer

B

80 What is $(-2)^6$?

- 64
- -64

80 What is $(-2)^6$?

- 64
- -64

Answer

A

81 Evaluate: 4^3

81 Evaluate: 4^3

Answer

64

82 Evaluate: $(-2)^7$

82 Evaluate: $(-2)^7$

Answer

-128

Slide 167 (Answer) / 206

83 Evaluate: $(-3)^4$

Slide 168 / 206

83 Evaluate: $(-3)^4$

Answer

81

Slide 168 (Answer) / 206

Special Term: Squares

A number raised to the second power can be said to be "squared."

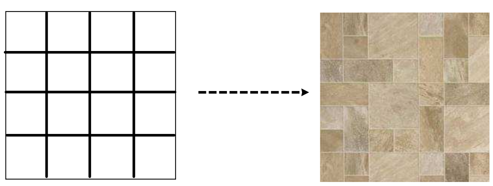
That's because the area of a square of length x is x^2: "x squared."

Slide 169 / 206

Area of a Square

The **area** of a figure is the number of square units needed to cover the figure.

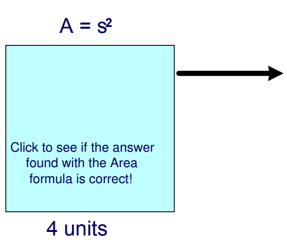
The area of the square below is 16 square units because 16 square units are needed to COVER the figure...



Slide 170 / 206

Area of a Square

The area (A) of a square can be found by squaring its side length, as shown below:



The area (A) of a square is labeled as square units, or $units^2$, because you cover the figure with squares...

Slide 171 / 206

84 What is the area of a square with sides of 5 inches?

- A $16\ in^2$
- B $20\ in^2$
- C $25\ in^2$
- D $30\ in^2$

Slide 172 / 206

84 What is the area of a square with sides of 5 inches?

- A $16\ in^2$
- B $20\ in^2$
- C $25\ in^2$
- D $30\ in^2$

Answer

C

Slide 172 (Answer) / 206

85 What is the area of a square with sides of 6 inches?

- A $16\ in^2$
- B $20\ in^2$
- C $24\ in^2$
- D $36\ in^2$

Slide 173 / 206

85 What is the area of a square with sides of 6 inches?

- A $16\ in^2$
- B $20\ in^2$
- C $24\ in^2$
- D $36\ in^2$

Answer

D

86 If a square has an area of $9\ ft^2$, what is the length of a side?

- A 2 ft
- B 2.25 ft
- C 3 ft
- D 4.5 ft

86 If a square has an area of $9\ ft^2$, what is the length of a side?

- A 2 ft
- B 2.25 ft
- C 3 ft
- D 4.5 ft

Answer

C

87 What is the area of a square with a side length of 16 in?

87 What is the area of a square with a side length of 16 in?

Answer

256 sq. in.

88 What is the side length of a square with an area of 196 square feet?

88 What is the side length of a square with an area of 196 square feet?

Answer

14 ft.

Square

When you **square** a number you multiply it by itself.

5^2 = ___ = ___ so the square of 5 is ___

You can indicate squaring a number with an **exponent** of 2, by asking for the square of a number, or by asking for a number squared.

What is the square of seven? *click* ______

What is nine squared? *click* ______

Squares

Make a list of the numbers 1-15 and then square each of them.

Your paper should be set up as follows:

Number	Square
1	1
2	4
3	

(and so on)

The Root as an Inverse Operation

Performing an operation and then the inverse of that operation returns us to where we started.

We already saw that if we add 5 to a number and then subtract 5, we get back to the original number.

Or, if we multiply a number by 7 and then divide by 7, we get back to the original number.

The Root as an Inverse Operation

Inverses of exponents are a little more complicated for two reasons.

First, there are two possible inverse operations.

The equation $16 = 4^2$ provides the answer 16 to the question: what is 4 raised to the power of 2?

One inverse operation is shown by: $4 = \sqrt{16}$

This provides the answer 4 to the question: What number raised to the power of 2 yields 16?

This shows that the square root of 16 is 4.

It's true since (4)(4) = 16

Logs as an Inverse Operation

The other inverse operation will not be addressed until Algebra 2.

Just for completeness, that inverse operation is $2 = \log_4 16$.

It provides the answer 2 to the question:

To what power must 4 be raised to get 16.

You'll learn more about that in Algebra II, but you should realize it's the other possible inverse operation.

Slide 182 / 206

The Root as an Inverse Operation

Number	Square
1	1
2	4
3	9
4	16
5	25
6	36
7	49
8	64
9	81
10	100
11	121
12	144
13	169
14	196
15	225

The numbers in the right column are squares of the numbers in the left column.

If you want to "undo" squaring a number, you must take the **square root** of the number. The symbol for square root is called the radical sign and it looks like this: $\sqrt{\ }$

So, the numbers in the left column are the square roots of the numbers in the right column. For example:

$$\sqrt{81} = 9$$

Slide 183 / 206

Perfect Square

Number	Square
1	1
2	4
3	9
4	16
5	25
6	36
7	49
8	64
9	81
10	100
11	121
12	144
13	169
14	196
15	225

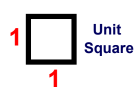
When the square root of a number is a whole number, the number is called a **perfect square**.

Since all of the numbers in the right hand column have whole numbers for their square roots, this is a list of the first 15 perfect squares.

Slide 184 / 206

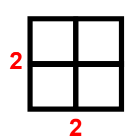
A Closer Look at Perfect Squares

A number is a perfect square if you can take that quantity of 1x1 unit squares and form them into a square.



For Example:
4 is a perfect square, because you can take 4 unit squares and form them into a 2x2 square.

(Notice that the square root of 4 is the length of one of its sides, since that side times itself equals 4.)



Is 5 a perfect square? Explain how you know.

Find the Square Root

You may refer to your chart if you need to.

$\sqrt{4} = \square$

$\sqrt{49} = \square$

$\sqrt{64} = \square$

$\sqrt{1} = \square$

$\sqrt{0} = \square$

Slide 185 / 206

89 What is $\sqrt{1}$?

Slide 186 / 206

89 What is $\sqrt{1}$?

Answer

1

Slide 186 (Answer) / 206

90 What is $\sqrt{81}$?

90 What is $\sqrt{81}$?

Answer

9

91 What is the square of 15?

91 What is the square of 15?

Answer

225

92 What is $\sqrt{256}$?

92 What is $\sqrt{256}$?

Answer

16

93 What is 13^2?

Slide 190 / 206

93 What is 13^2?

Answer

169

Slide 190 (Answer) / 206

94 What is $\sqrt{196}$?

Slide 191 / 206

94 What is $\sqrt{196}$?

Answer

14

95 What is the square of 18?

95 What is the square of 18?

Answer

324

96 What is 11 squared?

96 What is 11 squared?

Answer

121

97 What is 20 squared?

97 What is 20 squared?

Answer

400

Slide 194 (Answer) / 206

Glossary & Standards

Return to Table of Contents

Slide 195 / 206

Teacher Notes

Vocabulary Words are bolded in the presentation. The text box the word is in is then linked to the page at the end of the presentation with the word defined on it.

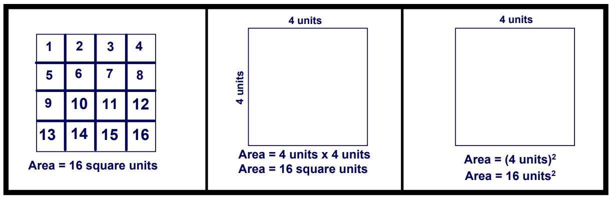
Return to Table of Contents

Slide 195 (Answer) / 206

Slide 196 / 206

Area

The number of square units needed to cover a figure.



Back to Instruction

Slide 197 / 206

Exponent

A quick way to write repeated multiplication.

also known as Power	What is 7^2? $7 \times 7 = 49$ $7^2 = 49$	ten to the power of 3 $10^3 =$ $10 \times 10 \times 10 =$ 1,000

Back to Instruction

Slide 198 / 206

Fractions

Numbers created through division written as the ratio of two numbers.

$\frac{2}{3}$ $\frac{1}{4}$ $\frac{1}{8}$ $\frac{1}{3}$ $\frac{4}{5}$ $\frac{7}{5}$ $\frac{80}{4}$	Dividing by zero is not allowed.

Back to Instruction

Integers

Positive numbers, negative numbers and zero

..., -2, -1, 0, 1, 2, ...	$\mathbb{Z}$ symbol for integers

Back to Instruction

Inverse Operation

The operation that reverses the effect of another operation.

Addition + ↓ ↑ − Subtraction Multiplication x ↓ ↑ ÷ Division	- 5 + x = 5 + 5 + 5 x = 10	11 = 3y + 2 - 2 - 2 9 = 3y ÷ 3 ÷ 3 3 = y

Back to Instruction

Natural Numbers

Counting numbers

1, 2, 3, 4, ...	$\mathbb{N}$ symbol for natural numbers

Back to Instruction

Perfect Square

A number made by squaring a whole number.

49 ✓ $\sqrt{49} = 7$ (7)(7) = 49	169 ✓ $\sqrt{169} = 13$ (13)(13) = 169	24 ✗ $\sqrt{24} = 4.898...$ 4.89897... ≠ whole number

Back to Instruction

Square

To multiply a number by itself.

What is 4 squared? $4^2 =$ 4 x 4 = (4)(4) = 16	What is the square of 6? $6^2 =$ 6 x 6 = (6)(6) = 36	What is 10 squared? $10^2 =$ 10 x 10 = (10)(10)= 100

Back to Instruction

Square Root

A value that, when multiplied by itself, gives the number. The result of undoing the squaring of a number.

Symbol: $\sqrt{\ }$ "radical sign"	$\sqrt{64} = 8$ (8)(8) = 64 8 x 8 = 64	$\sqrt{121} = 11$ (11)(11) =121 11x11 = 121

Back to Instruction

Whole Numbers

Counting numbers including 0

0, 1, 2, 3, ...	$\mathbb{W}$ symbol for whole numbers

Back to Instruction

Standards for Mathematical Practice

MP1 Making sense of problems & persevere in solving them.

MP2 Reason abstractly & quantitatively.

MP3 Construct viable arguments and critique the reasoning of others.

MP4 Model with mathematics.

MP5 Use appropriate tools strategically.

MP6 Attend to precision.

MP7 Look for & make use of structure.

MP8 Look for & express regularity in repeated reasoning.

Click on each standard to bring you to an example of how to meet this standard within the unit.

COMMON CORE STATE STANDARDS INITIATIVE
PREPARING AMERICA'S STUDENTS FOR COLLEGE & CAREER