Unit 8: Operations with Rational Numbers
Standards, Checklist and Concept Map

Common Core Georgia Performance Standards (CCGPS):

MCC7.NS.1a: Describe situations in which opposite quantities combine to make 0.

MCC7.NS.1b: Understand $p + q$ as the number located a distance $|q|$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.

MCC7.NS.1c: Understand subtraction of rational numbers as adding the additive inverse, $p – q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.

MCC7.NS.1d: Apply properties of operations as strategies to add and subtract rational numbers.

MCC7.NS.2a: Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (-1)(-1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.

MCC7.NS.2b: Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then $–(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts

MCC7.NS.2c: Apply properties of operations as strategies to multiply and divide rational numbers.

MCC7.NS.2d: Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

MCC7.NS.3: Solve real-world mathematical problems involving the four operations with rational numbers.

What Will I Need to Learn??

Mark a check next to each concept as you master them.

_____ To show integer addition and subtraction on a number line

_____ To understand that the sum of opposites is zero

_____ To add and subtract integers, including in real-life situations (wd. problems)

_____ Understand that subtracting is the same as adding the inverse

_____ How to multiply integers

_____ How to divide integers

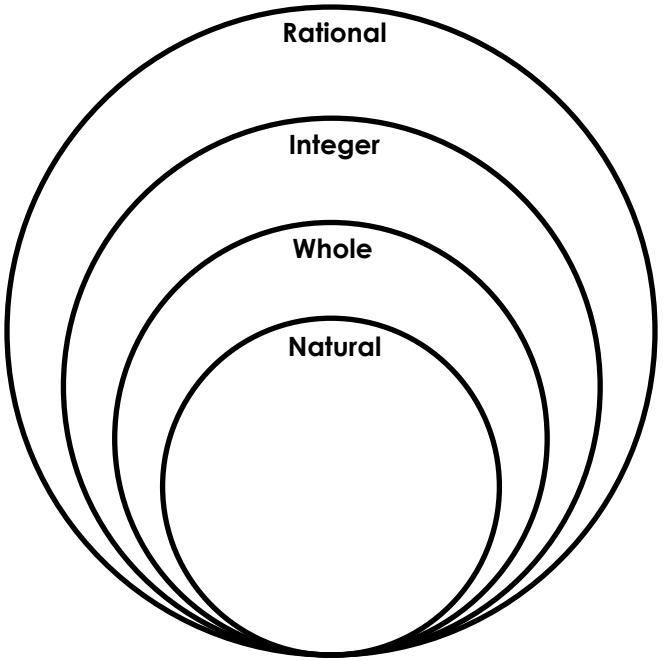
_____ Convert fractions (rational numbers) to decimals

_____ How to solve problems with rational numbers

Unit 1 Concept Map: On the left page, make a concept map of the standards listed above. Underline the verbs and circle the nouns they modify. Then, place those verbs on the connector lines of your concept map, and the nouns in the bubbles of the concept map.

Unit 8 Vocabulary

Vocabulary Term	Definition
Distributive Property	To multiply a sum by a number, multiply each addend of the sum by the number outside the parentheses.
Positive number	A number greater than zero
Negative number	A number less than zero
Opposite numbers	Two numbers with the same numeral but opposite signs (they are the same distance from zero on the number line, in opposite directions)
Natural numbers	"Counting numbers" from one to infinity
Whole numbers	"Counting numbers" from zero to infinity (all natural numbers and zero)
Integers	Whole numbers and their opposites
Rational numbers	A real number that can be written as an integer, a fraction, or a repeating or terminating decimal



Adding Rational Numbers

To add rational numbers with the same sign, add their absolute values.
The sum is:

- positive if both integers are positive.
- negative if both integers are negative.

To add rational numbers with different signs, subtract their absolute values.
The sum is:

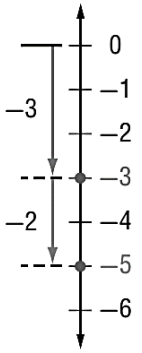
- positive if the positive integer's absolute value is greater.
- negative if the negative integer's absolute value is greater.
- **Remember:** What do you have more of, positives or negatives, and how many more do you have?

Examples:

1. Find $-3 + (-2)$.

Start at 0. Move 3 units down to show -3.

From there, move 2 units down to show -2.

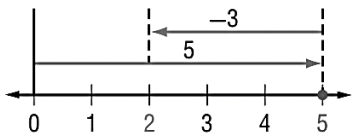


So, $-3 + (-2) = -5$.

2. Find $-26 + (-17)$.

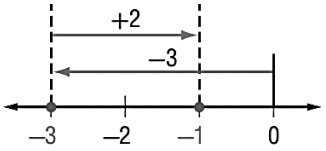
$-26 + (-17) = -43$

3. Find $5 + (-3)$.



So, $5 + (-3) = 2$.

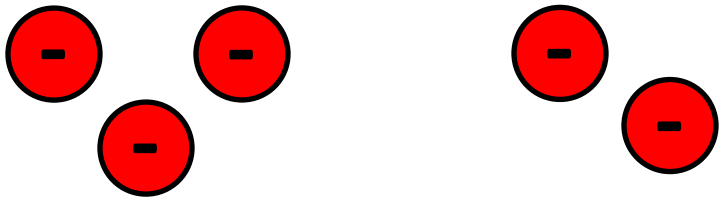
4. Find $-3 + 2$.



So, $-3 + 2 = -1$.

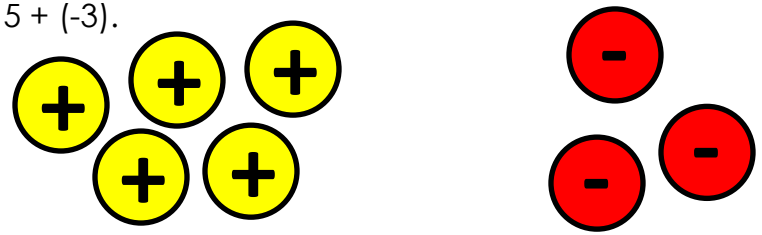
Find the sum using two-color counters.

Find -3 + (-2).

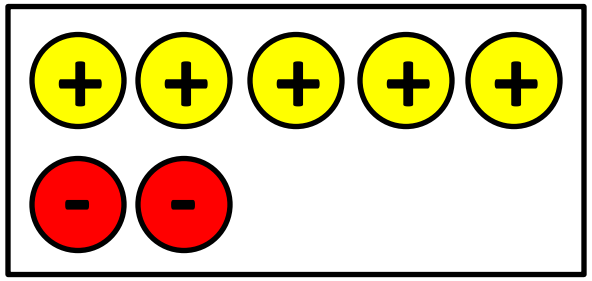


Three negatives (-3) plus another two negatives (-2) gives you five negatives (-5).

Find 5 + (-3).

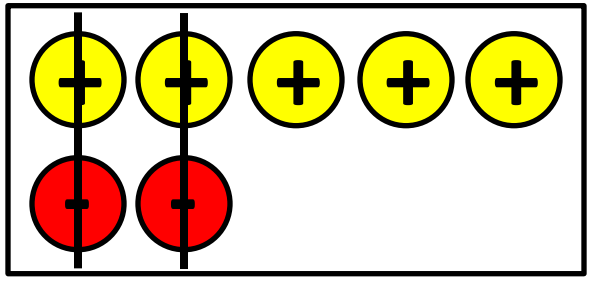


First, match up your zero pairs.



Remember that the sum of a number and its opposite is always 0. A number and its opposite are zero pairs.

Then cross out your zero pairs.



There are three positives left so, $5 + (-2) = 3$.

You Try:

Use (+) and (–) counters or a number line to find the sum.

1. –5 + (–2)

2. 8 + 1

3. –7 + 10

4. 16 + (–11)

5. –22 + (–7)

6. –50 + 50

7. –10 + (–10)

8. 100 + (–25)

9. –35 + (–20)

Use any method to find the sum.

10. –7 + (–3) + 10

11. –42 + 36 + (–36)

12. –17 + 17 + 9

13. 5 + (–8)

14. –3 + 3

15. –3 + (–8)

16. –7 + (–7)

17. –8 + 10

18. –7 + 13

19. $\frac{5}{8}+\frac{1}{8}$

20. $-\frac{1}{4}+\frac{3}{4}$

21. $-\frac{7}{15}+(-\frac{4}{15})$

22. –1.4 + (–1.3)

23. 1.4 + (–.27)

24. –28 + 1.6

25. 5 + 11 + (–5)

26. 7 + (–5) + 5

27. 9 + (–9) + 10

Write an addition expression to describe each situation. Then find each sum.

28. HAWK A hawk is in a tree 100 feet above the ground. It flies down to the ground.

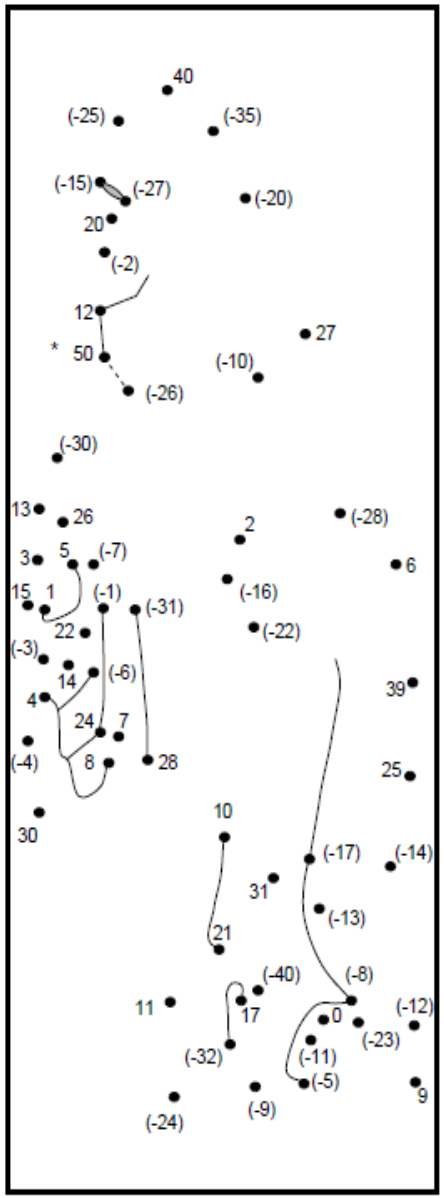
29. RUNNING Leah ran 6 blocks north then back 4 blocks south.

Answer the problems below and connect the dots in the order they are given. The pattern is started for you. Note: The two patterns are not connected together.

PATTERN #1

41 + 9 = 50
(-9) + (-17) = (-26)
(-20) + (-11) = ____
(-5) + 4 = ____
(-14) + 7 = ____
(-3) + 8 = ____
13 + 13 = ____
(-14) + (-16) = ____
(-7) + 20 = ____
(-4) + 7 = ____
(-2) + 3 = ____
21 + (-6) = ____
5 + (-9) = ____
17 + 13 = ____
(-4) + 8 = ____
0 + (-3) = ____
5 + 9 = ____
11 + 11 = ____
(-14) + 8 = ____
12 + 12 = ____
11 + (-3) = ____
3 + 4 = ____
11 + 17 = ____
0 + 11 = ____
(-10) + (-14) = ____
5 + (-14) = ____
(-20) + (-20) = ____
(-3) + 20 = ____
(-10) + (-22) = ____
2 + 19 = ____

LINE ENDS



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PATTERN #2

(-18) + 8 = ____
(-3) + 5 = ____
(-10) + (-6) = ____
(-11) + (-11) = ____
6 + 4 = ____
33 + (-2) = ____
1 + (-18) = ____
(-18) + 5 = ____
(-8) + 0 = ____
2 + (-25) = ____
2 + (-2) = ____
(-9) + (-2) = ____
(-3) + (-2) = ____
6 + 3 = ____
(-20) + 8 = ____
(-3) + (-11) = ____
35 + (-10) = ____
20 + 19 = ____
3 + 3 = ____
(-19) + (-9) = ____
6 + 21 = ____
(-4) + (-16) = ____
(-30) + (-5) = ____
20 + 20 = ____
25 + (-50) = ____
(-5) + (-10) = ____
(-5) + (-22) = ____
9 + 11 = ____
3 + (-5) = ____
8 + 4 = ____

LINE ENDS

More Adding Rational Numbers

If a = -3, b = -5 and c = 5, find the sum.

1. c + b

2. a + |b|

3. |a + b|

4. a + b + c

5. a + |c + b|

6. a + c

If x = -10, y = 2 and z = -1, find the sum.

7. x + z

8. |z| + x

9. |x + y + z|

10. z + y

11. x + y

12. |x + y| + z

Write an addition expression to describe each situation. Then find each sum.

13. FOOTBALL A team gains 20 yards. Then they lose 7 yards.

14. MONEY Roger owes his mom $5. He borrows another $6 from her.

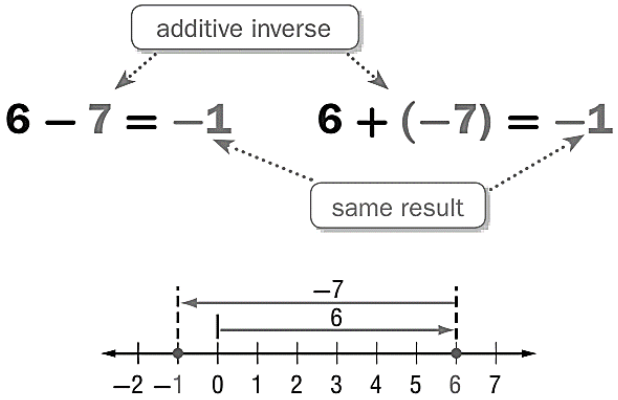
15. HOT AIR BALLOON A balloon rises 340 feet into the air. Then it descends 130 feet.

16. CYCLING A cyclist travels downhill for 125 feet. Then she travels up a hill 50 feet.

Subtracting Rational Numbers

Are you able to add rational numbers? Then you are able to subtract integers.

To subtract an integer, add its additive inverse. In other words, you subtract rational numbers by adding the opposite.



Examples:

1. **Find 8 − 13.**

$8 - 13 = 8 + (-13)$ To subtract 13, add -13.

$= -5$ Simplify.

Check by adding $-5 + 13 \stackrel{?}{=} 8$

$8 = 8$ ✓

2. **Find −10 − 7.**

$-10 - 7 = -10 + (-7)$ To subtract 7, add -7.

$= -17$ Simplify.

Check by adding $-17 + 7 \stackrel{?}{=} -10$

$-10 = -10$ ✓

You Try:

Subtract.

1. 5 – 2

2. 6 – (–7)

3. –3 – 2

4. 8 – 13

5. –7 – (–7)

6. 6 – 12

7. 15 – (–7)

8. –15 – 6

9. –3 – 8

10. –10 – 12

11. 13 – (–12)

12. 14 – (–22)

13. 10 – (–20)

14. –16 – 14

15. –25 – 25

16. 6 – (–31)

17. –18 – (–40)

18. 15 – (–61)

Evaluate each expression if r = –4, s = 10, and t = –7.

19. $r - 7$

20. $t - s$

21. $s - (-8)$

22. $t - r$

23. $s - t$

24. $r - s$

26. FOOTBALL A team gained 5 yards on their first play of the game. Then they lost 6 yards. Find the total change in yardage.

27. CHECKING Your checking account is overdrawn by $50. You write a check for $20. What is the balance in your account?

28. TEMPERATURE The average temperature in Calgary, Canada, is 22°C in July and –11°C in January. Find the range of the highest and lowest temperatures in Calgary.

Evaluate each expression if x = –8, y = 7, and z = –11.

29. $x - 7$

30. $-13 - y$

31. $-11 - z$

32. $x - z$

33. $z - y$

34. $y - x$

35. $x - (-z)$

36. $|y - z|$

37. $x - z - y$

38. $3 + -x$

Solving One-Step Equations

Solving a one-step equation with integers requires you to create zero pairs to isolate the variable.

Examples:

#1 Solve: $r + 5 = -10$

$-5 \quad -5$

$r = -15$

Check: $r + 5 = -10$

$-15 + 5 = -10$

$-10 = -10$ ✓

#2 Solve: $p - (-3) = -6$

$p + 3 = -6$

$-3 \quad -3$

$p = -9$

Check: $p - (-3) = -6$

$-9 - (-3) = -6$

$-9 + 3 = -6$

$-6 = -6$ ✓

You Try!

Solve each equation. Don't forget to check your answer.

1. $x - 13 = -22$ **2.** $x - (-4) = 10$ **3.** $y + 16 = -2$

5. $z + (-5) = 12$ **6.** $t + (-7) = -5$ **7.** $r - (-12) = -17$

8. $j + 23 = 54$ **9.** $y - 14 = 9$ **10.** $e + (-13) = -2$

Mixed Practice

Find the sum or difference.

1. -3 + 5 **2.** -7 + (-7) **3.** 3 – 7

4. -2 + 2 + (-2) + 2 **5.** 4 + 9 + (-14) **6.** -120 + 2

7. -5 – 4 **8.** 6 + (-2) – (-3) **9.** 0 – (-14)

10. -69 + - (32) **11.** -20 – 0 **12.** -30 – 2 – (-20)

13. |-13| - |13| **14.** 6 + (-4) + 9 + (-2) **15.** -5 – 4

Evaluate each expression if r = –5, s = 11, and t = –6.

19. $r - 7$ **20.** $t - s$

21. $s - (-8)$ **22.** $t - r$

23. $s - t$ **24.** $r - s$

Solve each equation. Don't forget to check your answer.

1. $x - (-4) = 7$ **2.** $y + 3 = -12$ **3.** $z - 5 = -15$

Multiplying Rational Numbers

The PRODUCT of two rational numbers with the same sign is always positive.

Examples:

1) 2(6) = 12 2) -10 (-6) = 60 3) $(-4)^2$

You Try:

1) -12 (-4) = 2) $(-5)^2$ = 3) 6 (7) =

4) -34 (-2) = 5) -20 (8) = 6) $(-2)^4$

The PRODUCT of two rational numbers with different signs is always negative.

Examples:

1) 6 (-4) = -24 2) -5 (7) = -35

You Try:

1) -7 (11) = 2) $(-3)^3$ = 3) -2 (14) =

4) (-3) (-4) (-5) = 5) (-9) (-1) (-5) = 6) 8 (-12) =

Evaluate each expression if a = -6, b = -4, c = 3, and d = 9. Show all work including substitution and computation.

7) $-5c$ = 8) b^2 = 9) $2a$ =

10) bc = 11) abc = 12) abc^3 =

30. $-3a^2$ = 31. $-cd^2$ = 32. $-2a + b$ =

Dividing Rational Numbers

The QUOTIENT of two rational numbers with the same sign is always positive.

Examples:

1) 80 ÷ (10) = 8 2) $\frac{-66}{-11} = 6$ 3) -42 ÷ (-6) = 7

You Try:

1) –14 ÷ (–7) = 2) $\frac{-80}{-20}$ = 3) -420 ÷ (-3) =

4) $\frac{540}{45}$ = 5) –24 ÷ (–8) = 6) 100 ÷ (–0) =

The QUOTIENT of two rational numbers with different signs is always negative.

Examples:

1) 80 ÷ (-10) = -8 2) $\frac{-66}{11} = -6$ 3) -42 ÷ 6 = -7

You Try:

1) -12 ÷ 4 = 2) $\frac{18}{-2}$ = 3) -10 ÷ 10 =

4) 350 ÷ (-25) = 5) $\frac{-256}{16}$ = 6) -12 ÷ (4) =

ALGEBRA Evaluate each expression if *d* = –24, *e* = –4, & *f* = 8.

7) $12 \div e$ 8) $40 \div f$ 9) $d \div 6$

10) $d \div e$ 11) $f \div e$ 12) $e^2 \div f$

13) $\frac{-d}{e}$ 14) $ef \div 2$ 15) $\frac{f+8}{-4}$

Mulitiplying and Dividing Practice

Multiply and/or Divide.

1) $-15 \div 3 =$

2) $-30(5) =$

3) $22 \div (-2) =$

4) $-14(-6) =$

5) $-8 \div (-8) =$

6) $-7\ (15) =$

7) $225 \div (-15) =$

8) $7(-3) =$

9) $-38 \div 2 =$

10) $-2(-10) =$

11) $-500 \div (-50) =$

12) $-3(-3)(4) =$

13) $(-5)^2 =$

14) $-24 \div (-8) =$

15) $20(-6) =$

16) $-49 \div (-7) =$

17) $(-13)^2 =$

18) $\frac{-36}{-4} =$

19) $-3(4) =$

20) $\frac{0}{-9} =$

21) $3(-3) =$

22) $\frac{64}{4} =$

23) $(-5)(-3)(4) =$

24) $-189 \div (-21) =$

Evaluate each expression if m = –32, n = 2, and p = –8. Show all your work!

25) $m \div n =$

26) $p \div 4 =$

27) $p^2 \div m =$

28) $m \div p =$

29) $\frac{-p}{n} =$

30) $p \div (-n^2) =$

31) $\frac{p}{4n} =$

32) $\frac{18-n}{-4} =$

33) $\frac{m+8}{-4} =$

34) $\frac{m+n}{6} =$

35) $mnp =$

36) $m \div n =$

Mixed Operation Practice