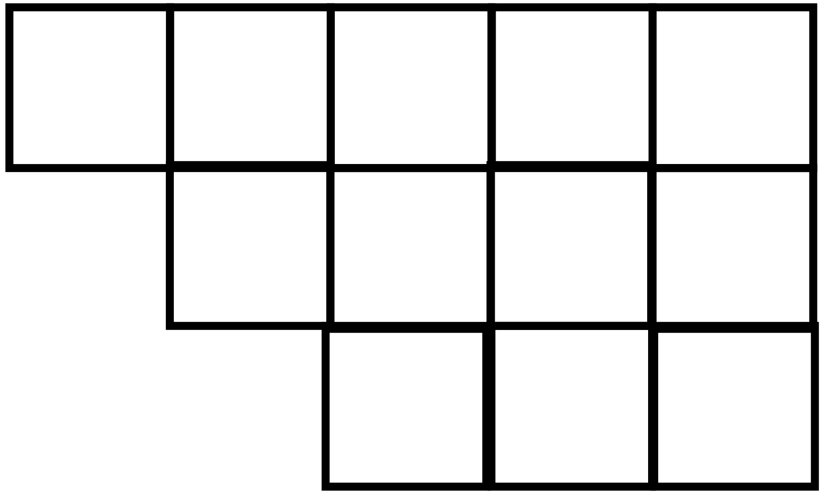
Day 2:
Absolute Value, Irrational Numbers, Multiples and Factors

Warm-up

How many boxes are there? Make an equation using integers (whole numbers).



5+4+3 = 12

1+2+3+3+3 = 12

1+2+9 = 12

1+2 + (3*3) = 12

PLATO - Unit 1, “Number Sense”

- Week 1 review:
  - The Number Line
  - Ordering Values in the Real World
  - Operations with Decimals
  - Solving Real-World Problems involving Rational Numbers

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Questions from PLATO this week?

Homework included fractions, which we did not get to in class (they will be next week!)

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  - The Number Line
  - Ordering Values in the Real World
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  - Solving Real-World Problems involving Rational Numbers

Questions from PLATO this week?

- Week 2 topics:
  - Add, Subtract, Multiply and Divide Rational Numbers
  - Absolute Values
  - Common Factors and Multiples

Integers: positive and negative numbers

- An integer can be a positive whole number (1, 2, 3…) or a negative one (-1, -2, -3…), written with a negative sign.
- Integers can be added, subtracted, multiplied and divided.
- Sometimes you may need to determine an integer's **absolute value,** or its distance from 0. Absolute value are always greater than or equal to 0, never negative.

The absolute value of both 9 and -9 is **9**

Practice!

- In the morning, the temperature was -3 degrees F. By mid-afternoon, the temperature was 12 degrees F. What was the change in temperature between the morning and afternoon?

a) -15F
b) -9F
c) 9F
d) 15F

* The change in temperature is found by subtracting the final temperature from the starting temperature: (12F) – (-3F). Subtracting an integer is the same as adding it opposite, so the expression can be rewritten as (12F) + (3F) = 15F. Since the temperature increased during the day, the change is positive.

Practice!

- Maria has a balance of $154 in her savings account. She withdraws $40 from a cash machine. What is her new balance?

  a) $194
  b) $114
  c) $-114
  d) $50

Practice!

- Sasha’s home is 212 feet above sea level. She participated in a scuba dive in which she descended to 80 feet below sea level. Which integer describes Sasha’s change in position from her home to the lowest point of her dive?

  a) -292
  b) -132
  c) 132
  d) 292

Operations Review

What are the four basic math operations?

- Addition: add quantities to find a **sum**, or total.
- Subtraction: subtract to find the **difference** between two quantities.
- Multiplication: multiply quantities to find a **product** when you need to add a number many times
- Division: divide when separating a quantity into equal groups. The **dividend** is the initial quantity. The **divisor** is the number by which you divide. The **quotient** is the answer.

Factors and Multiples

Operations with Integers

Addition

Like

$2 + 7 = 9$

${}^{-}2 + {}^{-}7 = {}^{-}9$

Unlike

${}^{-}2 + 7 = 5$

$2 + {}^{-}7 = {}^{-}5$

Subtraction

$5 - {}^{-}8 = 5 + 8 = 13$

${}^{-}5 - 8 = {}^{-}5 + {}^{-}8 = {}^{-}13$

A) If integers have like signs, add and keep the common sign. If they have different signs, find the difference.

B) To subtract an integer, add its opposite. For example, the opposite of -5 is 5.

Multiplication

Like

$4 \times 3 = 12$

$^-4 \times {}^-3 = 12$

Unlike

$4 \times {}^-3 = {}^-12$

$^-4 \times 3 = {}^-12$

Division

Like

$10 \div 5 = 2$

$^-10 \div {}^-5 = 2$

Unlike

$10 \div {}^-5 = {}^-2$

$^-10 \div 5 = {}^-2$

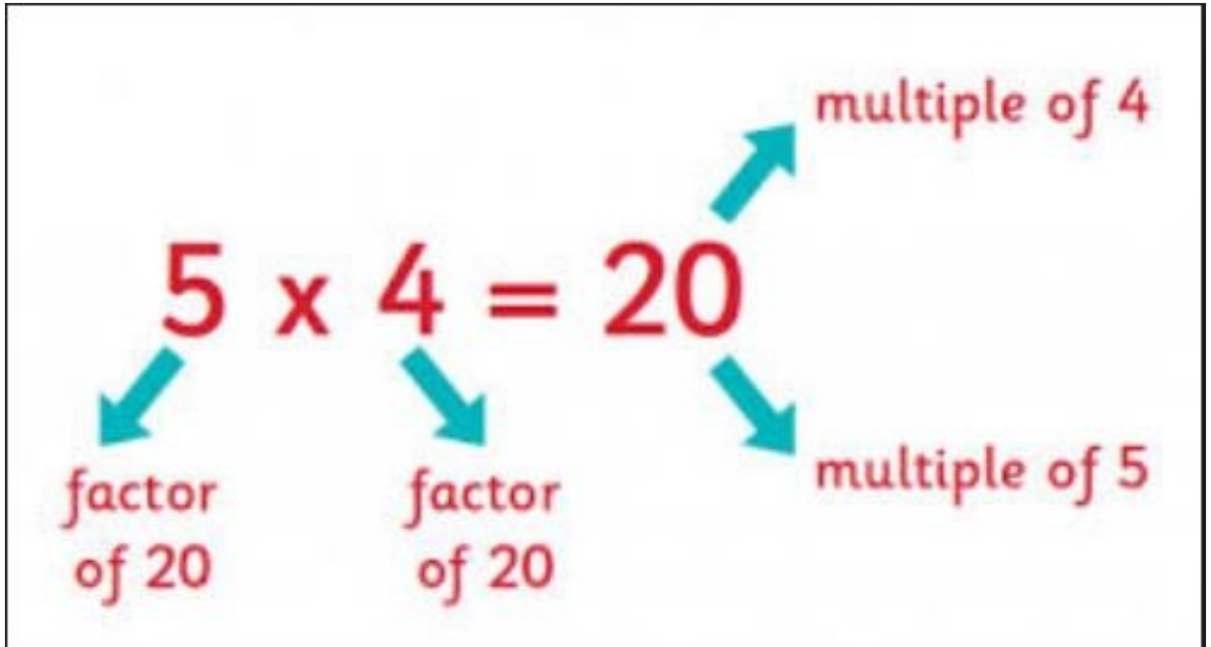
C) For multiplying and dividing integers: if the signs are the same, the answer will be positive. If the signs are different, the answer will be negative.

Factors and Multiples

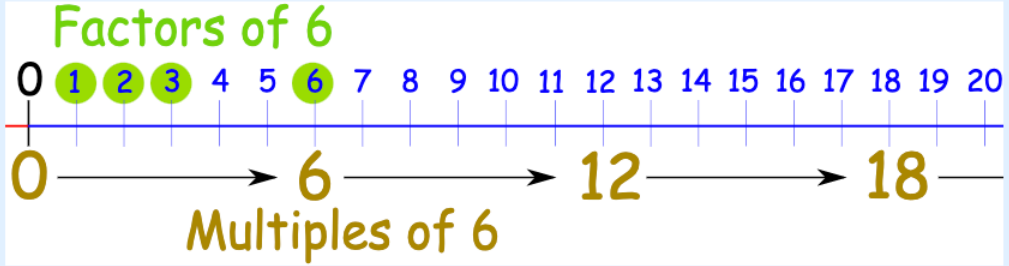
Factors and multiples are **different** things.

But they both involve **multiplication**:

- Factors are what we can multiply to get the number
- Multiples are what we get **after** multiplying the number by an integer (not a fraction).



Example: the positive factors, and some multiples, of 6:



Factors:

- $1 \times 6 = 6$, so **1** and **6** are factors of 6
- $2 \times 3 = 6$, so **2** and **3** are factors of 6

Multiples:

- $0 \times 6 = 0$, so **0** is a multiple of 6
- $1 \times 6 = 6$, so **6** is a multiple of 6
- $2 \times 6 = 12$, so **12** is a multiple of 6
- and so on

(Note: there are negative factors and multiples as well)

Factors

"Factors" are the numbers we can **multiply together** to get another number:

$$\underset{\text{Factor}}{2} \times \underset{\text{Factor}}{3} = 6$$

2 and 3 are factors of 6

A number can have **many** factors.

Example: 12

- $3 \times 4 = 12$, so **3** and **4** are factors of 12
- Also $2 \times 6 = 12$, so **2** and **6** are also factors of 12,
- And $1 \times 12 = 12$, so **1** and **12** are factors of 12 as well.

AND because multiplying negatives makes a positive, −1, −2, −3, −4, −6 and −12 are also factors of 12:

- $(-1) \times (-12) = 12$
- $(-2) \times (-6) = 12$
- $(-3) \times (-4) = 12$

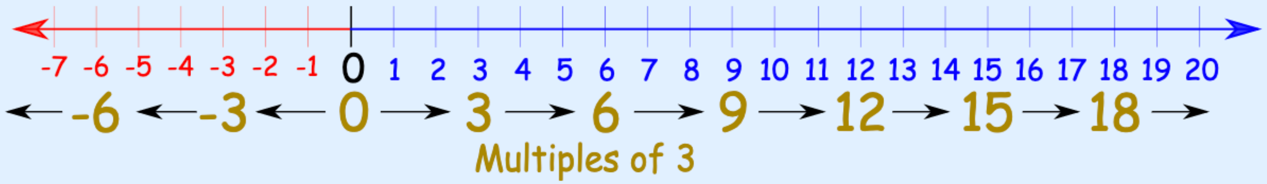
So ALL the factors of 12 are:

1, 2, 3, 4, 6 and 12
AND **−1, −2, −3, −4, −6 and −12**

Multiples

A multiple is the result of **multiplying** a number **by an** **integer** (not a fraction).

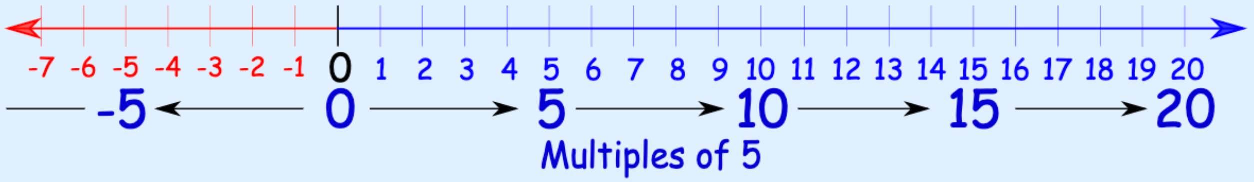
Example: Multiples of 3:



..., −9, −6, −3, 0, 3, 6, 9, ...

Example: 15 **is** a multiple of 3, as 3 × 5 = 15
Example: 16 is **not** a multiple of 3

Example: Multiples of 5:



..., −15, −10, −5, 0, 5, 10, 15, ...

Example: 10 **is** a multiple of 5, as 5 × 2 = 10
Example: 11 is **not** a multiple of 5

Practice!

- Four friends went for pizza. The total cost for appetizers, pizza, and drinks was $64. If the friends split the cost equally, how much did each friend pay?

Practice!

- Four friends went for pizza. The total cost for appetizers, pizza, and drunks was $64. If the friends split the cost equally, how much did each friend pay?

- Since the four friends split the $64 cost equally, divide 64 by 4. Dividing the first digit of the dividend (6) by the divisor (4) gives 1 as the tens digit of the quotient. Multiplying 4 by 1, writing the product (4) under 6 in the dividend, and subtracting gives a 2. Next, after you carry down the ones digit in the dividend (4), divide 24 by the divisor (4), getting 6 as the ones digit in the quotient.

Practice!

- Not including 1 and 60, which whole numbers are factors of the number 60?

Practice!

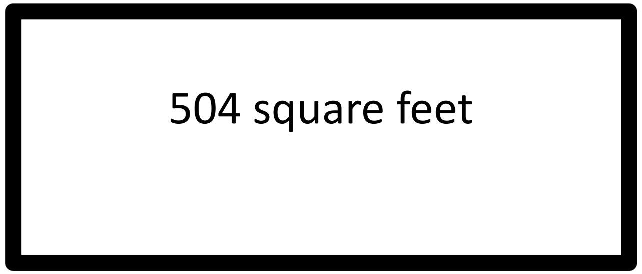
- Not including 1 and 60, which whole numbers are factors of the number 60?

2, 3, 4, 5, 6, 10, 12, 15, 20, 30

- Since 60 is an even number, 2 is the smallest factor; dividing 60 by 2 gives you 30, the largest factor. The remaining factors can be found by looking for numbers between 2 and 30 that divide evenly into 60.

Practice!

➢**DIRECTIONS:** Study the diagram and then write your answer in the box below.



Claire is purchasing bags of mulch to cover her vegetable garden. One bag of mulch will cover 12 square feet. How many bags of mulch will Claire need?

Practice!

- **DIRECTIONS:** Study the diagram and then write your answer in the box below.

504 square feet

Claire is purchasing bags of mulch to cover her vegetable garden. One bag of mulch will cover 12 square feet. How many bags of mulch will Claire need?

42

- To find the answer, divide 504 by 12.

- My car has a 15 gallon gas tank. At the Speedway, gas is $2.50 per gallon.

- I have $40. Can I fill up my tank all the way?

Rational vs. Irrational Numbers

An **Irrational Number** is a real number that **cannot** be written as a simple fraction.

Irrational means **not Rational**

$1.5 = \frac{3}{2}$ Ratio

Rational

$\pi = 3.14159\ldots = \frac{?}{?}$ (No Ratio)

Irrational

Rational Numbers

A **Rational** Number **can** be written as a **Ratio** of two integers (ie a simple fraction).

Example: **1.5** is rational, because it can be written as the ratio **3/2**

Example: **7** is rational, because it can be written as the ratio **7/1**

Example **0.333...** (3 repeating) is also rational, because it can be written as the ratio **1/3**

Irrational Numbers

But some numbers **cannot** be written as a ratio of two integers ...

...they are called **Irrational Numbers**.

Example: π **(Pi)** is a famous irrational number.

π = 3.1415926535897932384626433832795... (and more)

We **cannot** write down a simple fraction that equals Pi.

The popular approximation of $^{22}/_{7}$ = 3.1428571428571... is close but **not accurate**.

Another clue is that the decimal goes on forever without repeating.

Cannot Be Written as a Fraction

*It is **irrational** because it cannot be written as a **ratio** (or fraction),*
not because it is crazy!

So we can tell if it is Rational or Irrational by trying to write the number as a simple fraction.

Example: **9.5** can be written as a simple fraction like this:

$$9.5 = \frac{19}{2}$$

So it is a **rational number** (and so is **not irrational**)

Here are some more examples:

Number	As a Fraction	Rational or Irrational?
1.75	$\frac{7}{4}$	????
.001	$\frac{1}{1000}$	????
√2 (square root of 2)	?	????

PLATO Homework – to review Week 2 topics:

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- Absolute Values
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Study tip:

Write down any problems that were difficult for you.

Next week we will have a chance to address them.