Unit 1
Integer Math, Exponents and Order of Operations

Math Essentials

1

Place value

- **Digit-** a number 0, 1, 2, 3, 4, 5, 6, 7, 8, or 9
- **Periods-** groups of 3 digits, called ones, thousands, millions, billions, trillions, and so on

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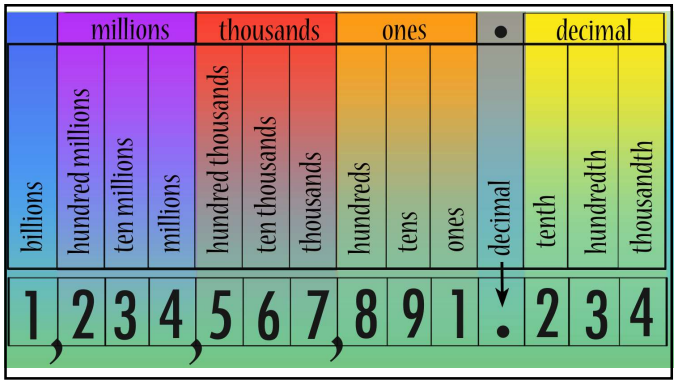

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Practice 1.1

Which digit is in each of the following place values?

9,054,067,312

1. Ones
2. Ten thousands
3. Hundreds
4. Hundred millions

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Practice 1.2

In each of the following numbers, what does the digit 8 mean?

1. 278,342
2. 872,342
3. 28,343,399,223
4. 98,413,099
5. 6328

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Numbers to Words

3,024,107 = 3 millions
+ 2 ten thousands
+ 4 thousands
+ 1 hundred
+ 7 ones

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Numbers to Words

- Example
  - **46,605,314,732**
  - Forty-six billion, six hundred five million, three hundred fourteen thousand, seven hundred thirty-two

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Practice 1.3

Write each number in standard notation.

1. Fifty thousand, three hundred twenty-four
2. Nineteen million, six hundred ten thousand, four hundred thirty-nine

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Consider...

- You go to the Bentonville Famers' Market to do some shopping. At your favorite coffee stand, a small iced coffee is $2.64 and a cinnamon roll is $4.15. You also need 3 tomatoes which are $0.45 each, a block of cheddar cheese for $2.95, and a loaf of bread for $8.25.
- If all you have is a $20 bill, will you be able to purchase all that you need (want) at the market? No calculators! (Don't consider tax)

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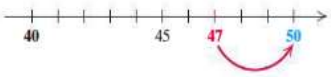
Rounding

We round in situations where we do not need an exact answer.

Example: Round 47 to the nearest ten.

47 is between 40 and 50. Since 47 is closer to 50, we round up to 50.



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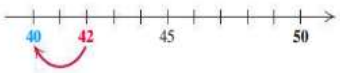
Rounding

Example: Round 42 to the nearest ten.

42 is between 40 and 50. Since 42 is closer to 40, we round down to 40.



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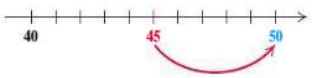
Rounding

Example: Round 45 to the nearest ten.

45 is halfway between 40 and 50. We could round 45 down to 40 or up to 50. We agree to round up to 50.



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Rounding

To round to a certain place:

1. Locate the digit in that place.
2. Look to the digit to the RIGHT.
3. If the digit to the right is 5 or greater, round up. If 4 or lower, round down.
4. Change all digits to the right of the rounding location to zeros.

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Rounding

Try it!

Round 6485 to the nearest ten.

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EXAMPLE 4 Round 6485 to the nearest ten.

a) Locate the digit in the tens place, 8.

6 4 8 5

b) Consider the next digit to the right, 5.

6 4 8 5

c) Since that digit, 5, is 5 or higher, round 8 tens up to 9 tens.

d) Change all digits to the right of the tens digit to zeros.

6 4 9 0 ← This is the answer.

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Practice 1.4

1. Round 48,943 to the nearest ten.
2. Round 48,943 to the nearest hundred.
3. Round 48,943 to the nearest thousand.
4. Round 48,943 to the nearest ten thousand.

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Practice 1.5

Round 5950 to the nearest hundred.

Note: When a nine rounds up, it increases the digit to the left and becomes a zero.

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Practice 1.6

Add

1. $350 + 2$
2. $350 + 20$
3. $353 + 24$
4. $359 + 24$
5. $30{,}593 + 2{,}578$

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Practice 1.7

Subtract

1. $53 - 2$
2. $50 - 2$
3. $500 - 2$
4. $516 - 29$
5. $30{,}593 - 2{,}578$

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Practice 1.8

Multiply

1. 5×8
2. 5×1
3. $5 \cdot 0$
4. $(15)(100)$
5. 15×8

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Consider...

- You owe $200 on your credit card statement. How do we represent this number mathematically? What if you have $200 saved up in a bank account?

- What is the difference between 50° F and -50° F?

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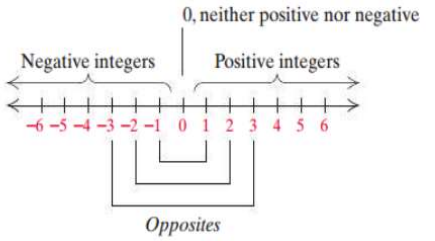
Integers- the whole numbers and their opposites



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Integers

What do negative numbers mean in terms of...

- Elevation?
- The stock market?
- Temperatures?

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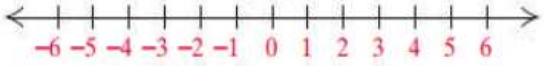
Order on the number line

Numbers increase on a number line as we move left to right.



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Order on the number line

- Numbers increase on a number line as we move left to right.
- Fill in the blank with < or >

-2 ___ 0

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Practice 1.9

Plot -9,11, and 3 on a number line

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Practice 1.10

Fill in the blanks with < or > or =

1. -4 ___ -7
2. -3 ___ 11
3. -11 ___ -2

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Practice 1.11

Fill in the blanks with < or >

1. -1 ___ 5
2. -6 ___ -4
3. 1 ___ -2

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Opposites

- If you reflect 2 across 0, you get to –2. And if you reflect –2 over 0, you get 2!
- **Opposites** have the **same absolute value** but **different signs**.
- Example: What is the opposite of…1? -3? 0?

$$1 \to -1, \quad -3 \to 3, \quad 0 \to 0$$

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Consider...

What is...

1. $2 + 3$
2. $-2 + 3$
3. $2 + (-3)$
4. $-2 + (-3)$

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Addition

To find a+b, start at a and move according to b.

1. If b is positive, move from a to the RIGHT.
2. If b is negative, move from a to the LEFT.
3. If b=0, stay at a.

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Number Line Handout

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Practice 1.12

1. $-1+7$
2. $5+(-8)$
3. $-3+(-7)$
4. $4+(-4)$
5. $3+(-1)+2$

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Adding positive and negative integers

To add a positive and a negative integer, find their **DIFFERENCE.**

- If the **negative** integer has the greater absolute value, the answer is negative. $-9 + 5$
- If the **positive** integer has the greater absolute value, the answer is positive. $9 + (-5)$
- If the integers have the **same** absolute value, the answer is 0. $9 + (-9)$

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Practice 1.13

Fill in the blanks with < or >

1. -1 ___ 5
2. -6 ___ -4

Add the following

3. $2 + (-3)$
4. $-12 + (-9)$
5. $-8 + 1 + 2$

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Consider...

- There are 12 muffins in the pan and you eat 4 of them. How many are left over?
- You have $300 in your bank account, and you purchase a $500 laptop using a credit card. How much money do you have?

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Consider...

Try the following:

1. $3 - 2$
2. $2 - 3$
3. $3 - (-2)$
4. $-3 - (-2)$

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Number Line Handout (Subtracting)

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Practice 1.14

Evaluate the following:

1. $4 - 3$
2. $4 + (-3)$
3. $3 - 9$
4. $3 + (-9)$

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Subtraction

Subtracting is the same as **adding the opposite.**

$$a - b = a + (-b)$$

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Practice 1.15

Subtract the following

1. $-2 - 3$
2. $2 - 3$
3. $-12 - (-9)$

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Practice 1.16

Frank is riding in a bike race that goes through a valley and a nearby mountain range. The table gives the altitude (in ft above sea level) for the checkpoints in the race.

1. How much higher is Checkpoint 5 than point 2?
2. What is the altitude of a hill that rises 340 ft above Checkpoint 1?

Checkpoint	Altitude (feet above sea level)
1	−191
2	−53
3	536
4	3,248
5	2,219

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Break

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Consider...

- Joy decides to spread a little joy and write encouraging notes to two friends. At the end of the note, she tells her friends to write two encouraging notes EACH to two of their own friends. How many people will get notes after 10 repetitions of the process?
- How could we represent this situation mathematically?

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Writing Exponential Notation

- Multiplication represents repeated addition.

$$2 + 2 + 2 + 2 + 2 = 2 \times 5$$

- Exponential notation represents repeated multiplication.

$$2 \times 2 \times 2 \times 2 \times 2 = 2^5$$

- Why do we say 7 squared for 7^2?

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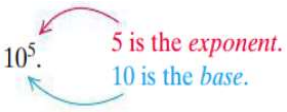
Writing Exponential Notation



NOTATION	WORD DESCRIPTION
3^4	"three to the fourth power," or "the fourth power of three"
5^3	"five cubed," or "the cube of five," or "five to the third power," or "the third power of five"
7^2	"seven squared," or "the square of seven," or "seven to the second power," or "the second power of seven"

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Evaluating Exponential Notation

- Rewrite as a product and then evaluate.
- Example: 5^3 = ?
  - $5^3 = 5 \times 5 \times 5$

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Practice 1.17

Evaluate the following.

1. 6^2
2. 2^5
3. 10^3
4. 8^2

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Practice 1.18

Rewrite $4 \times 4 \times 4$ using an exponent.

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Practice 1.19

1. $(-7)^2 =$
2. $(-4)^3 =$
3. $-(-2)^3 =$
4. $-(8)^2 =$

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Simplifying expressions

A SUP rental place rents the paddleboards for $5 per hour plus a $15 base fee. How much would it cost to paddle for 3 hours?

Which expression is correct:
15+5x3 or 5x3+15??

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The Order of Operations

1. Do all calculations within **grouping symbols**, including **P**arentheses, brackets, braces, and within numerators or denominators. — P
2. Evaluate all **Exponential** expressions. — E
3. Do all **Multiplication and Division** in order from left to right. — MD
4. Do all **Addition and Subtraction** in order from left to right. — AS

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Practice 1.20

1. $15 \div 5 \times 3$
2. $15 - 5 \times 3$
3. $15 - (5 - 4) \times 3^2$

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Practice 1.21

Evaluate

1. $4 \times 5 - 18 \div 3 + 7$
2. $-12 - 8 \div (-4)$

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Practice 1.22

$$3 - 3^3 + \big((-4)(-2)\big)^2$$

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Practice 1.23

Try the following:

1. $4^2 + 3(-1)$
2. $-2[(6 + 1) - 9]$

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Magic Square Activity

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Ladder Puzzle (Groups)

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