MAC1105C Boot Camp – Day 1

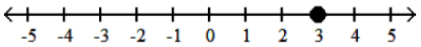
Topics

1. Absolute value
2. Operations with signed numbers
3. Rules of exponents
4. Combining like terms
5. Multiplication of polynomials

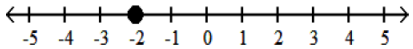
1. Absolute value

The absolute value of a number is the distance of that number from zero on the number line.
The symbol for absolute value is vertical bars on either side of the number, $|3|$.

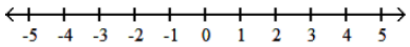
Example 1: 3 is three steps from zero on the number line, so $|3| = 3$

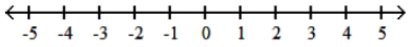


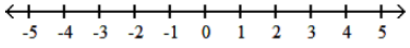
Example 2: -2 is two steps from zero on the number line, so $|-2| = 2$



Practice: Find the absolute value.

1) $|5|$ 

2) $|-1|$ 

3) $|0|$ 

Tip:

The absolute value of a positive number or zero is just that number. To find the absolute value of a negative number, just drop the negative.

2. Operations with signed numbers

<u>Addition with signed numbers</u>

If the two numbers have the same sign, then add the absolute value of the numbers and keep the sign of the two numbers.

If the two numbers have different signs, then subtract the absolute value of the smaller number from the absolute value of the larger number. Then, the answer has the sign of the number with the larger absolute value.

Example 1: $-4 + (-7)$. Since the numbers have the same sign add the absolute values of the numbers, $|-4| + |-7| = 4 + 7 = 11$. Then, since both numbers are negative, the answer is negative.
So $-4 + (-7) = -11$.

Example 2: $-8 + 5$. Since the numbers have different signs, subtract the absolute value of the numbers, $|-8| - |5| = 8 - 5 = 3$. The answer has the sign of the number with the larger absolute value, which is -8. So $-8 + 5 = -3$.

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Practice: Find the sum.

1) $-3 + (-7)$

2) $-7 + (-2)$

3) $-3 + 8$

4) $4 + (-11)$

5) $-5 + 5$

Tip:

Think of positive numbers as money you have or money you earn. Think of negative numbers of money you owe or money you spend. Then $-8 + 5$ is like you owe 8 dollars on your credit card and then you earn 5 dollars. If you use that 5 dollars to pay off your credit card, then you still owe 3 dollars. So $-8 + 5 = -3$.

Subtraction of signed numbers

Change the subtraction to addition and change the sign of the second number. Then, add the two numbers.

Example 1: $5 - 8 = 5 + (-8) = -3$

Example 2: $3 - (-7) = 3 + 7 = 10$

Practice: Find the difference.

1) $7 - 9$

2) $-3 - 5$

3) $10 - (-20)$

Multiplication and division of signed numbers

If the two numbers have the same sign, then the answer is positive.

If the two numbers have different signs, then the answer is negative.

Note: Zero divided by any non-zero number is zero, e.g. $0 \div 5 = 0$. Any non-zero number divided by zero is undefined, e.g. $-3 \div 0$ is undefined.

Practice: Find the product or quotient.

1) $8(-3)$

2) $-4 \cdot 7$

3) $(-5)(-5)$

4) $30 \div (-6)$

5) $\frac{-36}{-9}$

6) $\frac{-40}{4}$

7) $\frac{7}{0}$

8) $0 \div (-12)$

Applying order of operations

Use the word **PEMDAS** or phrase **Please Excuse My Dear Aunt Sally** to remember the order of operations.

1. **P**arentheses: Perform any operations inside parentheses or any other grouping symbols like radicals, absolute value, brackets, or within a numerator or denominator of a fraction.
2. **E**xponents: Apply any exponents.
3. **M**ultiplication and **D**ivision from left to right.
4. **A**ddition and **S**ubtraction from left to right.

Practice: Simplify.

1) $-18 - 5(-3 - 4)$

2) $5^2 - 6^2 \div (-1 - 2)$

3) $22 - 36 \div 3(-2) + 5$

4) $1 + 2[3(4 + 5)]$

5) $15 - \frac{-3+9}{5-8}$

3. Rules of exponents

$b^m \cdot b^n = b^{m+n}$ When multiplying the same base, keep the same base and add the exponents.

$\frac{b^m}{b^n} = b^{m-n}$ When dividing the same base, keep the same base and subtract the top exponent minus the bottom exponent.

$(b^m)^n = b^{mn}$ When raising a power to another power, keep the same base and multiply the exponents.

Practice: Simplify.

1) $z^5 z^2$

2) $x^2 y^3$

3) $m^2 m^3 m$

4) $\frac{x^{10}}{x^2}$

5) $\frac{s^7}{s}$

6) $\frac{t^4 t^9}{t^2}$

7) $(6x^3y^7)(-2xy^3)$

8) $(y^2)^3$

9) $(2x^5)^3$

Tip:

To help remember these rules, think of examples with numbers. For example:

$$2^3 \cdot 2^2 = 8 \cdot 4 = 32 = 2^5 = 2^{3+2}$$

$$\frac{2^4}{2^3} = \frac{16}{8} = 2 = 2^1 = 2^{4-3}$$

$$(2^3)^2 = 8^2 = 64 = 2^6 = 2^{3 \cdot 2}$$

4. Combining like terms

Like terms have the same variables and the same exponents. Add or subtract like terms by adding or subtracting the coefficients. Unlike terms cannot be combined.

Example 1: Simplify $2x + 3x$. Since $2x$ and $3x$ have the same variables to the same exponents, they are like terms. Simplify by adding the coefficients. So, $2x + 3x = 5x$.

Example 2: Simplify $2x^2 + 3x$. Since $2x^2$ and $3x$ have different exponents, they are not like terms and cannot be combined. It is already simplified.

Practice: Simplify.

1) $8x + 3x$

2) $-11y + 8y - y$

3) $7z^3 - 5z^3$

4) $6a + 5$

5) $4m^4 + 4m^3$

6) $3b^2 - 2c^2$

Tip:

When combining like terms, think of them as physical objects.

Adding $2x + 3x$ is like thinking, "if I have 2 apples and add 3 apples, then I have 5 apples."

Adding $2x^2 + 3x$ is like thinking, "if I have 2 oranges and 3 apples, then I don't have 5 of anything. I just have 2 oranges and 3 apples."

5. Multiplication of polynomials

Distributive property

$2(y - 3) = 2(y) - 2(3) = 2y - 6$

Practice: Multiply.

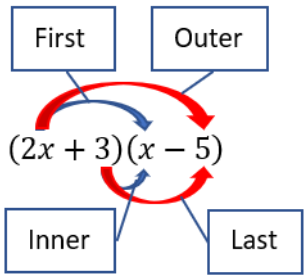
1) $2x^3(5x^2 + 3)$

2) $3a^3b(6a^2b^4 - 4ab)$

FOIL

FOIL is an acronym that stands for **F**irst, **O**uter, **I**nner, **L**ast. This is a method to multiply two binomials.

Example 1: Multiply $(2x + 3)(x - 5)$.



First: $2x(x) = 2x^2$

Outer: $2x(-5) = -10x$

Inner: $3(x) = 3x$

Last: $3(-5) = -15$

Combine like terms: $2x^2 - 10x + 3x - 15 = 2x^2 - 7x - 15$

Practice: Multiply.

1) $(d + 7)(d - 4)$

2) $(x - 5)^2$

MAC1105C Boot Camp – Day 1 – Answer Key

Topic 1 – Absolute value

1) 5
2) 1
3) 0

Topic 2 – Operations with signed numbers

Addition with signed numbers

1) -10
2) -9
3) 5
4) -7
5) 0

Subtraction of signed numbers

1) -2
2) -8
3) 30

Multiplication and division of signed numbers

1) -24
2) -28
3) 25
4) -5
5) 4
6) -10
7) Undefined
8) 0

Applying order of operations

1) 17
2) 37
3) 51
4) 55
5) 17

Topic 3 – Rules of exponents

1) z^7
2) x^2y^3
3) m^6
4) x^8
5) s^6
6) t^{11}
7) $-12x^4y^{10}$
8) y^6
9) $8x^{15}$

Topic 4 – Combining like terms

1) $11x$
2) $-4y$
3) $2z^3$
4) $6a + 5$
5) $4m^4 + 4m^3$
6) $3b^2 - 2c^2$

Topic 5 – Multiplication of Polynomials

Distributive property

1) $10x^5 + 6x^3$
2) $18a^5b^5 - 12a^4b^2$

FOIL

1) $d^2 + 3d - 28$
2) $x^2 - 10x + 25$