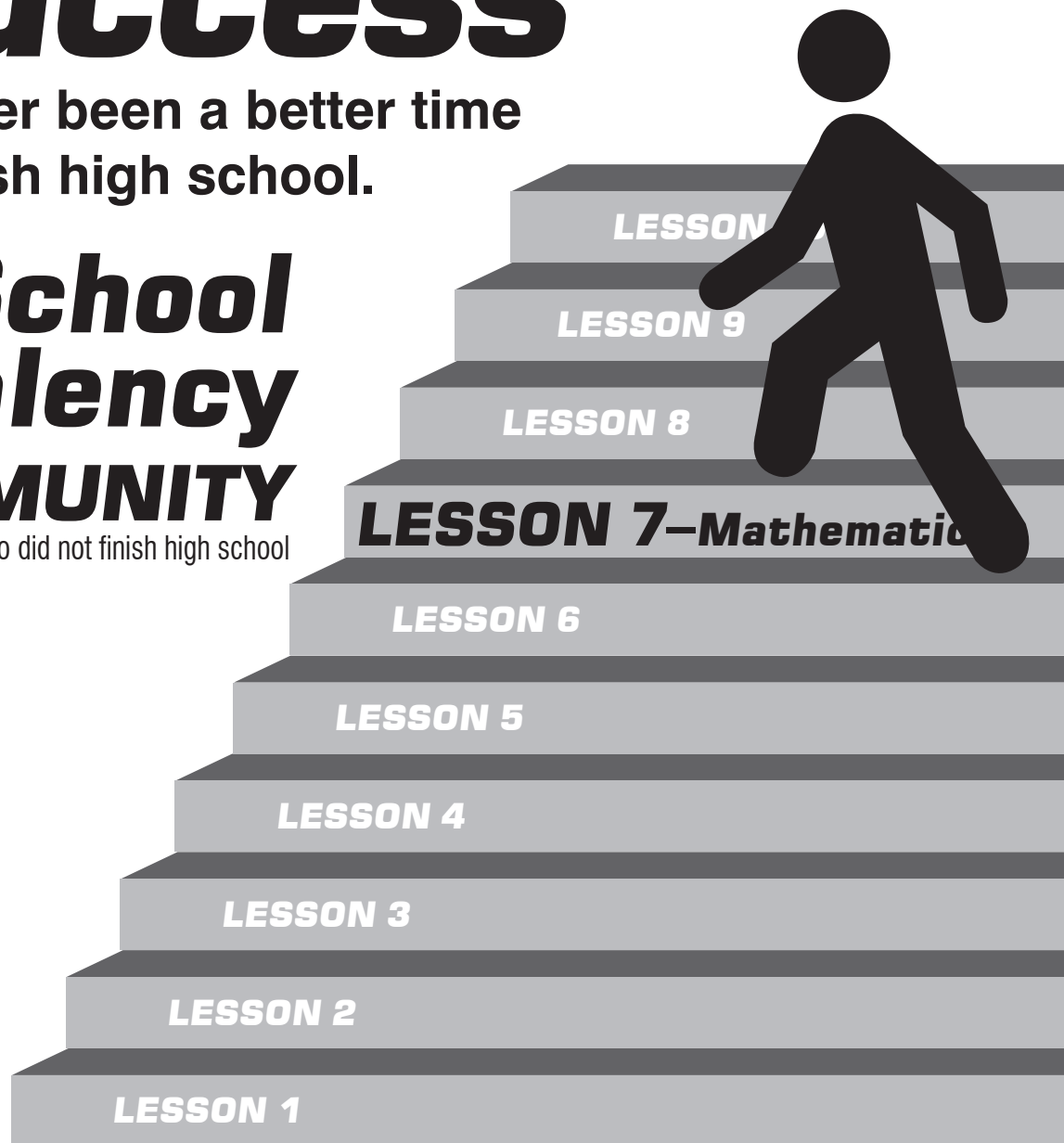# Steps to Success

There's never been a better time to finish high school.

High School Equivalency *in the* COMMUNITY
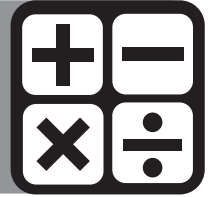
a 'Mail-In' program for adults who did not finish high school

LESSON

LESSON 9

LESSON 8

LESSON 7–Mathematic

LESSON 6

LESSON 5

LESSON 4

LESSON 3

LESSON 2

LESSON 1

Seventh Step– KEEP STEPPING!

LESSON 7
Mathematical Reasoning

Combining Like Terms

1. A term is a constant or a variable in an expression.

   Expression: 5a + 7b − a − 2b

   Terms: 5a, 7b, -a and -2b

2. Like terms are terms that have the same variable and exponent. So in the example above 5a and -a are like terms, and 7b and -2b are like terms:

   $$5a \underline{+ 7b} - a \underline{- 2b}$$

3. The coefficients of an expression are the numbers in front of the variables. The coefficients in our example are 5, 7, -1, and -2, as shown below. Note that when a term has no coefficient, we can give it a coefficient of 1. So you can *think of –a as –1a.*

   $$5a + 7b - 1a - 2b$$

4. To simplify this expression, combine like terms by adding their coefficients. Combine 5a

   $$5a - 1a = 4a$$
   $$+ 7b - 2b = {}^+5b$$

   Answer: 4a + 5b

5. Remember that like terms must have the same variable and exponent.

ASSIGNMENT 1

DIRECTIONS
Simplify the expression.

1. $2x^2 - 3x + 12 + 4x - 5x^2$

   a. What are the like terms?

   _____

   _____

   _____

   b. Simplify the expression.

   _____

   _____

   _____

2. $5x^2 + 7x + 2 - 2x^2 + 7 + x^2$

   What are the like terms?

   a. What are the like terms?

   _____

   _____

   _____

   b. Simplify the expression.

   _____

   _____

   _____
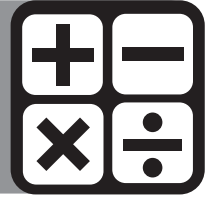
Combining Like Terms is also used to make equations easier to solve.

Solving an Equation

Simplifying

$$-6 + 2x + 3x = 29$$

- Combine like terms:
  $$2x + 3x = 5x$$

- Simplified:
  $$-6 + 5x = 29$$

Solving for variable 'x'

$$-6 + 5x = 29$$

- Move all terms containing x to the left, all other terms to the right.

- Add '6' to each side of the equation.
  $$-6 + 6 + 5x = 29 + 6$$

- Combine like terms: **-6 + 6 = 0**
  $$0 + 5x = 29 + 6$$
  $$5x = 29 + 6$$

- Combine like terms: **29 + 6 = 35**
  $$5x = 35$$

- Divide each side by '5'.
  $$x = 7$$

- Solved:
  $$x = 7$$

DIRECTIONS
Simplify and Solve. Show your work on a separate sheet of paper.

3. $-6 + 2x + 3x = 29$

4. $2y + -1y + -1y + x = -13$

Equations with variable on both sides may seem difficult at first, but if you take one step at a time you will not have any problems.

We will solve the following equation one step at a time.

$$x + 3x + 7 = 42 + x - 12$$

When combining like terms it is important to preserve the equality of the equation by only combining like terms on one side at a time. We will simplify the left hand side first.

The first step is to find pairs of like terms, the second step is to add. The x and 3x are like terms, so they are added resulting in 4x. (HINT: when a variable such as x has no coefficient, its coefficient is 1 so x is the same as 1x.) The 7 does not have a like term, so it is not changed. The equation now reads:

$$4x + 7 = 42 + x - 12$$

The next step is to simplify the right hand side of the equation. This time there is no term which can be added with x, but there are two constants which are like terms. The 42 and the -12 are added, resulting in 30. The equation now reads:

$$4x + 7 = x + 30$$

Now you must get the x's together on the left hand side and the constants together on the right hand side. Subtract x from both sides of the equation.

$$3x + 7 = 30$$
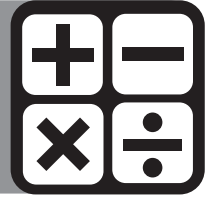
Then subtract 7 from both sides of the equation.

$$3x = 30$$

You can now solve the equation by dividing both sides of the equation by 3.

$$X = 10$$

LESSON 7
Mathematical Reasoning

DIRECTIONS
Simplify and Solve. Show your work on a separate sheet of paper.

5. $6x + -2 + 2x = -2 + 4x + 8$

6. $x + 2 + 2 + 5x = 19 + x + 5$

7. $3 + 4x + 10 = 5x$

Polynomials

Skin Products: A drug store sells three popular kinds of suntan lotions—Dry Skin, Sensitive Skin, and Dry Sensitive Skin. The expressions represent the number of products sold after x months over a 12-month period.

Dry Skin	$-0.5x^2 + 7x + 107$
Sensitive Skin	$-x^2 + 34x - 110$
Dry Sensitive Skin	$-3x^2 + 19x + 314$

A. How do you find the expression that represents the total number of suntan lotions sold in the 12-month period?

B. How do you find the expression that represents the difference in the number of Dry Skin suntan lotions sold and the number of Sensitive Skin suntan lotions sold?

After we work through this lesson, we will come back to this math problem.

Monomial—A *monomial* is a number, variable, or the product of a number and one or more variables with nonnegative integer exponents. All variables of a monomial must be in the numerator of the expression.

Is the following equation a monomial?

$$\frac{-12}{g^{-3}}$$ *Yes!*

The expression $\frac{-12}{g^{-3}}$ is a monomial because it can be simplified to -12g3. Now it's written as the product of a number and a variable with a positive integer exponent

ASSIGNMENT 2

DIRECTIONS
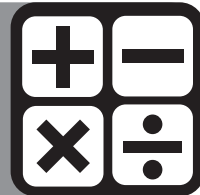**Circle the monomials.**

1. $-9x^2y^3$

2. $7m^2n^{-4}$

3. $\dfrac{2^5a^3b^4}{3}$

4. $x^2 - \dfrac{3}{x}$

The Degree of a Monomial

All monomials have a degree. The degree of a monomial with one variable is the exponent of the variable. The degree of a monomial with multiple variables is the sum of the exponents of the variables. The degree of a nonzero constant is always 0. The constant 0 does not have a degree.

Example: $3a^2$

The exponent of the variable is 2 and it has a degree of 2.

Example: $-8x^2yz^5$

The exponents of the variables are 2, 1, and 5.

$$2 + 1 + 5 = 8$$

So, $-8x^2yz^5$ **has a degree of 8.**

Example: $6^{12}m^2n^4$

The exponents of the variables are 2 and 4.

$$2 + 4 = 6$$

So, $6^{12}m^2n^4$ **has a degree of 6**.

Now you try!

DIRECTIONS
What is the degree of each monomial?

5. **x^3**
   A. 3
   B. 1
   C. 0

6. **$8^3x^2y^4$**
   A. 9
   B. 6
   C. 4

DIRECTIONS
Find the degree of each monomial?

7. **$10x^5$**

   Degree _____

8. **7**

   Degree_____

Polynomials

The prefix *mono* means one. The prefix poly means many. When you combine "many" monomials, the result is a polynomial.

A polynomial can be a monomial or the sum or difference of monomials. Each monomial is a term of the polynomial.

For example, $2x^2 + 3x - 6$ is a polynomial with 3 terms.

DIRECTIONS
What are the terms in the polynomial below?
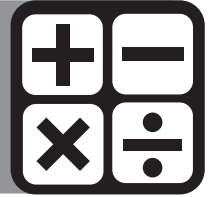
$$5x^4 - 6x^3 + 9x^2 - 3x + 10$$

9. **Circle the correct answer.**
   A. 5, 6, 9, 3, and 10
   B. $5x^4$, $-6x^3$, $9x^2$, $-3x$, and 10
   C. $5x^4$, $6x^3$, $9x^2$, $3x$, and 10

Some polynomials have special names. A *binomial is the sum or difference of two* monomials. *A trinomial is the sum or difference of three* monomials.

Binomials	Trinomials
$2x + 6$	$x^2 + 2x - 8$
$5x^3 - 2y$	$x + y + z$

DIRECTIONS
**Identify the name(s) that describe each algebraic expression.
Select all that apply.**

10. -3x³ + 4

A. Monomial
B. Polynomial
C. Binomial
D. Trinomial

11.   6x² + 5x − 11

A. Monomial
B. Polynomial
C. Binomial
D. Trinomial

- Just like a monomial has a degree, so does a polynomial.

- The degree of a polynomial in one variable is determined by the term with the highest exponent.

Let's look at how to find the degree of the polynomial **3x² + 5x − 4**.

1. Identify the terms in the polynomial	$3x^2$	degree: 2
2. Find the degree of each term	$5x$	degree: 1
3. The highest degree of the terms is the degree of the polynomial.	-4	degree: 0
The polynomial 3x² + 5x – 4 has a *degree of 2*.		

12. 3x² − ½x² + 8x + 2   **Degree_____**

13. x + 14   **Degree_____**

14. 6x² − 12   **Degree_____**

15. y² + 8y − 11   **Degree_____**

While the terms of a polynomial can be written in any order such as 4x + 3 or 3 + 4x, we typically write the terms in descending order by degree like $-7x^3 + 9x^2 + 6x - 1$. This arrangement is called the **standard form** of a polynomial.

16. Which of the following polynomials are written in standard form? *Circle* **all that apply.**

A. 4x + 17
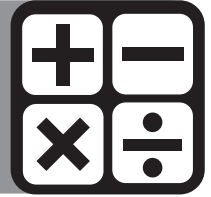B. $9x^2 + 1 - x$
C. $x^2 - 3$
D. $7 + 8x^2$
E. $5x^3 + 6x - 9$

17. Write the polynomial in standard form.

$$9 + 5x^3 - x^2$$

Standard Form _____

ASSIGNMENT 3

Adding Polynomials

Recall: Terms that contain the same variable with the same exponents are called ***like terms***. For example, the cubic terms $2x^3$ and $-8x^3$ are like terms because each term has a variable x with the exponent 3.

1. $4x^3$ and $4x^4$ **NO**   **YES**

2. $6x^2$ and $6y^2$ **NO**   **YES**

Identifying and combining like terms are the keys to simplifying polynomial expressions. Read each step to see how to simplify the polynomial expression.

Example:

$$6x^2 - 8x^3 + 24x + 9x^3 - 7x + x^2$$

Simplify the polynomial expression:

A. Identify like terms.

$$6x^2 \underline{- 8x^3} + 24x \underline{+ 9x^3} - 7x + \mathbf{x^2}$$

B. Group the like terms together.

$$6x^2 + x^2 \underline{- 8x^3 + 9x^3} + 24x - 7x$$

C. Combine the like terms

$$7x^2 + \underline{x}^3 + 17x$$

D. Write in standard form

$$x^3 + 7x^2 + 17x$$

3. $5x^2 - 6x^3 + 4x - 10x + 3x^2 + 11x^3$
   A. $7x^{12}$
   B. $5x^6 + 8x^4 - 6x^2$
   C. $5x^3 + 8x^2 - 6x$
   D. $17x^3 + 8x^2 + 14x$

4. $7a + 8b - 12a - 3b$
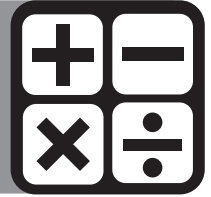   A. $19a + 11b$
   B. $-5a + 5b$
   C. $15a - 15b$
   D. 0

5. $8g^2 + 7g - 3g^2 + 2g$

   _____

   _____

   _____

   _____

6. $-7m^2 - 9m - m^2 - m^5 - m$

   _____

   _____

   _____

   _____

Let's find the perimeter of the figure.

12x - 4

$x^2 + 2$

-6x + 11

$2x^2 + x + 5$
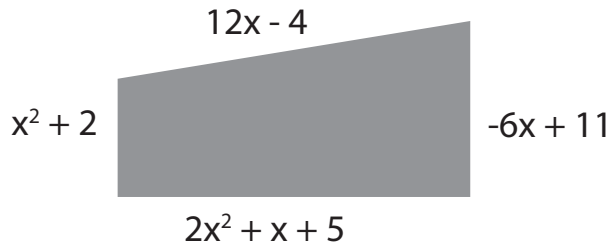
Recall that to find the perimeter of a figure we *add* all the sides of the figure. Notice in this case the lengths of the sides of the trapezoid are polynomials. We can add polynomials horizontally or vertically. Adding polynomials horizontally is similar to simplifying polynomials—*identify the like terms, then combine them.*

Let's find the perimeter of the figure above.
One way to set up the expression for the perimeter is:
$(12x − 4) + (−6x + 11) + (2x^2 + x + 5) + (x^2 + 2)$

Now, add the polynomials horizontally using the following steps:

A. Identify like terms
$(\mathbf{12x} − 4) + (−\mathbf{6x} + 11) + (\underline{2x^2} + \mathbf{x} + 5) + (\underline{x^2} + 2)$

B. Group
$(\mathbf{12x − 6x + x}) + (\underline{2x^2 + x^2}) + (−4 + 11 + 5 + 2)$

C. Combine
$\mathbf{7x + 3x^2 + 14}$

D. Standard Form
$\mathbf{3x^2 + 7x + 14}$

DIRECTIONS
Add the polynomials. Show your work.

7. $(−8x^2 + x + 2) + (−4x^2 + 10x − 1)$

_____

_____

_____

_____

8. $(7x^3 − x^2 + 13x) + (−5x^2 + 8x − 4) + (x^3 − 7x)$

_____

_____

_____

_____

Adding Polynomials

Adding polynomials vertically is similar to adding numbers vertically.

For example, to add 2,456 and 567, we must align the digits according to place value. That means ones should be aligned with ones, tens with tens, hundreds with hundreds, and so on.

$$\begin{array}{r} 2{,}456 \\ +567 \\ \hline 3{,}023 \end{array}$$

For polynomials, rather than aligning by place value, we align the like terms. Let's look at an example.

Example:
   Add $(x^2 + 6x − 4)$ and $(9x^2 + x − 15)$

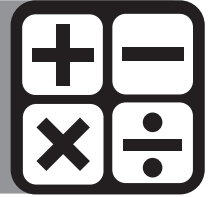**A. Align like terms.** (Identify and group like terms)

$$\begin{array}{rrr} x^2 & + 6x & − 4 \\ 9x^2 & + x & − 15 \end{array}$$

B. Simplify. (Combine and use standard form)
$$10x^2 + 7x − 19$$

LESSON 7
Mathematical Reasoning

DIRECTIONS
Simplify the expression.

9. $(8x^2 - 5) + (-3x^2 - 6x + 4)$

   First, align like terms. Which of the following is the correct way to align the polynomials in order to add? Remember like terms must be together.

   Circle the correct alignment.

   A. $-3x^2 \quad\quad - 6x + 4$
       $\underline{\quad + 8x^2 \quad\quad\quad - 5}$

   B. $-3x^2 \; - 6x \quad + 4$
       $\underline{\quad\quad + 8x^2 \quad - 5}$

DIRECTIONS
Simplify each expression.

10. $(12a^2 - b + 7) + (-3a^2 + 9b - 2)$

    1. Align _____

       _____

    2. Simplify _____

       _____

11. $(6m + 14 - 2m^2) + (5m^2 - 11 + 8m)$

    1. _____

       _____

    2. _____

       _____

Now, let's look at the problem from the beginning of the lesson.

Skin Products: A drug store sells three popular kinds of suntan lotions—Dry Skin, Sensitive Skin, and Dry Sensitive Skin. The expressions represent the number of products sold after x months over a 12-month period.

Dry Skin	$-0.5x^2 + 7x + 107$
Sensitive Skin	$-x^2 + 34x - 110$
Dry Sensitive Skin	$-3x^2 + 19x + 314$

DIRECTIONS
Write an expression that represents the total number of suntan lotions sold in the 12-month period. Use a separate sheet of paper if necessary to show your work.

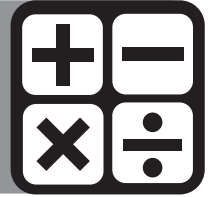**Write the Expression**

_____

Identify like terms

_____

Group like terms

_____

Combine

_____

Write the expression in *Standard Form*

_____

ASSIGNMENT 4

Subtract Polynomials

$(3t - 9) - (-8t^2 + 6t + 4)$

1. Write the expression using addition. You can do this by using the *distributive property*.

$(3t - 9) + (8t^2 - 6t - 4)$

2. Identify like terms.

_____

3. Group like terms.

_____

4. Combine and write in standard form.

_____

5. $(3c^2 + 7c - 1) - (-c^2 - 12c + 9)$

_____

_____

_____

_____

6. $(-10x - 5) - (2x^2 - 10x)$

_____

_____

_____

7. $(5x^2 + 7x - 8) - (3x^2 - 2x + 5) - (2x + 3)$

_____

_____

_____

_____

Summary

To add polynomials
1. Identify and group like terms.
2. Simplify (combine and write in standard form).

To subtract polynomials
1. Write the expression using addition.
2. Identify like terms and simplify

References

www.sascurriculumpathways.com

Common Core Basics, Building Essential Test Readiness Skills for High School Equivalency Exams, Science-McGraw-Hill Education, 2014