

Polynomials

What is a polynomial? Rather than use the textbook's complicated definition, lets just look at some examples of polynomials:

$$6x^2 \quad y^3 - 4 \quad 1/2w^5 \quad 4t^8 - 7t^3$$

Notice the examples above don't have any variables in the denominator (that means bottom of the fraction) or any variables in the exponent. They also don't have absolute values of variables and all the variables have whole number exponents.

To clarify this let's look at some examples of things that would NOT be a polynomial:

$$2^x \quad \frac{4}{3p^2} \quad \sqrt{x} \quad n^{.85} - n$$

Classifying Polynomials

Before we can classify polynomials we have to get the polynomial into Standard Form. Standard Form is when you line up the terms of a polynomial from highest degree term to lowest degree term.

Which of the following polynomials is in Standard Form? (Yes or No)

$$3x^2 - 14 + x^4 \quad \underline{\text{NO}} \quad 2x^2 + 3x + 9 \quad \underline{\text{YES}} \quad x + 2 \quad \underline{\text{YES}}$$

(Answers: No, Yes, Yes)

Once the polynomial is in Standard Form there are two steps to naming it.

First Step: Degree

The degree of a polynomial is the number of the highest exponent in the leading term of the polynomial.

Name	Degree	Example
Constant	0	-5
Linear	1	y+4
Quadratic	2	n ² + 3n + 1
Cubic	3	x ³ + 4x ² - 8
Quartic	4	z ⁴ - 16

So for example if you had the polynomial, $3x^3 + 6x^2 - 7$, what would the degree of this polynomial be? Write your answer to the side.

3

Hopefully you wrote 3. If not raise your hand and ask for help!

Second Step: Number of Terms

The second way to classify polynomials is by the number of terms they have.

Name	Terms	Example
Monomial	1	$8y^2$
Binomial	2	$m + 6$
Trinomial	3	$3z^4 - z^2 + 12$
Polynomial with...	4,5,6,....	$5p^7 + 2p^5 - 4p^3 - p^2 + \dots$

Leading Coefficient

Another thing I can ask you about polynomials is “what is the leading coefficient”. In order to answer this you must first put the polynomial in standard form (if it’s not already). Then all you have to do is tell me the number in front of the first term. Yes it’s that simple.

Example: $2x^2 - 7x + 5x^5 + 3$

What would the leading coefficient be? (*Hint: First put into standard form.*)

What does this equation look like in standard form? $5x^5 + 2x^2 - 7x + 3$

After you’ve done that what is the leading coefficient? 5

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**** When you are done with the assignment, go on to the next page to learn about adding and subtracting polynomials together! ****

Adding and Subtracting Polynomials

Now that you know how to classify polynomials let's get on to the fun stuff, adding and subtracting. Look at the following example.

$$(5x^2 + 9 + 2x) + (11x^3 + 4 + 2x^2 - 2x)$$

Now in order to add these two things together we need to make sure we are adding like terms together. This means we need to add all the cubic terms together, all the quadratic terms together, etc.

To make this visually easy, line up each one vertically (one over the other). As you're doing this step make sure you are writing out each polynomial in standard form! It should look like this when you're done:

$$\begin{array}{r} 5x^2 + 2x + 9 \\ + 11x^3 + 2x^2 - 2x + 4 \end{array}$$

Notice how all of the like terms now line up with each other? This makes it really easy now for us to add the terms together. Go ahead and solve this. Show your answer below.

$$11x^3 + 7x^2 + 13$$

You hopefully got $11x^3 + 7x^2 + 13$. If you didn't, raise your hand and get some help!

You'll follow this same method for subtracting polynomials as well. First line up the like terms vertically. Then just subtract.

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Mr. Ward Answer Key

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35. $\boxed{4}$ 38. $\boxed{8}$

36. $\boxed{1}$ 39. $\boxed{3}$

37. $\boxed{2}$ 40. $\boxed{6}$

41. $4.9t^3 - 4t^2 + t + 2.5$
4.9

42. $-10a^2 + 8a + 2$
-10

43. $x^{10} + x^7 - x^5 + x^3 - x$
1

44. $-3m^2 - m + 7$
-3

45. $5x^3 + 3x^2 + 5x - 4$
5

46. $-n^2 - 2n + 1$
-1

47. $-d^3 + 3d^2 + 4d + 5$
-1

48. $12s^3 + 3s^2 + 6$
12

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

50. constant monomial

51. linear monomial

52. cubic trinomial

53. quadratic trinomial

54. quadratic binomial

55. quartic trinomial

56. cubic trinomial

57. quadratic monomial

Mr. Ward Answer Key

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1. $-3a^2 + 9a$

2. $7x^2 + 9y^2$

3. $0.26r^4 + 0.32r^3$

4. $\frac{1}{4}P^3 + \frac{2}{3}P^3$

$$\frac{3}{12}P^3 + \frac{8}{12}P^3 = \frac{11}{12}P^3$$

5. $3b^3c$

6. $3m - 11$

7. $23n^3 + 3n + 15$

8. $8q^2 - 10.9q + 5.3$

9. $9x^2 - x - 6$

10. $3x^4 + 8x^3$

11. $4c^4 + 8c + 6$

12. $16y^2 - 8y + 9 - 6y^2 + 2y - 7y$
 $= 10y^2 - 13y + 9$

13. $2r + 5 - 5r + 6$
 $= -3r + 11$

14. $-7k^2 + 3 - 2k^2 - 5k + 1$
 $= -9k^2 - 5k + 4$

15. $(8a^2 - 2a + 5) + (7a + 4)$
 $= 8a^2 + 5a + 9$