

A symbolic statement in x with an equals sign is called an *equation in x* . The equal sign divides the equation into two parts, the left side and the right side. The two sides are called *expressions*.

Example: $2x+5 = 3x+1$

Expression Expression Equation

The following chart contains both linear and nonlinear expressions in x . Sort them into two groups and be prepared to explain what is different about the two groups.

$5x + 3$	$-8x + \frac{7}{9} - 3$	$9 - x^2$
$4x^2 - 9$	$0.31x + 7 - 4.2x$	$\left(\frac{x}{2}\right)^3 + 1$
$11(x + 2)$	$-(6 - x) + 15 - 9x$	$7 + x^{-4} + 3x$

This is how I sorted mine.

$5x + 3$	$-8x + \frac{7}{9} - 3$	$9 - x^2$
$4x^2 - 9$	$0.31x + 7 - 4.2x$	$\left(\frac{x}{2}\right)^3 + 1$
$11(x + 2)$	$-(6 - x) + 15 - 9x$	$7 + x^{-4} + 3x$

What was my rule?

Red = linear expressions
- exponents are 1 or 0

Black = non-linear
- any other exponents

Is $2x^2 + 3x - 9$ linear or non-linear? Why?

Non-linear \rightarrow # bigger than 1

Is $3x^1+4+5x^1-9$ linear or non-linear? Why?

linear \rightarrow exp = 1

How many terms does it have?

4 terms

Is $3+4x+5x^{-7}$ linear or non-linear? Why?

Non-linear

Classwork

Exercises

Write each of the following statements in Exercises 1–12 as a mathematical expression. State whether or not the expression is linear or nonlinear. If it is nonlinear, then explain why.

1. The sum of a number and four times the number

Let $n =$ a number

$$n + 4n$$

This is a linear expression!

2. The product of five and a number

↪ multiplication
let $n = \text{a number}$

$$5 \cdot n$$

This is linear.

3. Multiply six and the reciprocal of the quotient of a number and seven.

If 5 is our #, then
the reciprocal $\frac{1}{5}$

Let $n =$ a number answer to division problem

$$6 \cdot \frac{1}{x \div 7}$$

$$6 \cdot \frac{7}{x}$$

Non-Linear, b/c exponent is negative $= 6 \cdot 7 \cdot x^{-1}$

4. Twice a number ^{2x} subtracted from ^{4x} four times a number, added to 15

Let $n =$ a number

$$4x - 2x + 15$$

Linear

5. The square of the sum of six and a number

Let $n =$ a number

$$(6+x)^2 \text{ OR } (6+x)(6+x)$$

Non-Linear b/c exponent greater than 1

6. The cube of a positive number divided by the square of the same positive number

Let $n =$ a positive number

$$n^3 \div n^2 = \frac{n^3}{n^2} = \frac{\cancel{n}n\cancel{n}}{\cancel{n}\cancel{n}} = n$$

Linear 😊

7. The sum of four consecutive ^{odd} numbers

let $x =$ an odd number

$$x + \underline{x+2} + \underline{x+4} + \underline{x+6}$$

Linear

8. Four subtracted from the reciprocal of a number

9. Half of the product of a number multiplied by itself three times

10. The sum that shows how many pages Maria read if she read 45 pages of a book yesterday and $\frac{2}{3}$ of the remaining pages today

11. An admission fee of \$10 plus an additional \$2 per game

Let n = number of games

$$10 + 2n$$

12. Five more than four times a number and then twice that sum