Rules for counting significant digits:

1. All non-zero digits are significant.
2. All zeros between non-zero digits are significant.
3. All zeros which are at the same time to the right of the decimal point and at the end of the number are significant.
4. All zeros which are to the left of a written decimal point and are in a number greater than or equal to 10 are significant.

Break for Practice: Identify the number of significant digits.

Number	Number of Significant Digits
48,923	5
3.967	4
900.06	5
0.0004	1
8.1000	5
501.040	6
3,000,000	1
3,000,000.	7
10.0	3

Extended Practice: Complete the chart. Count the number of significant digits in the original form of the number.

Decimal Notation	Scientific Notation	Number of Significant Digits
7,500	7.5×10^3	2
106,000	1.06×10^5	3
0.608	6.08×10^{-1}	3

0.0038	3.8×10^{-3}	2
10.05	1.005×10^{1}	4
762.20	7.6220×10^{2}	5
0.0320	3.20×10^{-2}	3
0.0000460	4.60×10^{-5}	3
5,000	5×10^{3}	1
0.0001	1×10^{-4}	1
0.0043	4.3×10^{-3}	2
10,000,000	1×10^{7}	1
67,500	6.75×10^{4}	3
0.0620	6.20×10^{-2}	3
0.00750	7.50×10^{-3}	3
400.0	4.000×10^{2}	4

* When approximations (examples: numbers that are measured during a science lab) are multiplied or divided, the answer should have the same number of significant digits as the least accurate factor.

Break for Practice: Calculate the following on your calculator and record your answer in scientific notation with the correct number of significant digits.

1. $(4.763 \times 10^3)(2.48 \times 10^2)$ 4 3 $11.81224 \times 10^5 = 1.181224 \times 10^6$ 1.18×10^6	2. $\frac{2.71\times10^8}{1.6\times10^{-3}} = 1.69375 \times 10^{11}$ 2 sig. dig. 1.7×10^{11}
3. $\frac{(5.7\times10^2)(3.81\times10^{10})}{4.2\times10^5} = 517071142.86$ 2 sig. dig 5.2×10^7	4. $\frac{4.2\times10^5}{(5.7\times10^2)(3.81\times10^{10})} = 1.933\,96878 \times 10^{-8}$ 2 sig. dig 1.9×10^{-8}
5. $\left(\frac{5.7\times10^4}{2.96\times10^2}\right)^3 = 7140842.164$ 2 sig dig 7.1×10^6	

Extended Practice: Calculate the following on your calculator and record your answer in scientific notation with the correct number of significant digits.

1. $(1.72 \times 10^{-5})(3.6 \times 10^{-11})$ 2 sig dig 6.2×10^{-16}	2. $(8.15 \times 10^3)(2.0296 \times 10^{-18})$ 3 sig dig. 1.65×10^{-14}
3. $(8.792 \times 10^6)(5.31 \times 10^7)$ 3 sig dig 4.67×10^{14}	4. $(3.98 \times 10^{-14})(6.818 \times 10^{19}) = 2713564$ 3 sig dig 2.71×10^6
5. $(3.29 \times 10^{-3})(1.9532 \times 10^{-4})$ 3 sig dig 6.43×10^{-7}	6. $(9.032 \times 10^{-4})(7.91 \times 10^{-17})$ 3 sig dig 7.14×10^{-20}
7. $\frac{7.76\times10^{13}}{3.1\times10^5} = 250322580.6$ 2 sig dig 2.5×10^8	8. $\frac{8.92\times10^4}{2.6\times10^{17}} = 3.4 \times 10^{-13}$ 2 sig fig
9. $\frac{4.15\times10^{-19}}{5.011\times10^{-4}} = 8.28 \times 10^{-16}$ 3 sig dig	10. $(1.29 \times 10^7)^2 = 1.66 \times 10^{14}$ 3 sig fig
11. $(6.1 \times 10^{-6})^2 = 3.7 \times 10^{-11}$ 2 sig dig	12. $(7.021 \times 10^5)^{-3} = 2.889 \times 10^{-18}$ 4 sig dig
13. $\frac{(7.5\times10^6)(5.0\times10^{-1})}{1.5\times10^8} = .025$ 2 sig dig 2.5×10^{-2}	14. $\left[\frac{(8.4\times10^{15})(1.5\times10^{-5})}{(4.02\times10^4)(1.2\times10^3)}\right] = 2611.94$ 2 sig fig 2.6×10^3

Simplifying Rational Algebraic Expressions

The rational algebraic expressions that we will be simplifying in this section will include polynomials in the numerator and denominator. The skills that are practiced in this section will help us when we begin graphing in the next section.

Example: Simplify

$$\frac{5x^2+4x-1}{5x^2-10x-15} = \frac{(5x-1)(x+1)}{5(x-3)(x+1)} = \frac{(5x-1)}{5(x-3)}$$

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

Steps:

1. Factor the numerator and denominator.
2. Cancel the common factors.

Break for Practice: Simplify

1. $\frac{8x^2+16x}{4x} = \frac{4x(2x+4)}{4x} = 2x+4$

2. $\frac{x^2-16}{x^2+7x+12} = \frac{(x-4)(x+4)}{(x+3)(x+4)} = \frac{x-4}{x+3}$

▶ $(3-x)$
$-1(-3+x)$
$-1(x-3)$

* opposites cancel and give -1

$(3-x)(x-3)$
-1

3. $(x^4-5x^3+6x^2)(9x-x^3)^{-1}$

$\frac{(x^4-5x^3+6x^2)}{(9x-x^3)} = \frac{x^2(x^2-5x+6)}{x(9-x^2)} = \frac{x^2(x-3)(x-2)}{x(3-x)(3+x)}$

see above ▲

$= \frac{x(x-3)(x-2)}{-1(x-3)(3+x)} = \frac{x(x-2)}{-(3+x)}$

4. $(2-x-3x^2)(9x^2-4)^{-1}$

$\frac{(2-x-3x^2)}{(9x^2-4)} = \frac{(2-3x)(1+x)}{(3x-2)(3x+2)} = \frac{-1(3x-2)(1+x)}{(3x-2)(3x+2)}$

$= \frac{-(1+x)}{(3x+2)}$

Extended Practice: Simplify

1. $\frac{5x^2-15x}{10x^2} = \frac{5x(x-3)}{2\cdot 5x^2} = \frac{(x-3)}{2x}$

2. $\frac{3t^4-9t^3}{6t^2} = \frac{3t^3(t-3)}{6t^2} = \frac{t(t-3)}{2}$

3. $\frac{u^2-u-2}{u^2+u} = \frac{(u-2)(u+1)}{u(u+1)} = \frac{(u-2)}{u}$

4. $\frac{z^3-4z}{z^2-4z+4} = \frac{z(z^2-4)}{(z-2)(z-2)} = \frac{z(z-2)(z+2)}{(z-2)(z-2)} = \frac{z(z+2)}{(z-2)}$

5. $(p-q)(q-p)^{-1} = \frac{(p-q)}{(q-p)} = \frac{(p-q)}{-1(p-q)} = \frac{1}{-1} = -1$

6. $(r^2 - rs)(r^2 - s^2)^{-1}$

$$\frac{(r^2-rs)}{(r^2-s^2)} = \frac{r(r-s)}{(r-s)(r+s)} = \boxed{\frac{r}{(r+s)}}$$

7. $\frac{s^2-t^2}{(t-s)^2}$ $= \frac{(s-t)(s+t)}{(t-s)(t-s)} = \frac{-1(t-s)(s+t)}{(t-s)(t-s)} = \boxed{\frac{-(s+t)}{(t-s)}}$

8. $\frac{(a-x)^2}{x^2-a^2}$ $= \frac{(a-x)(a-x)}{(x-a)(x+a)} = \frac{-1(x-a)(a-x)}{(x-a)(x+a)} = \boxed{\frac{-(a-x)}{(x+a)}}$

9. $\frac{x^2-5x+6}{x^2-7x+12}$ $= \frac{(x-2)(x-3)}{(x-3)(x-4)} = \boxed{\frac{(x-2)}{(x-4)}}$

10. $\frac{2t^2+5t-3}{2t^2+7t+3}$ $= \frac{(2t-1)(t+3)}{(2t+1)(t+3)} = \boxed{\frac{(2t-1)}{(2t+1)}}$