unit 3

5.4: Scientific Notation

5.4.1

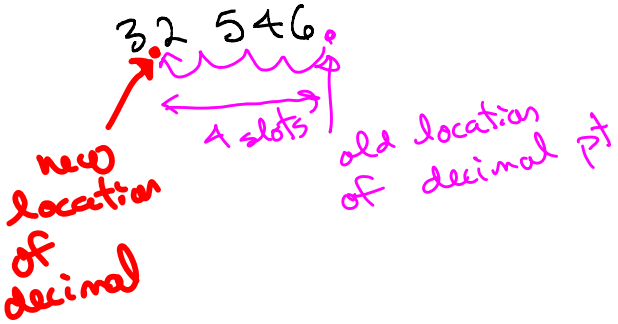
Note Title 10/23/2017

Scientific notation: used for very large or very small numbers. When written in scientific notation, a number will have one nonzero digit to the left of the decimal point, multiplied by an appropriate power of 10.

Example: write 32546 in scientific notation.

(same as 32,546 or 32 546)

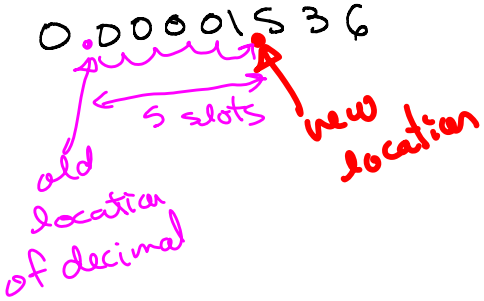
$$32546 = 3.2546 \times 10^4$$



Ex: Write 0.00001536 in scientific notation.

$$0.00001536 = 1.536 \times 10^{-5}$$

Note: this is a "small number", so the exponent is negative



5.4.2

Example: write the number without scientific notation.

2.5731×10^{-3}

$2.5731 \times 10^{-3} = 0.0025731$

000002.5731

new location ← original location

Careful: It is a good idea to write a leading zero before the decimal point (write 0.2 instead of .2). Much less likely to lose the decimal point, or get the meaning confused in a sentence.

Ex: write the number without scientific notation

2.3458×10^{8}

$2.3458 \times 10^{8} = 234\ 580\ 000$ or $234,580,000$

this is a big number, due to positive exponent on 10.

2.34580000.0000

old location → new location

Ex:
Calculate $(651)^4$ on your calculator.

Most calculators give you

1.796072876 E11

This means $1.796072876 \times 10^{11}$

Ex: Calculate $\frac{1}{(6214)^3}$.

Should get $4.167602148 \times 10^{-12}$

Ex:

$\frac{1}{581} = 0.00172117$

or $1.721170396 \times 10^{-3}$

6.1: The Greatest Common Factor and Factoring by Grouping

Chapter 6: Factoring polynomials

$(x+3)(x+4)$ ← factored form

$= x^2+7x+12$ ← unfactored form.

To find the Greatest Common Factor (GCF)

* Find the largest number that divides into all the coefficients.
* Find highest power of each variable that is a factor of all the terms.
  (if a variable appears in all the terms, choose the smallest exponent)
* multiply the numerical part and the variable part to get the GCF.

Example: Factor out the GCF.

$15x^4 - 6x^2$ GCF: $3x^2$

$= 3x^2\left(\frac{15x^4}{3x^2} - \frac{6x^2}{3x^2}\right)$

$= \boxed{3x^2(5x^2-2)}$

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

$= 15x^4 - 6x^2$ ✓

6.1.2

Ex: Factor.

$48x^3 - 32x$

GCF: $8x$

$= 8x(6x^2 - 4)$

can still factor out 2

Check: $8x(6x^2-4) = 48x^3 - 32x$ ✓

(this means we did not get the greatest common factor)

$= 8x(2)(3x^2 - 2)$

$= \boxed{16x(3x^2 - 2)}$

Try again from the beginning:

GCF: $16x$

$48x^3 - 32x$

$= \boxed{16x(3x^2 - 2)}$

Ex: Factor.

$24x^3 + 18x^2 - 6$

GCF: 6

$= \boxed{6(4x^3 + 3x^2 - 1)}$

Check it by multiplying.

EX: Factor.

$-30x^4y^3z + 12x^3y^6 - 42x^4y^2z^2$

GCF: $6x^3y^2$

$= 6x^3y^2\left(\frac{-30x^4y^3z}{6x^3y^2} + \frac{12x^3y^6}{6x^3y^2} - \frac{42x^4y^2z^2}{6x^3y^2}\right)$

$= \boxed{6x^3y^2(-5xyz + 2y^4 - 7xz^2)}$

Check by multiplying.

Factoring by grouping

6.1.3

Example: Factor. $3x^3 - 7x^2 + 15x - 35$ GCF: 1

Group: $= (3x^3 - 7x^2) + (15x - 35)$

$= x^2(3x - 7) + 5(3x - 7)$

$= \boxed{(3x-7)(x^2+5)}$

Note:
$x^2y + 5y$
$y(x^2+5)$
$3x-7$ playing the role of y here

Check: $(3x-7)(x^2+5)$

$= 3x^3 + 15x - 7x^2 - 35$ ✓

Also correct: $\boxed{(x^2+5)(3x-7)}$

Ex: Factor.

$4x^3 - 3x^2 - 36x + 27$

$= (4x^3 - 3x^2) + (-36x + 27)$

$= x^2(4x-3) - 9(4x-3)$

$= \boxed{(4x-3)(x^2-9)}$

Turns out it factors more:

$(4x-3)(x+3)(x-3)$

Check: $(4x-3)(x^2-9)$

$= 4x^3 - 36x - 3x^2 + 27$ ✓

Check: $(x+3)(x-3)$

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

$= x^2 - 9$

Ex: Factor:

$-16x^2y - 4x^2 + 24xy + 6x$ GCF: $2x$

$= 2x(-8xy - 2x + 12y + 3)$

$= 2x[(-8xy - 2x) + (12y + 3)]$

$= 2x[-2x(4y + 1) + 3(4y + 1)]$

$= 2x[(4y+1)(-2x+3)]$

$= \boxed{2x(4y+1)(-2x+3)}$

Same as: $\boxed{-2x(4y+1)(2x-3)}$

Preview of 6.2:

$x^2 + 6x + 8$

$\boxed{(x+4)(x+2)}$

Check: $x^2 + 2x + 4x + 8$

$= x^2 + 6x + 8$ ✓