Chapter 4 -- Decimals

$34.99 ➔ decimal notation

ex. The cost of an object. ex. The balance of your bank account ex The amount owed

ex. The tax on a purchase.

Just like Whole Numbers –
Place Value - 1.23456789

from the decimal point: ones, decimal (and), tenths, hundredths, thousandths, ten-thousandths, hundred-thousandths,…see page 235

Write in words 3.456 ➔ _____

ex. Write a check for $38.43 ➔ _____

ex. You buy two items that sell for $85.90 and $42.30 . You pay a total of $13.22 in taxes. How much should you write a check for ? Write it.

Notice that we can write 8 / 4 = ___ 12/3 = _____ 24/6 = _____

We can write fractions as decimals
Sometimes they terminate some times they do not (nonterminating)

ex. 7/10 = ____ 3/8 = _____ but 2/3 = _____

Other fractions:

7/25 = _____ ex. 42/1000 = _____ 7/9 = _____

What place value is the digit 3 in the number 42.567321 ? ➔ _____

Write as a decimal.

3/10 = _____ , 93/100 = _____ 58 /1000 = _____

Write as a fraction.

0.4 = _____, 0.24 = _____ 0.004 = _____

Write in words.

0.023 =_____

23.05 = _____

Order. Insert the correct symbol (< or >)

2.3 2.03 0.41 0.401 0.203 0.0343

Rounding: Round the number to the given place value

8.345 tenths ➔ _____ 35.0256 thousandths ➔ _____

Addition and Subtraction of decimals
We still have the same rule of signs

ex. Add: 0.435 + 9.7 + 87.43 ex. Subtract 43.82 - 9.876

evaluate: x - y if x = -7.37 and y = - 3.921

Estimate: 53.29 - 0.89

Multiplication of Decimals:
sum of the decimal places of the factors have to equal the decimal places of the product.

3.2 • 8 = _____ 4.2 • 1.2 = _____

- 43.2 x 2.01 = _____

Special Case: When multiplying by powers of 10 such as 10, 100, 1000:

ex. 10 x 3.25 = _____ 456.1 x 100= _____ 56.02 x 10^5 = _____

Division: 8 ÷ 4 = 2 ; 4 is the divisor and 2 is the quotient

Move the decimal point in the divisor to the right so that the divisor is a whole number. Move the decimal place in the dividend the same number of places. Place the decimal point directly above.

ex. 256.04 ÷ 0.4 = ex. 3.03505 ÷ 1.01

Special Case: Division by powers of 10;

48.03 ÷ 100 = _____ 4.2105 ÷ 10 = _____ 0.032 ÷ 1000 = _____

We can write every fraction as a decimal if we interpret the fraction bar as a division. When we write a fraction as a decimal we get two types of decimal expression; terminating and nonterminating

ex. 3/5 = _____ 5/8 = _____ 3/ 11 = _____

ex. 9/1000 = _____ ex. 2 5/9 = _____

We can also reverse the process and write a decimal expression as a fraction.

ex. 0.023 = _____ ex. 4.01 = _____ ex. 0.004 = _____

ex. 0.125 = _____

Estimate by rounding.

ex. 3.02 • 49.1 = _____ ex. 456.1 ÷ 0.34 = _____

ex. 4.02 - 0.097 = _____

Evaluate if x - = 0.1 and y = - 2.1 ; $-x^2$ = _____ - xy = _____

Compare decimal expressions(and fractions) :

ex. 9/10 0.89 ex. 7/18 0.39 ex. 8/15 0.543

Other Examples:

ex. Your annual salary last year was $52432. What was your monthly salary ? _____

ex. You travel 34.2 miles per gallon. If you have a car with a 12.8 gallon capacity, then what is the maximum number of miles that you can travel ?

ex. A year consists of 52 weeks. You get a biweekly salary of $850. What is your yearly pay ?

ex. At the end of each of month you save a fixed amount into a savings account. At the end of 1 ½ years you have $ 2400. How much did you save each month ?

Equations:

As before we have two basic types of operations that can be used to solve equations.

ex. $-4v = 7$ (write as a decimal)

ex. $-2.02 + 1.5x = -4.12$

ex. $-7.1 - x = 4.01$

$1.02 - x = 0.1 \rightarrow x =$ _____

ex. $6.6 - 2.2x = 0.44 \rightarrow x =$ _____

$x / -0.4 = 8 \rightarrow x =$ _____

Square roots and perfect squares

Perfect Squares: 1, 4, 9, 16, 25, 36, 49, ….

Def. A square root of a positive number x is a number whose square is x.

ex. 4 is square root of _____ since $4^2 =$ _____

ex. -8 is the square root of _____ since $(-8)^2 =$ _____

Every positive number has

two square roots; one positive and one negative. We use the symbol $\sqrt{\ }$ to represent the positive square root.

Notation: $\sqrt{x}$

$\sqrt{\ }$ is called the radical, x is is called the radicand

Each of these numbers has two square roots:
4 and 25 since $(-2)^2 = 4$, $(2)^2 = 4$; $(-5)^2 = (5)^2 = 25$

The radical only refers to the positive square root. $\sqrt{49} = 7$,
if we want the negative value we write $-\sqrt{49} = -7$

More Examples:
Find all of the square roots of

64 ➔ _____, _____ 121 ➔ _____ , _____

400 ➔ _____ , _____

Find

$\sqrt{81}$ = _____ , $\sqrt{169}$ = _____, $-\sqrt{144}$ = _____

What is

$\sqrt{49} - \sqrt{16}$ = _____ $\sqrt{25} + \sqrt{4}$ = _____ $5 \cdot \sqrt{36}$ = _____

$\sqrt{25} \cdot \sqrt{16}$ = _____ $\sqrt{\frac{9}{16}}$ = _____

Not all whole numbers are perfect squares – what do we do when we try to find the square root of such a whole number ?

$\sqrt{26}$ = _____ $\sqrt{53}$ = _____

What two consecutive whole numbers does $\sqrt{37}$ lie between ?

_____ < $\sqrt{37}$ < _____

We can give approximations with a calculator or an algorithm – we also have exact values.

Property of radicals

$\sqrt{ab} = \sqrt{a} \bullet \sqrt{b}$. We can use this property to simplify radicals -

Find (exact value)

$\sqrt{20}$ = _____ $\sqrt{50}$ = _____

$\sqrt{18}$ = _____ $\sqrt{80}$ = _____

Real Numbers

Now that we have introduced radicals , we are ready to complete the set that we call the set of real numbers.

Sets of Numbers

{ 1, 2, 3, … } ➔ _____

{ 0, 1, 2, 3, … } ➔ _____

{ … -3, -2, - 1, 0, 1, 2, 3, … } ➔ _____

A rational number is a number that can be written as a fraction a/b, where both a and b are integers

Every rational number has a decimal expression that is terminating or repeating .

1/5 = 0.2, 3/8 = 0.375, 5/9 = 0.5555... = $.\overline{5}$

0.231456231456... = $0.\overline{231456}$

An irrational number is a number whose decimal representation never terminates or repeats

-- can not be written as a fraction of integers

π = 3.1415926..., $\sqrt{2}$ = _____ , 0.312311223111222..., 0.2010010001...,

The set of rational numbers and the irrational numbers when combined create the set of real numbers

We can plot these numbers on a number line ---

ex. Plot -5, 7, 3.5, $\sqrt{3}$ _____

ex. We can also write real numbers on the number line with inequalities –

a) Write down all of the real numbers less than 2

b) Write down all of the real numbers greater than or equal to –1

c) write down all the numbers between -2 and 3

ex. Which of the values -4, 0, 2, 3/2 , make the inequality $x \geq 2$ true ? _____

ex. Which of the values 2, 2.1, 0.21 make the inequality $x > 2.01$ true ? _____

Properties of Real Numbers :

1. $a + b = b + a$ ➔ _____

2. $ab = ba$ ➔ _____

3. $(a + b) + c = a + (b + c)$ ➔ _____

4. $a(bc) = a(bc)$ ➔ _____

5. $a(b + c) = ab + ac$ ➔ _____

6. Addition Property of 0 ➔ _____, we call 0 the additive identity

7. Multiplication Property of 0 ➔ _____

8. Multiplication Property of 1 ➔ _____, we call 1 the multiplicative identity

9. Inverse Property of addition ➔ _____, a and (- a) are called additive inverses of each other (we also call them) _____ of each other

10. Inverse Property of Multiplication ➔ If $a \neq 0$, then _____, a and 1/a are called multiplicative inverses of each other.

Find

$6(3x) =$ _____ Why ?

$(3x) \bullet 5 =$ _____ Why ?

$(2x)(5x) =$ _____ Why ?

$1 \bullet c =$ _____ $-1 \bullet c =$ _____ $(-3) \bullet (-c) =$ _____

$-3t + 8 + 3t =$ _____ $2(3x + 4) =$ _____

$-2(3x + 5) =$ _____ $-4(2x + 4) =$ _____

$-4(3x - 4) =$ _____ $2(x - 3a + 2c) =$ _____

$-(x + 2y) = -1 \bullet (x + 2y) =$ _____

Terms, coefficients, variable terms, variable expressions, combining similar terms,

How many terms? what are they ? $3x^3 + 3x - 4$ ➔ _____

How many are constant terms ?

Same Questions for the polynomial $-2x^2 + 2y - 5$ ➔ _____

What are the coefficient terms of $x^2 + x + 1$ ➔ _____

of $-2x^2 - x + 3$ ➔ _____

Similar Terms (Like Terms) :

Combine terms. (Alternate form of the distributive law)

Instead of thinking of the distributive law in the form: $a(b + c) = ab + ac$,

let us think of it as $ab + ac = a(b + c)$

$8x + 13a =$ _____ $12c - 16c =$ _____ $6c - 6c =$ _____

$2x - 4y + 3x =$ _____ $3x + y + 4x - 4y =$ _____

$2x + 3(x + 4) =$ _____ $4 + 2 (3x - 1) =$ _____

$2c - 2 [2 - 3 (2c - 3)] =$ _____

Polynomials :

Def. A monomial is a number, a variable, or a product of numbers and variables. Exponents on variables must be nonnegative integers.

Def. A polynomial is a variable expression in which the terms are monomials (a sum of monomials)

A polynomial with one term is called a _____

with two terms ➔ _____

with three terms ➔ _____

Addition of polynomials. Combine similar terms (like terms)

ex. $(3x^2 + 2x - 3) + (5x^2 - 4x - 12) =$ _____

ex. $(2xy + x) + (5xy + y) =$ _____

Subtraction: We perform subtraction operations as before - write as an addition problem and use addition rules.

ex. $(2x - 3xy) - (4x - 2y) =$ _____

ex. $(2x + y - 3) - (3x - 2y - 4) =$ _____

Degree of a monomial:

$x^3 \rightarrow$ _____ $x^{10} \rightarrow$ _____ $5x^6 \rightarrow$ _____

$2x^2y \rightarrow$ _____ $12x^4y^8 \rightarrow$ _____

Degree of a polynomial:

$1 + x + x^{10} \rightarrow$ _____ $2 + 3y - 4x^{20} \rightarrow$ _____

$2xy + 3 \rightarrow$ _____ $2^5 + x + x^3 \rightarrow$ _____

$4x^3y^2 + 3y^4 \rightarrow$ _____

Multiplication of Polynomimals:

Rules of exponents:

1. If m and n are positive integers (natural numbers) , then

$x^m \bullet x^n = x^{m+n}$

ex. Find $a^4 \bullet a^8 =$ _____ $4^3 \bullet 4^{10} =$ _____ $(-2)^4 (-2)^3 =$ _____

What about $x^3 \bullet y^5 =$ _____ or $(4x^3)(3x^2) =$ _____

$(2a^3 b)(a^2b^5) =$ _____

2. I m and n are positive integers, then $(x^m)^n =$ _____

ex. Find $(2^3)^4 =$ _____ $(x^3)^2 =$ _____

3. If m, n, and p are positive integers, then

$(x^m y^n)^p =$ _____

ex $(2x^3)^4 =$ _____ $(x^4 y^2)^5 =$ _____

These types of rules help us multiply monomials together but what about the product of polynomials ?

Products of powers of 10.

What is $123.45 \bullet 100 ?$ = _____ Find $3.01 \bullet 1000$ _____

Quotients of powers of 10 .

What is $123.45 \div 10^2 ?$ = _____ Find $0.056 \div 0.01$ = _____

Convert to a decimal –

9/16 = _____ 7/4 = _____ 5/3 = _____

3 2/9 = _____

Exponents – Just like we worked with natural numbers, whole numbers, integers, we can work with fractions.

ex. $(2/3)^2$ = _____ ex. $(2\ 1/5)^2$ = _____

ex. $(2\ ½)^3 \bullet (1\ ½)^3$ = _____

HW: page 322 ➔ 1, 5, 10, 15, 20, 25, …95
Math 130A – Week 6 day 2, October 3, 2001 - Quiz #11

0.1 Homework – 20, 15, 10, 0 ➔ _____

0.2 { 0, 1, 2, 3, … } is called the set of _____

0.3 The set of rational numbers consists of _____ and proper fractions or mixed numbers. Each of these numbers can be written as a fraction and have a terminating decimal expression or have a repeating part if it is nonterminating

1. Write as a fraction 0.019 ➔ _____

2. Write as a fraction in simplest (reduced) form; 0.02 ➔ _____

3. Write in decimal form

a) 3/1000 = _____ b) 3/8 = _____

4. Write in words; 103.016 ➔ _____

5. Round to the nearest thousandth 31.00167 ➔ _____

6. Perform the given operation (add, subtract, multiply, divide)

a) 3.1 + (- 1.01) = _____ b) 2.01 • 1.1 = _____

c) 1.02 - 4.1 = _____ d) 3.08 ÷ 0.4 = _____

7. Evaluate. x^2 - y if x = - 1.1 and y = 0.1

8. Find the solution of each of the following equations.

a) $0.2x = 9.8$ b) $4.2 - 2x = 6.8$

More HW problems on page 267-272

Square roots , radicals $\sqrt{\ }$, Product Property of Square roots

Name_____ Math 130A – Quiz #12, October 5, 2001

0.1 Homework 20, 15, 10, 0 ➔ _____

1. Give me an example of an improper fraction . _____

2. Write 6/ 5 in decimal form . _____

3. Solve for x. $0.5 - 0.2x = 1.03$

4. $2 \bullet 0.4 =$ _____

5. $4 + 3.05 =$ _____

6. $10.1 - 8.01 =$ _____

7. A pen sells for $1.50 after taxes. You pay with $20 and get $6.50 back in change – how many pens did you buy if all your money went towards the purchase of pens.

8. 6 % of the students in Math 130A are known to drop out of school at the end of the semester. If there are 240 students enrolled during the semester, then how many will return next semessteer ?

(HINT: use the fact that 6 % = 0.06)

Name _____ Math 130A – October 2, 2002 – week 6 – day 2

1. What do you call the set of real numbers that can be written as fraction (have terminating decimal expressions or repeat)?

2. Find the square roots of 36 . _____

3. Simplify the following radicals.

a) $\sqrt{49}$ = _____ b) $\sqrt{100}$ = _____ c) $\sqrt{1600}$ = _____

d) $\sqrt{16} \cdot \sqrt{25}$ = _____ e) $4\sqrt{36}$ = _____

4. Complete the formula ➔ $\sqrt{ab}$ = _____

5. Write the following in simplest form by using the formula in #4.

a) $\sqrt{8}$ = _____ b) $\sqrt{32}$ = _____

6. Use a number line to plot $x > 4$ ➔ _____

7. Use a number line to plot $x \leq -2$

8. List two consecutive integers that $\sqrt{32}$ lies between ? _____ < $\sqrt{32}$ < _____

Math 130A – Week 7, day 2 , October 10, 2001 - Quiz

1.Simplify

a) $4(3x) =$ _____ b) $-2(3x) =$ _____

c) $-5/3(2a) =$ _____ d) $(4x)(5x) =$ _____

e) $-4(-\frac{1}{4}a) =$ _____ f) $-4h + 3h =$ _____

g) $2(h + 5) =$ _____ h) $4 + (-2) - 2y =$ _____

2. List the terms of

3. What are the coefficients of

4. Simplify by combining like (similar) terms

HW page 322
Math 130A – Week 5, September 24, 2001

HW: page 211 – 1, 6, 11, 16, 21, 26, 31, 36, 41, 3, 8, 13, 18, 23, 28, 33, 38,
page 199 1, 6, 11, 16, …166

Exponents and Complex Fractions - section 3.6 page 213-222.
Name _____ Math 130A, Quiz #9 , September 26, 2001

1. Did you do all/most of your homework ? _____ yes/no

2. Homework points 20, 15, 10 _____

3. Find the sum of 3 ¼ and 2 3/8 . _____

4. What is the total of (- 3 2/5) and (+ 2 ¼) ? _____

5. Find the difference; 4 ½ - 2 ¾ = _____

6. Write as an improper fraction; 2 3/5 = _____

7. Find 4 + 6 3/11 = _____

8. What is the product of 4 and 3/8 ? _____

9. Find 8 • 2 ½ = _____

10. Is 2 a solution of 2/3 = x/3 ? _____
Name _____ Math 130A, Quiz 10, September 28, 2001

1. Which of these represents an improper fraction ?

15/17, 2 ½ , 27/8, 12/16, or none of these ➔ _____

2. Multiply

3 1/5 • 3 3/4 = _____

3. What is the product of 4 and 2 1/8 ? _____

4. Find the solution of each of the following equations.

a) x/3 = 2 1/3 ➔ x = _____

b) 3x/5 = - 4 ➔ x = _____

c) 2/3 - ¾ x = ¼ ➔ x = _____

5. Let x = 4 ¼ and y = - 2 3/8. Find

a) x - y = _____ b) x + 2y = _____

6. 2 /3 of a household's budget goes towards essentials. If the $2400 is budgeted for this month, how much of it goes towards the household's budget.

7. Find - 4 3/8 - (- 2 ¾)

September 28, 2001