1. Operations with Real Numbers

1.1 Algebraic Expressions

1.1 Exercise Set, page 40 (22): 1, 3, 5, 7, 9, 10, 12, 22, 27

1.2 Integers

1.2 Exercise Set, page 69 (51): 1, 2, 6, 18, 25, 32, 39, 40, 48

1.4 Decimals

1.4 Exercise Set, page 112 (94): 1, 2, 4, 5, 9, 10, 18, 19, 25, 31, 33, 42, 44

1.2

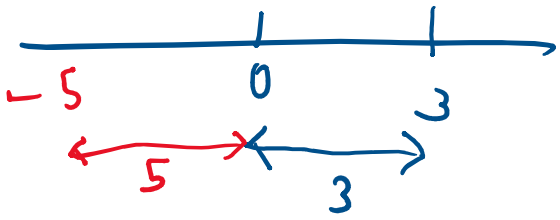
Memorize

Absolute Value

The absolute value of a number is its distance from 0 on the number line.

The absolute value of a number n is written as $|n|$.

Geometric definition



$|3| = 3$

$|-5| = 5$

$|0| = 0$

Algebraic definition

$$|x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{if } x < 0 \end{cases}$$

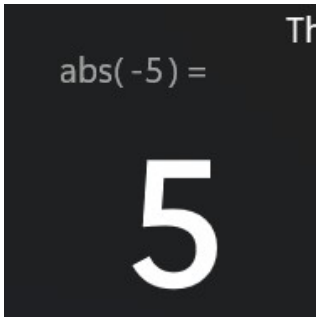
$3 \geq 0 \Rightarrow$ use top formula

$|3| = 3$

$|3| = 3$

$-5 < 0 \Rightarrow$ use bottom formula

$|-5| = -(-5) = 5$



Windows scientific calculator

5, ±, |⬚|

−

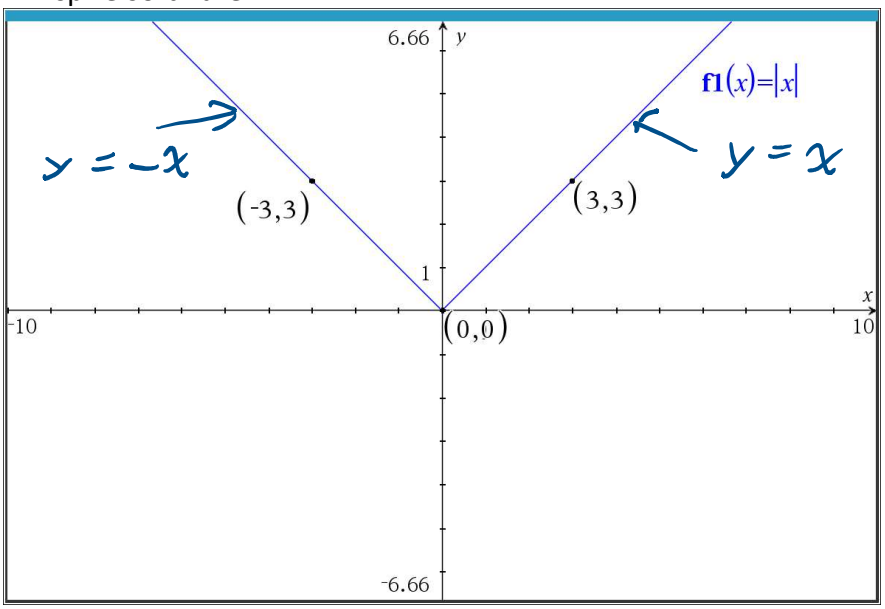
Memorize

Property of Absolute Value

$|n| \geq 0$ for all numbers

Absolute values are always greater than or equal to zero!

TI-nspire software



Copilot

The TI-30XIIS calculator doesn't have a dedicated absolute value (x) button, but you can still calculate it manually with a simple workaround:

Manual Method for Absolute Value

1. **Enter the number**: Type in the value of *x*.
2. **Check the sign**:
   - If *x* is positive, the absolute value is just *x*.
   - If *x* is negative, press the **(-)** key (located near the bottom left) to negate it.
3. **Use parentheses if needed**: For expressions like −5 + 3, calculate the expression first, then apply the absolute value logic.
4. **Final step**: If the result is negative, just re-enter it as positive manually.

This method works because absolute value is defined as the distance from zero—always positive.

Memorize

Grouping Symbols

Parentheses	( )
Brackets (sqnare)	[ ]
Braces (curly)	{ }
Absolute value	| |

memorize

Subtraction Property

$$a - b = a + (-b)$$

Subtracting a number is the same as adding its opposite.

Memorize

Multiplication of Signed Numbers

For multiplication of two signed numbers:

Same signs	Product	Example
Two positives Two negatives	Positive Positive	$7 \cdot 4 = 28$ $-8(-6) = 48$

Different signs	Product	Example
Positive \cdot negative Negative \cdot positive	Negative Negative	$7(-9) = -63$ $-5 \cdot 10 = -50$

Memorize

Multiplication by -1

$-1a = -a$

Multiplying a number by -1 gives its opposite.

Multiplication and Division of Signed Numbers

For multiplication and division of two signed numbers:

- If the signs are the same, the result is positive.
- If the signs are different, the result is negative.

Same signs	Result
Two positives	Positive
Two negatives	Positive

If the signs are the same, the result is positive.

Different signs	Result
Positive and negative	Negative
Negative and positive	Negative

If the signs are different, the result is negative.

1.3

Summary of Fraction Operations

Fraction Operation	Sample Equation	What to Do
Fraction multiplication	$\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}$	Multiply the numerators and multiply the denominators
Fraction division	$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c}$	Multiply the first fraction by the reciprocal of the second.
Fraction addition	$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$	Add the numerators and place the sum over the common denominator.
Fraction subtraction	$\frac{a}{c} - \frac{b}{c} = \frac{a-b}{c}$	Subtract the numerators and place the difference over the common denominator.

To multiply or divide fractions, an LCD is NOT needed. To add or subtract fractions, an LCD is needed.

1.4

Learning Objectives

By the end of this section it is expected that you will be able to:

- Round decimals
- Add and subtract decimals
- Multiply and divide decimals
- Convert decimals, fractions, and percent

Memorize

Decimals are another way of writing fractions whose denominators are powers of 10.

$$\begin{aligned} 0.1 &= \frac{1}{10} && \text{0.1 is “one tenth”} \\ 0.01 &= \frac{1}{100} && \text{0.01 is “one hundredth”} \\ 0.001 &= \frac{1}{1{,}000} && \text{0.001 is “one thousandth”} \\ 0.0001 &= \frac{1}{10{,}000} && \text{0.0001 is “one ten-thousandth”} \end{aligned}$$

Memorize

Place Value											
Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones	.	Tenths	Hundredths	Thousandths	Ten-thousandths	Hundred-thousandths
						.					

Figure 1

$365 = (3 \times 100) + (6 \times 10) + (5 \times 1)$

HOW TO: Round Decimals

1. Locate the given place value and mark it with an arrow.
2. Underline the digit to the right of the place value.
3. Is this digit greater than or equal to 5?
   - Yes—add 1 to the digit in the given place value.
   - No—do not change the digit in the given place value.
4. Rewrite the number, deleting all digits to the right of the rounding digit.

Round 1.067 to the nearest tenth

$6 \geq 5$

$\Rightarrow 0+1=1$

$\boxed{1.1}$

HOW TO: Add or Subtract Decimals

1. Write the numbers so the decimal points line up vertically.
2. Use zeros as place holders, as needed.
3. Add or subtract the numbers as if they were whole numbers. Then place the decimal point in the answer under the decimal points in the given numbers.

Add 21.46 + 317.001

$$\begin{array}{r} 317.001 \\ +\ 21.460 \\ \hline 338.461 \end{array}$$

317.001 + 21.46 =

338.461

HOW TO: Multiply Decimals

1. Determine the sign of the product.
2. Write in vertical format, lining up the numbers on the right. Multiply the numbers as if they were whole numbers, temporarily ignoring the decimal points.
3. Place the decimal point. The number of decimal places in the product is the sum of the number of decimal places in the factors.
4. Write the product with the appropriate sign.

$(2.3)(6.48)$

$$\begin{array}{r} 6.48 \\ \times\ 2.3 \\ \hline 1944 \\ 12960 \\ \hline 14.904 \end{array}$$

approximate
$(6)(2) = 12$

extra - counting out 9's.

$$\begin{array}{r} 5321 \\ 9\overline{)47896} \\ 45 \\ 28 \\ 27 \\ \hline 19 \\ 18 \\ \hline 16 \\ 9 \\ \hline 7 \end{array}$$

47896 (7)

273 (3)

81 (0)

6.48 → 0

2.3 → ×5

14.904 ← 0

14.707 → 0

HOW TO: Divide Decimals

1. Determine the sign of the quotient.
2. Make the divisor a whole number by "moving" the decimal point all the way to the right. "Move" the decimal point in the dividend the same number of places—adding zeros as needed.
3. Divide. Place the decimal point in the quotient above the decimal point in the dividend.
4. Write the quotient with the appropriate sign.

Memorize

Repeating Decimal

A **repeating decimal** is a decimal in which the last digit or group of digits repeats endlessly.

What is $0.\overline{9}$ equal to?

claim $0.\overline{9} = 1$

Let $x = 0.\overline{9} = 0.999$

$10x = 10(0.999)$

$10x = 9.999$

$-x = 0.999$

$9x = 9$

$x = \frac{9}{9}$

$x = 1$

$0.\overline{9} = 1$

$\frac{1}{7} = 0.\overline{142857}$

$\frac{1}{7} = .142857\overline{142857}$

$7\overline{)1.000000}$

7
30
28
20
14
60
56
40
35
50
49
1

claim $0.\overline{3} = \frac{1}{3}$

Let $x = 0.\overline{3}$

$10x = 3.\overline{3}$

$-x \quad -0.\overline{3}$

$9x = 3$

$x = \frac{3}{9}$

$x = \frac{1}{3}$

$\therefore 0.\overline{3} = \frac{1}{3}$

$0.333 \approx \frac{1}{3}$ ↑ approximate

$.\overline{3}$

$3\overline{)1.00}$

9
1

Your Name MTH 111 quiz 1 write each problem. No calculator.

1. Is 9x-4 an expression or equation?
   This is an expression, because there is no equal sign.

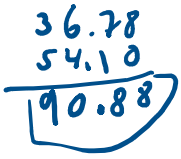
2. Can we solve 9x-4 for x? Why or why not?

No. We cannot solve for x because we don't have an equation. Furthermore, an expression does not have a truth value.

3. Give the integers in this list:

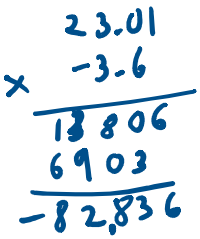
$3, \quad -5, \quad 1/2, \quad 0, \quad -3/4, \quad 9.04$

4. Add 36.78+54.1



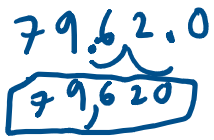
36.78+54.1=90.88 one-note check

5. Multiply $23.01 \times (-3.6)$



6. Round 82.03 to the nearest ten.

7. Multiply 79.62×1000



8. Divide $79.62 \div 1000$