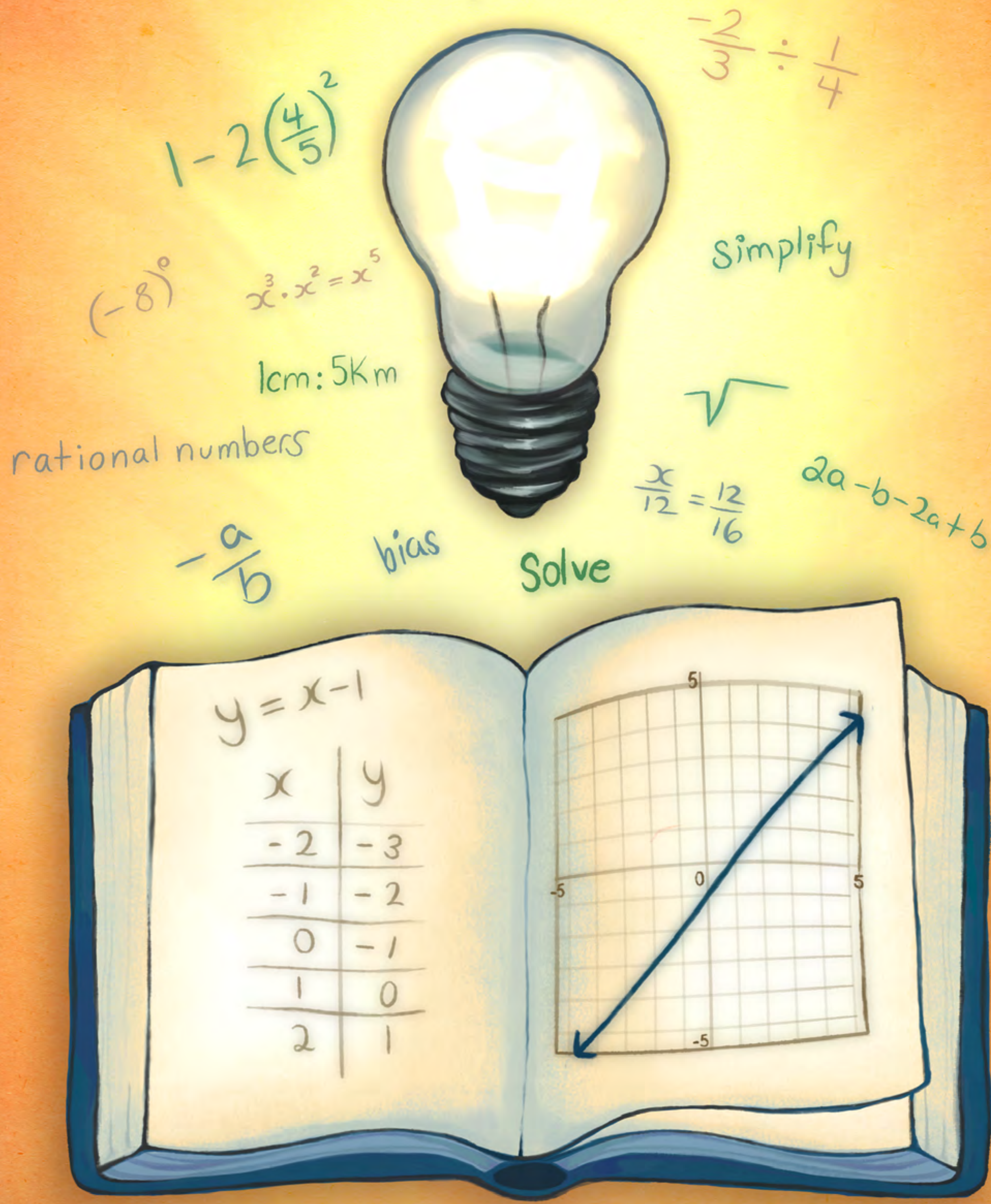
BC Math 9



$\frac{-2}{3} \div \frac{1}{4}$
$1-2\left(\frac{4}{5}\right)^2$
simplify
$(-8)^0$
$x^3 \cdot x^2 = x^5$
1cm : 5Km
$\sqrt{}$
rational numbers
$\frac{x}{12} = \frac{12}{16}$
$2a-b-2a+b$
$-\frac{a}{b}$
bias
Solve
$y = x-1$
x y
-2 -3
-1 -2
0 -1
1 0
2 1
5
-5
0
5
-5

edvantage interactive

BC MATH 9

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BC Math 9

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Contents

Welcome to Edvantage Math: BC Math 9

Before diving into your course, we invite you to read this introduction. It outlines key ideas from modern cognitive science research, ideas that shaped how this textbook was designed to help you learn more effectively and remember for longer.

What Is Learning?

Let's start with a research-based definition from *Make It Stick: The Science of Successful Learning*:

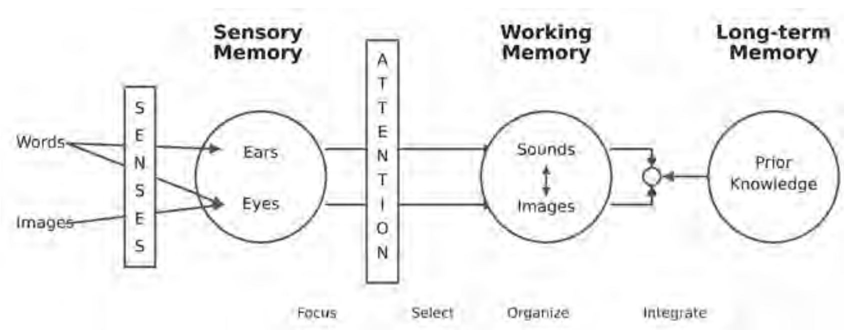
> **"Learning is acquiring knowledge and skills and having them readily available from memory so you can make sense of future problems and opportunities."**
>
> Brown, Roediger, & McDaniel (2014), p. 2

This means that learning isn't just about reading or listening. It's about getting ideas and skills into your long-term memory so that you can apply them when you face new challenges. That's what this course, and this textbook, are designed to help you do.

How Your Brain Learns: A Simplified Model

The diagram you'll see below is a simplified version of the Cognitive Theory of Multimedia Learning (Mayer, 2005), which integrates decades of research on how people learn from words, images, and experiences.

The diagram highlights three key memory systems:



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- **Sensory memory**: Information enters through your senses (especially eyes and ears).
- **Working memory**: Where your brain holds and organizes new information.
- **Long-term memory**: Where learning is stored and integrated with your prior knowledge.

Understanding how these systems interact is critical for learning effectively.

Attention: The Gatekeeper of Learning

You can't learn what you don't notice. Your sensory memory only processes what you give attention to. If you're distracted by your phone, for example, you won't retain what your teacher is saying, no matter how good the explanation.

That's why attention is the first essential skill for learning. This textbook is structured to help you focus on *what matters most* in each lesson.

Cognitive Load: Why Less Is More

Your working memory can only hold about 4 to 7 pieces of new information at once and often fewer when the material is unfamiliar. If too much is thrown at you at once, your brain gets overwhelmed and can't process it deeply enough to store in long-term memory.

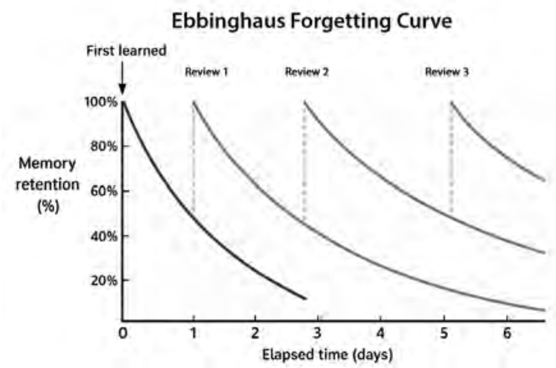
That's called cognitive overload, and it's a major barrier to learning.

To address this, Edvantage Math: BC Math 9 is carefully designed to reduce unnecessary cognitive load so your brain can focus on understanding core ideas. Clear diagrams, structured problem-solving prompts, and scaffolded practice are just a few of the strategies we've built in to help.

The Importance of Forgetting (and Remembering)

Forgetting is normal. It happens to everyone. In fact, it begins as soon as we learn something. This is known as the Ebbinghaus Forgetting Curve and is illustrated in the graph below. But here's the good news: forgetting can be slowed and even reversed by reviewing information at spaced intervals as shown in the graph.

This process is called retrieval practice, and it's one of the most powerful learning strategies discovered in cognitive science. You'll find many activities in this book designed to help you remember what you learn when you need it most.



This Book Supports How You Learn

Try Together – Partially Worked Solutions

Every sample problem is followed by a Try Together problem. This problem is a **partially worked solution**. This helps you focus on the key aspects of the problem without overloading your working memory with too many steps at once.

How's it Going?

During each chapter, *you become the teacher*. You'll mark a sample student's quiz, allowing you to retrieve, evaluate, and apply what you've learned. This kind of elaborative practice strengthens long-term memory and makes your learning more durable.

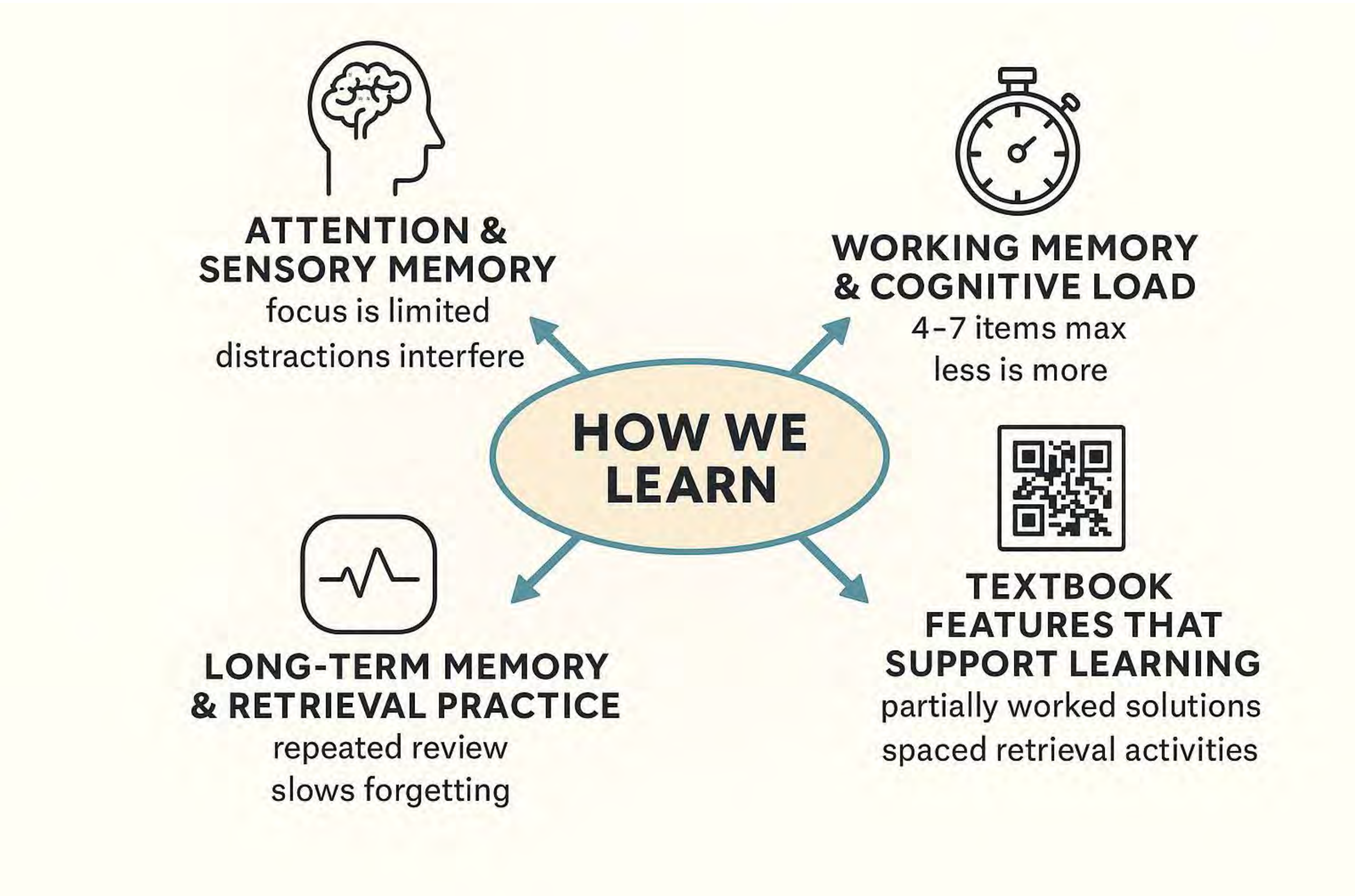
Remembering Ebbinghaus

Periodically, you'll encounter questions that revisit earlier topics even if they're not part of your current unit. This deliberate spacing and retrieval strengthens memory and prepares you to use math concepts flexibly, not just repeat them on a test.

Final Thoughts

If you've read this far, congratulations. You've already taken the first step in developing strategies that help you learn. This textbook is more than a source of information; it's a tool to help you become a better learner.

Good luck on your journey through BC Math 9.



References and Suggested Reading

Ashman, G. (2022). *Little Guide for Teachers: Cognitive Load Theory*.

Brown, P. C., Roediger, H. L., & McDaniel, M. A. (2014). *Make It Stick: The Science of Successful Learning*.

Christodoulou, D. (2014). *Seven Myths About Education*.

Ebbinghaus, H. (1885/1913). *Memory: A Contribution to Experimental Psychology.*

Kirschner, P., & Hendrick, C. (2020). *How Learning Happens: Seminal Works in Educational Psychology and What They Mean in Practice.*

Mayer, R. E. (2005). *The Cambridge Handbook of Multimedia Learning.*

Mirabelli, S., & Sandner, L. (2023) *Failsafe Strategies for Science and Literacy*

Welcome to BC Math 9

2026 Challenge

Use the four digits (2, 0, 2, 6) exactly once each along with any operations to create expressions equivalent to the numbers from 1 to 20. Can you continue this for the numbers from 1 to 50? Can you find more than one way to express each number from 1 to 20?

Examples

$0 = 6 \times 0 \times 2 \times 2$

$42 = 62 - 20$

$34 = 6^2 - 2 + 0$

$28 = 20 + 2 + 6$

1 =	11 =
2 =	12 =
3 =	13 =
4 =	14 =
5 =	15 =
6 =	16 =
7 =	17 =
8 =	18 =
9 =	19 =
10 =	20 =

1 Rational Numbers

Rational numbers are everywhere. A car travels 15 km and has half a tank of gas. There is a 25% discount on an item that costs \$49.95. The temperature outside is –10 °C. All of these numbers are rational. These numbers help us describe, measure, and compare quantities that involve decimals, fractions, percents, and rates.

Big Idea of the Chapter

Computational fluency and flexibility with numbers extend to operations with rational numbers.

In this chapter you will explore:

Rational numbers and why they are useful	Rational numbers are numbers that can be represented as a fraction $\frac{\mathrm{m}}{\mathrm{n}}$ where *m* (the numerator) and *n* (the denominator) are integers and *n* is not zero.
Add rational numbers	$\frac{1}{2}+\frac{1}{2}=\frac{2}{2}=1$, 0.005 + 0.5 = 0.505
Subtract rational numbers	$\frac{1}{2}-\frac{1}{3}=\frac{1}{6}$, 11.19 – 0.076 = 11.114
Multiply rational numbers	$\frac{2}{5}\times 5=\frac{10}{5}=2$, 0.3 × 0.4 = 0.12
Divide rational numbers	$3\div\frac{1}{2}=6$, 0.5 divided by 0.25 = 2
Order of operations with rational numbers	$\frac{-4(-2)+4(-9+11)}{(3-2)(-5+7)}$
Apply these concepts	Double a recipe asking for $\frac{1}{4}$ cup of sugar
Model operations to help deepen understanding	Number lines, fraction strips/circles, measuring tools, grids

Get Started

Rational numbers help us manage money (\$12.50) and time (12:30 pm). They help us measure things like distance, speed, acceleration, temperature, capacity, area, angles, probability, averages, decibels (sound), lumens (light), pH (acidity) and so much more. In grades 10 to 12, you will study irrational numbers. Together the rational and irrational numbers make up the real numbers used in secondary math.

All of the visuals below represent part of something. Specifically, they describe half of something. Identify what each picture is half of.





1.1 What is a Rational Number?

Warm Up

Competency Focus - *Model math in contextualized experiences*

Pick one of the questions below and solve.

- What fraction of the rectangle above is shaded?
- How many suns are there compared to the number of moons in the middle picture?
- How can you share $10 000 evenly with 3 people?

Define Rational Number

Rational numbers are numbers that can be represented as a fraction $\frac{m}{n}$ where *m* (the numerator) and n (the denominator) are integers and *n* is not zero.

Rational numbers help us to accurately represent, describe, compare and understand measurements, probabilities, proportions, and relations. They are everywhere, and there is evidence that they were used by humans for thousands of years, all over the world. "Rational" comes from the Latin word "rationalis" which means reasonable or logical.

Here are examples of rational numbers you might see today. Can you add to the list?

- 25% tariff.
- Overall average for grade 9 courses is 78%.
- 10 BC Transit concession tickets for $15.75.
- Batting average of 0.300.
- Speed limit on the highway is 100 km/h.
- 90% chance of rain.
- 2 cups of water for every cup of oats.
- Minimum wage is $18.25 an hour.
- The dimensions of this workbook are 8.5 inches by 11 inches.

Dividing by Zero

Consider the following division: $6 \div 0$. Try it on your calculator. Why can't we divide by zero? Now let's compare it to $6 \div 3$. How many 3s are in 6? 2 because $3 + 3 = 6$. So, how many zeros are there in 6? $0 + 0 + 0 + \ldots$ it doesn't work. It doesn't make sense.

In math and science, we can use more formal ways to prove something is true or not true. One of them is a proof by contradiction. Let's assume there is an answer that works, and we will call this answer *x*. $6 \div 0 = x$.

1. If $6 \div 3 = 2$, we know that $2(3) = 6$.
2. So, if $6 \div 0 = x$, then $0(x) = 6$.
3. We also know that multiplying by zero gives an answer of zero. $0(x) = 0$.
4. $0(x) = 6$ and $0(x) = 0$ is a contradiction. Our assumption was wrong.

That is why $6 \div 0$ has no answer. In math, we say it is undefined.

Fractions

The word **fraction** comes from the Latin word meaning "to break". Fractions help us describe parts of something. They also help us compare quantities and write division clearly.

All rational numbers can be written as a fraction. All rational numbers can also be written as either repeating or terminating decimals.

- Repeating decimals have a recurring pattern of digits. Example: $0.\overline{142}$ or $0.142142\overline{142}$.
- Terminating decimals have a finite number of digits. Example: 0.3 or 0.9876543.

Try This ...

1. With your calculator, convert the following fractions to a decimal number. Divide the numerator by the denominator. Does the decimal terminate or repeat? Write T for terminating and R for repeating beside the fraction.

a. $\frac{6}{5}$ b. $-\frac{12}{99}$ c. $-4\frac{2}{3}$ d. $\frac{2}{100}$ e. $-\frac{330}{15}$

Define Irrational Number

Numbers that are not rational are called **irrational**. You will study these numbers in grades 10 and 11. Three of the most famous irrational numbers are π, $\sqrt{2}$ and *e*.

Decimal numbers that are rational must be either **repeating** or **terminating**. If they are non-repeating and non-terminating, they are not rational numbers.

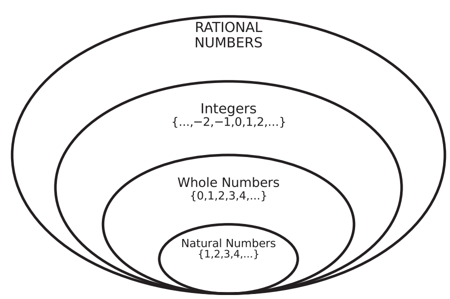
Rational Numbers as a Set of Numbers

A set is a collection of objects. In mathematics, sets are often used to group numbers that share similar properties.

The set of rational numbers is an infinitely large set. It includes numbers that can be written as a fraction of two integers. Some number sets are completely contained within larger sets. For example, every natural number is also a whole number, every whole number is also an integer, and every integer is also a rational number.

The set of rational numbers includes these kinds of numbers:

- Natural numbers {1, 2, 3 ...}
- Whole numbers {0, 1, 2, 3 ...}
- Integers {... –3, –2, –1, 0, 1, 2, 3 ... }
- Fractions like $-\frac{4}{5}, \frac{25}{650}, \frac{-5}{-3}$
- Terminating decimals like 5.25 and 0.07.
- Repeating decimals like $0.\overline{1}$, $78.\overline{658}$ and $2.3333333\overline{3}$



Try This ...

1a. Circle or highlight the rational numbers in the chart below. Hint: Can you write it as a terminating decimal? Fraction? Repeating decimal?

a. 3	b. $-2.\overline{123}$	c. 0.8	d. $-\frac{1}{3}$	e. 12.25
f. $0.\overline{5}$	g. 0	h. -11	i. 0.2222	j. 1.545454 ...
k. 32	l. $3\frac{1}{2}$	m. 0.0000001	n. 5678	o. $\frac{1}{0}$
p. -999999	q. $\frac{5}{2}$	r. π	s. 3.23467211976	t. $-\frac{5234}{4239995}$

1b. How many of the above numbers are natural?_____ Integers? ______Whole numbers?______ terminating decimals?_____ irrational numbers? ____.

2. True or false. If it is true, give an example or reason. If it is false, give a counterexample (an example that contradicts the sentence).

a. All whole numbers are integers.

b. All integers are natural numbers.

c. Natural numbers are integers.

d. All decimal numbers are irrational.

e. Real numbers can be rational or irrational.

f. A repeating decimal is irrational.

g. Terminating decimals are rational.

h. π is an irrational number.

Extend and Explore Irrational numbers are numbers that cannot be written as a fraction with integers. Explore the irrational numbers "π" and "*e*". What do they represent? Why are they useful? Which of the two would you say is the most useful? Explain.

1.1 Practice

1. Circle the rational numbers in the chart below.

a. 0	b. $5\frac{1}{2}$	c. –7.11813519	d. $-\frac{1}{19}$	e. 123.456
f. $0.\overline{8}$	g. 13	h. 0.3	i. $-2\frac{1}{2222}$	j. 3.14
k. 3.1415926536 ...	l. $-6.\overline{789}$	m. –0.0000008	n. 123456789	o. $\frac{8}{0}$
p. –444	q. $\frac{5}{-2}$	r. $\frac{543}{876}$	s. 1.1111	t. $-\pi$

2. How many of the numbers in this chart are:

Natural _________ Whole numbers _________ Integers _________ Terminating decimals _________

3. True or false. Is the sentence correct or not? (T or F) Justify your choice.

a. All integers are rational ______ because ____.

b. All rational numbers are integers ______. For example ____.

c. Natural numbers are real ______. For example ____.

d. All decimal numbers are rational ______ because ____.

e. Real numbers can be rational or irrational ______ because ____.

f. A number can be both an integer and a rational number ______. For example ________________________.

g. Terminating decimals are rational ______ because ____.

h. π is a rational number ______ because ____.

i. Rational numbers have been used by humans for almost 100 years. ______ because ____________________.

j. Dividing by zero always yields a result of zero. ______ because ________________________________.

4. Fill in the blanks.

a. Dividing by zero is _____________. (zero / one / undefined / infinity)

b. Decimal numbers that are rational are either ____________ or ____________.

c. Rational numbers can be written as fractions with ___________ in the numerator/denominator.

d. The top of the fraction is called the _________________.

e. 1.23456789 is an example of a ______________ decimal.

1.1 Practice Answer Key

1) Do not circle: k, o, t

2) Natural: 2, Whole: 3, Integer: 4, Terminating decimals: 6

3a) T; an integer can be written as itself over one 3/1 = 3. b) F; one half is not an integer. c) T; example: 2 is a natural number, whole number, integer, rational and real number. d) F; non-terminating, non-repeating decimals cannot be written in the form a/b where a and b are integers. e) T; definition of real number. f) T; for example 2. g) T; they can be written as a fraction with the denominator that is a multiple of 10. h) F; it is non-repeating and non-terminating. i) F; much longer than 100 years (evidence in ancient civilizations). j) F; dividing by zero is undefined.

4a) undefined, b) terminating, repeating, c) integers, d) numerator, e) terminating