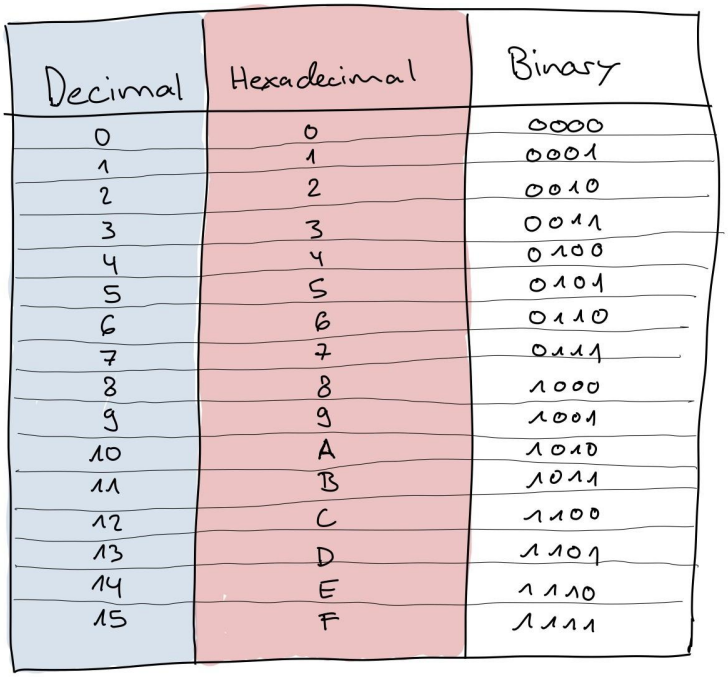
Number Systems



Decimal	Hexadecimal	Binary
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111

Source

NISD GT Process Standards

GT Process Standards provide guidance on what GT students should know, understand, and do as part of GT program services. Each lesson makes a connection to specific standards; however, teachers are encouraged to incorporate every standard where applicable.

I. Creative Thinking
Ability to look at problems or situations from a unique perspective through the use of imagination and/or innovative ideas

II. Critical Thinking
Ability to demonstrate clear, rational, open-minded thinking, informed by evidence

III. Depth & Complexity
Ability to dig deeper into a concept and to understand that concept with greater complexity

IV. Scholarly Inquiry & Research
Ability to interpret information that leads to new understandings and connects to the world beyond the classroom

V. Effective Communication
Ability to convey new learning through the use of written, spoken, and technological media

VI. Leadership & Responsibility
Demonstrates initiative, task commitment, and the elements of compromise and diplomacy

Scholarly Habits

- Scholars utilize varied resources
- Scholars exhibit curiosity
- Scholars demonstrate academic humility
- Scholars save ideas
- Scholars ponder the big idea
- Scholars see from different perspectives
- Scholars are always prepared
- Scholars display perseverance
- Scholars set goals
- Scholars take intellectual risks

Language of the Discipline

number system

numerals

digits

decimal

base 10

hexadecimal

binary

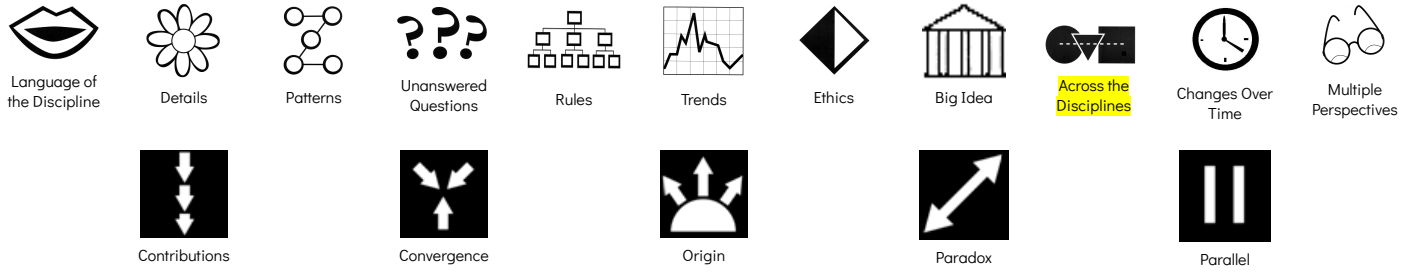
Roman numerals

octal

Science of Systems
Grade Level: Intermediate

Strand: Intro to Systems
Skill Focus: Across Disciplines

Depth and Complexity & Content Imperatives



Thinking like a Disciplinarian

Thinking like a ***mathematician*** (someone who uses an extensive knowledge of mathematics in their work, typically to solve mathematical problems).

Universal Generalizations

- Systems have parts that work to complete a task
- Systems are composed of subsystems
- Part of systems are interdependent upon one another and form symbiotic relationships
- A system may be influenced by other systems
- Systems interact
- Systems follow rules

Essential Questions

- What is a system?
- How are the parts of a system related to the entire system?
- How are system models used to predict and understand real world situations?

Supported TEKS

Science
3.2D, 4.2D, 5.2D (analyze and interpret patterns in data to construct reasonable explanations based on evidence from investigations)

Social Studies
3.14C, 4.19C, 5.23C (organize, interpret, and create visuals, including graphs, charts, tables, timelines, illustrations, and maps)
3.16, 4.22, 5.26 (use problem-solving and decision-making skills, working independently and with others)

RLA
3.6E, 4.6E, 5.6E (make connections to personal experiences, ideas in other texts, and society)
3.6F, 4. F, 5.6F (make inferences and use evidence to support understanding)
3.6H, 4.6H, 5.6H (synthesize information to create new understanding)
3.13E, 4.13E, 5.13E (demonstrate understanding of information gathered)
3.13H, 4.13H. 5.13H (use an appropriate mode of delivery, whether written, oral, or multimodal, to present results)

Math
3.1A, 4.1A, 5.1A (apply mathematics to problems arising in everyday life, society, and the workplace)
3.1B, 4.1B, 5.1B (use a problem solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution and evaluating the problem-solving process and the reasonableness of the solution)
3.1D, 4.1D, 5.1D (communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate)
3.1F, 4.1F, 5.1F (analyze mathematical relationships to connect and communicate mathematical ideas
3.1G, 4.1G, 5.1G (display, explain, and justify mathematical ideas, and arguments using precise mathematical language in written or oral communication
3.2, 4.2, 5.2 (applies mathematical process standards to represent and compare numbers and understand relationships related to place value)

# Instructional Plan	# Date:
Number Systems (1 week)	
Objectives: Students will understand... • how numbers and mathematics form a system. • different types of number systems are used around the world.	
Learning Experiences	**Resources/Materials**
Let's Get Curious (Slide 2) Abbott & Costello 7 x 13 = 28 • What do you notice? • What do you wonder? **Scholarly Habit: Pondering Ideas (Slide 3)** Discuss the Pondering Ideas scholarly habit with students. Scholars think about what they're learning and know that quality thoughts take time to develop. Throughout the lesson, remind students to ponder ideas. **Number Systems (Slides 4-6)** Share that today we are going to be focused on various number systems. These number systems are connected, so it is a great example of Across Disciplines. Where do you see numbers outside the classroom? (Slide 5-6) • Allow students time to jot everywhere they see and use numbers outside of their classroom. Ask students to think about their day from start to finish to help gather more ideas. • Share out the different ideas. Have students add to their lists as they hear more ideas. Use slide 6 if students are stumped. **Brydseed.TV Beyond Base-10 Lesson (Slides 7-10)** • View Part 1: Students will consider what a "numeral" is and how many we use. • View Part 2: Students will discuss how our base 10/decimal number system works. Then students will ponder base 9 systems. Students will complete Brydseed Worksheet 1. • View Part 3: Students will go further into a Base 9 system and practice transforming numbers.	BI_Lesson 2: Number Systems Slides Byrdseed.tv Puzzlements (teacher reference) Brydseed.TV's Beyond Base 10 Lesson CI_Brydseed Worksheet 1 Base 9 pr...

- View Part 4: Students will explore other real world number systems: Babylonian, Binary, and Hexadecimals. Then students will create their own number system. Students will complete Brydseed Worksheet 2.

DI_Brydseed Worksheet 2 Create Yo...

Pondering Big Ideas (Slides 11-21)
Ask students to imagine if the world switched to a base 9 system overnight, how would it impact phone numbers, credit card numbers, money, clocks, dates, Unlucky 13, jersey numbers, heights, house numbers, recipes? Guide students into a discussion that a change in a system might lead to consequences into many other systems.

System Generalizations (Slide 22)
Discuss the generalizations as it relates to our number system.

- What would our number system feel is the most important generalization?
- What would our number system feel is least important?

Number Systems Breakout (Slide 23)
Students will work in groups to explore various number systems and solve the clues to open their Breakout EDU box.

EI_Number Systems Breakout
**View the entire presenter notes section on each slide for details for each lock.*

BreakoutEDU Supplies Needed:
large box, small box, hasp, color lock, letter lock, 3 digit lock, 4 digit lock, key, UV light, and pen

Base-10 System Reflection (Slides 24-25)
Ask students to reflect on the question "Was the decimal (base-10) system discovered or invented?" and guide students to communicate their thinking.

Skill Stations: Introduction to Create Station (Slides 26-30)
Briefly go over the components of creativity, FFOE (slides 27-30)

Introduce Create Skill Station (Slide 31)

- What tools are available?
  - Tour of Create supplies
- What does it look like?
  - All students working, using materials appropriately, working on a specific task
- What does it sound like?
  - Appropriate voice level
- What does it feel like?
  - A bit of a challenge- that's okay! When you run out of ideas, try a new perspective and keep

<table>
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<td>going!
● What means you were successful?
○ Focused the entire work time, elaboration added to original idea, elements of FFOE included in work

Create Skill Station Task (Slide 32)
Complete Numeral Transformations. Students should focus on the components of creativity as they transform. Students will then complete a gallery walk to see their classmates' ideas.</td>
<td>FI_Numeral Transformations</td>
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<td colspan="2">Reflection/Metacognition (Slide 24-25)
Was the decimal (base-10) system discovered or invented? Students will reflect in their journals.</td>
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