Equivalencies in Other Bases

Purpose:
Participants will convert numbers in other bases to base ten numbers.

Overview:

Participants are given numbers in bases other than base ten. They convert the numbers to base ten numbers and complete the riddles.

TExES Mathematics 4-8 Competencies. The beginning teacher:

I.001.A Analyzes the structure of numeration systems and the roles of place vlue and zero in the base ten system.

TEKS Mathematics Objectives. The student is expected to:

4.1.A Use place value to read, write, compare, and order whole numbers through the millions place.

5.1.A Use place value to read, write, compare, and order whole numbers through the billions place.

6.1.B Generate equivalent forms of rational numbers including whole numbers, fractions, and decimals.

Terms.

Base Ten, algorithm, integer part

Materials.

- Transparencies
- Activity Sheet
- Calculators

Transparencies.

- *Transparency 1: Equivalencies in Other Bases Quiz*
- *Transparency 2: Solution Transparency*

Activity Sheet(s).

- *Activity Sheet 1: Equivalencies in Other Bases Quiz*

Procedure:

Steps	Questions/Math Notes
1. Distribute the *Equivalencies in Other Bases Quiz* to each participant. Encourage participants to work in pairs.	Demonstrate an example that is not on the quiz. For example, 100100_{two} = I. in a Y. *What does 100100_{two} equal in base ten?* ($100100_{two} = 36_{ten}$) *What might 36_{ten} = I. in a Y. mean? What does the number 36 mean to you?* (36 = Inches in a Yard)
2. Encourage participants to convert the numbers to base ten first. Then work on the riddles.	*What do the columns in base four represent?* (The columns in base four represent 1; 4; 16; 64; 256; 1024; 4096, etc.) *How can you convert 1102200_{four} to a base ten number?* ($1 \times 4^6 + 1 \times 4^5 + 0 \times 4^4 + 2 \times 4^3 + 2 \times 4^2 + 0 \times 4^1 + 0 \times 4^0 = 1 \times 4096 + 1 \times 1024 + 2 \times 64 + 2 \times 16 = 5280$) *What do the columns in base two represent?* (The columns in base two represent 1; 2; 4; 8; 16; 32; 64; 128; 256; 512; 1024; 2048; 4096, etc.) *How can you convert 110_{two} to a base ten number?* ($1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 = 1 \times 4 + 1 \times 2 + 0 \times 1 = 6$)
3. Provide time for participant pairs to solve the riddles once they have converted the numbers to base ten.	*What does the number 5280 mean to you? Is it an important quantity in measurement? Is it a significant number in history? Is it a significant number in literature?* (There are 5280 feet in a mile.) *What does the number 6 mean to you? Is it an important quantity in measurement? Is it a significant number in history? Is it a significant number in literature?* (6 = Wives of Henry the Eighth)
4. First check the number conversions and then allow another minute or two for participants to finish the riddles.	If the participants missed some of the conversions, you might want to ask: *Which step did you do incorrectly when converting the number to base ten?*

5. Have participants fill in the quiz sheet on the overhead. Ask each pair to fill in one unidentified riddle on the overhead. Repeat the process until all riddles are completed.	

Numeric Base Converter:
The following link will take you to a Numeric Base Converter that converts numbers from one base to another. http://www.mste.uiuc.edu/users/exner/ncsa/base/default.html#description

Solutions:

1. 1102200_{four} = 5280 Feet in a Mile
2. 110_{two} = 6 Wives of Henry the Eighth
3. 3_{five} = 3 Points for a Field Goal in Football
4. 110_{seven} = 56 Signers of the Declaration of Independence
5. 663_{eight} = 435 Members of the House of Representatives
6. 220_{five} = 60 Seconds in a Minute
7. 1101_{two} = 13 Cards in a Suit
8. 20_{four} = 8 Parts of Speech in the English Language
9. 30382_{nine} = 20,000 Leagues Under the Sea
10. 111_{five} = 31 Ice Cream Flavors at Baskin Robbins
11. 42_{seven} = 30 Days Hath Sept. April June and November
12. 10_{nine} = 9 Innings in a Baseball Game
13. 2_{eleven} = 2 Turtle Doves (and a Partridge in a Pear Tree)
14. 122_{six} = 50 Cents in a Half Dollar
15. 1111_{three} = 40 Thieves (with Ali Baba)
16. 422_{seven} = 212 Degrees at which Water Boils
17. 101_{two} = 5 Fingers on a Hand
18. 121_{three} = 16 Ounces in a Pound
19. 32_{six} = 20 Years that Rip Van Winkle Slept
20. 2420_{eight} = 1296 Square Inches in Square Yard