**A Trip to Quintopia!**

While on an Intergalactic Numismatics Tour, **you encounter a meteor shower** and are forced to make an unscheduled stop on the planet Quintopia. The monetary system used in Quintopia consists of three coins: a yellow coin (worth $1US), a red coin (worth five yellow coins), and a blue coin (worth five red coins).

Unlike its sister planet, Ufouria, Quintopia turns out to be a rather dull place to visit. To help pass the time at the shuttle docking area, you and a fellow passenger play a game with the Quintopia currency:

# **Coin Trading Game**

*Materials:* Quintopia coins (yellow, red and blue), one die (number cube)

*Players:* 2 or more

*Rules:* The youngest player starts, and players alternate turns afterwards.

On each turn, a player rolls the die and places that many yellow coins on his or her game sheet (see below).

Whenever possible, a player must trade in five yellow coins for a red coin, or trade in five red coins for a blue coin, and place them in their respective columns. As a result, no more than four coins of any one color should be a player’s game sheet.

The first player to get **two blue** coins is the winner.

|  |  |  |
| --- | --- | --- |
| BLUE | RED | YELLOW |
|  |  |  |

**Coin Trading Game Revisited**

A third passenger has been watching you play. She suggests it is more challenging to start the game with **TWO BLUE** coins and to remove the number of yellow coins equal to the number rolled on each turn. The first player to remove all of the coins from his or her playing board is the winner. (Note: On the last turn, the number rolled may exceed the number of yellow chips remaining.) Before you play this new version of the coin trading game, think about how you can remove yellow coins when you have none on your board (you only have two blue ones).

**Note:** Do not trade in coins until you absolutely need to – for example, you should not immediately trade in your two blue coins all for red or yellow coins.

|  |  |  |
| --- | --- | --- |
| BLUE | RED | YELLOW |
|  |  |  |

**What do you notice?**

**What do you wonder?**

**What ideas do you have?**

**Shopping in Quintopia**

You got bored on the ship deck and decided to visit Quintopia to do some shopping. You know you can only use Quintopian currency while shopping so you exchange some of your US dollars before your shopping and you have 3125 (in Quintopian currency), which means 3 blue, 1 red, and 2 yellows. While you’re shopping, recall that whenever possible, you must trade in five yellow coins for a red coin, or trade in five red coins for a blue coin, and so on.

**Question 1:** Before you left the ship, you won a gift card worth 245 (in Quintopian currency). How much total money do you have now for shopping? Show your process at least in two different ways.

**Question 2:** You spent 435 at Appletopia store. How much Quintopian money do you have left? Explain your process.

**Question 3:** You saw a pair of shoes you like and it only costs 325. Since it is very cheap, you want to buy three pairs. How much will it cost to buy three pairs of shoes (in Quintopia currency)? Solve this question in two different ways.

**Question 4:** After buying all three pairs of shoes, how much money do you have left?

**Question 5:** After all your shoppingyou had some dinner which cost 1025. Do you have enough Quintopian money to pay? If not, how much Quintopian money do you need? If you have an extra

$6 US currency, will that be enough to pay the rest?

**Wrap Up:** Discuss Base 5 and Base 10; and meaning of addition, subtraction and multiplication operations. Discuss expanded form.

**Connections to Base Blocks**

1. Using base-5 blocks discuss how Quintopian currency would be represented. For example, represent 3145 and 435. If you have $58 dollars how would you represent it using base-5 blocks?
2. If you have in base-5 blocks and you trade in all the blocks for their corresponding number of small cubes, how many small cubes would you have?
3. How do base-5 blocks compare to base-10 blocks?

What are the place values worth in base-5 vs. base-10?

What is the minimum/maximum number of blocks of each place value that you need in base-5? What about base-10?

How does this relate to the digits you need to represent numbers in base-5 vs. base-10?

1. Using base-10 blocks find the sum and the difference of 208 and 93.
2. List multiple things that you observe that are **similar** and **different** between **addition/subtraction** in base 5 (Quintopia) compared to base 10 (question 3).

**Algorithms for Addition/Subtraction**

1. Carry out the steps of the usual addition algorithm in the problem below in base 5. Carefully **EXPLAIN** what each of the “carried” (regrouped/traded in) numbers mean. You may want to refer to base 5 blocks in your explanation.

435 2435

+ 125 + 3245

2. Carry out the steps of the usual subtraction algorithm in the problem below using base 5. Carefully **EXPLAIN** what each of the “borrowed” (regrouped/traded in) numbers means. You may want to refer to base 5 blocks in your explanation.

3215 3015

- 1245 - 2135