

Home Base

Problems about numbers in various bases.

Problem 1 Explain why the following “joke” is “funny:” There are 10 types of people in the world. Those who understand base two and those who don’t.

Problem 2 You meet some Tripod aliens, they tally by threes. Thankfully for everyone involved, they use the symbols 0, 1, and 2.

- (a) Can you explain how a Tripod would count from 11 to 201? Be sure to carefully explain what number comes after 22.
 - (b) What number comes immediately before 10? 210? 20110? Explain your reasoning.
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Problem 3 You meet some people who tally by sevens. They use the symbols *O*, *A*, *B*, *C*, *D*, *E*, and *F*.

- (a) What do the individual symbols *O*, *A*, *B*, *C*, *D*, *E*, and *F* mean?
 - (b) Can you explain how they would count from *DD* to *AOC*? Be sure to carefully explain what number comes after *FF*.
 - (c) What number comes immediately before *AO*? *ABO*? *EOFFA*? Explain your reasoning.
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Problem 4 Now, suppose that you meet a hermit who tallies by thirteens. Explain how he might count. Give some relevant and revealing examples.

Problem 5 While visiting Mos Eisley spaceport, you stop by Chalmun’s Cantina. After you sit down, you notice that one of the other aliens is holding a discussion on fractions. Much to your surprise, they explain that $\frac{1}{6}$ of 36

Learning outcomes:
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is 7. You are unhappy with this, knowing that $1/6$ of 36 is in fact 6, yet their audience seems to agree with it, not you. Next the alien challenges its audience by asking, “What is $1/4$ of 10?” What is the correct answer to this question, and how many fingers do the aliens have? Explain your reasoning.

Problem 6 When the first Venusian to visit Earth attended a sixth grade class, it watched the teacher show that

$$\frac{3}{12} = \frac{1}{4}.$$

“How strange,” thought the Venusian. “On Venus, $\frac{4}{12} = \frac{1}{4}$.” What base do Venusians use? Explain your reasoning.

Problem 7 When the first Martian to visit Earth attended a high school algebra class, it watched the teacher show that the only solution of the equation

$$5x^2 - 50x + 125 = 0$$

is $x = 5$.

“How strange,” thought the Martian. “On Mars, $x = 5$ is a solution of this equation, but there also is another solution.” If Martians have more fingers than humans, how many fingers do Martians have on both hands? Explain your reasoning.

Problem 8 In one of your many space-time adventures, you see the equation

$$\frac{3}{10} + \frac{4}{13} = \frac{21}{20}$$

written on a napkin. How many fingers did the beast who wrote this have? Explain your reasoning.

Problem 9 What is the smallest number of weights needed to produce every integer-valued mass from 0 grams to say n grams? Explain your reasoning.

Problem 10 Starting at zero, how high can you count using just your fingers?

- (a) *Explain how to count to 10.*
- (b) *Explain how to count to 35.*
- (c) *Explain how to count to 1023.*
- (d) *Explain how to count to 59048.*
- (e) *Can you count even higher?*

Explain your reasoning.
