

Solutions to Attendance Quiz # 0 for Dr. Z.'s MathHistory for Lecture 0

1. (a) Express the number one hundred eighty two (in base 10) in terms of powers of 5.

Solution: Let's write the powers of 5 in increasing order (in our usual, base 10, notation)

$$1, 5, 25, 125, 625, \dots$$

The **largest** power of 5 that is less than 182 is 125.

Dividing 182 by 125 gives 1, with remainder 57. So

$$182 = 1 \cdot 125 + 57 \quad .$$

The **largest** power of 5 that is less than 57 is 25. Dividing 57 by 25 gives 2, with remainder 7. So

$$57 = 2 \cdot 25 + 7 \quad .$$

The **largest** power of 5 that is less than 7 is 5. Dividing 7 by 5 gives 1, with remainder 2. So

$$7 = 1 \cdot 5 + 2 \quad .$$

Combining all these we have, from bottom to top

$$57 = 2 \cdot 25 + 1 \cdot 5 + 2 \quad .$$

$$182 = 1 \cdot 125 + 2 \cdot 25 + 1 \cdot 5 + 2 \cdot 1 \quad .$$

$$= 1 \cdot 5^3 + 2 \cdot 5^2 + 1 \cdot 5^1 + 2 \cdot 5^0 \quad .$$

(b) Use the the above to express one hundred eighty two (base ten) in base five.

Ans. 182 in base ten is written 1212 in base five.

2. What is the decimal name of the integer that is called "One million and one" in base 2?

Sol. $2^6 + 2^0 = 64 + 1 = 65$.

Ans.: One million and one in base 2 equals 65 in base ten.