Hoover High School Math League

March 18-19, 2009

Bases other than 10: Problems

Integers

1. Convert 346_{seven} to a base 10 value.
   (a) 181
   (b) 346
   (c) 567
   (d) none of the above
2. Convert 128_{16} to a base 10 number.
   (a) 4736
   (b) 200
   (c) 256
   (d) 296
3. Convert 432 (base 10) to a base 5 value.
   (a) 3212_{five}
   (b) 2312_{five}
   (c) 432_{five}
   (d) none of the above
4. Convert 384 (base 10) to a hexadecimal (base 16) number.
   (a) 100_{16}
   (b) 120_{16}
   (c) 140_{16}
   (d) 180_{16}
5. Which of the following represents the number 34 (base 10) as a base-6 number?
   (a) 100_6
   (b) 54_6
   (c) 34_6
   (d) None of the above
6. $43_{nine} =$
   (a) 123_{five}
   (b) 125_{five}
   (c) 234_{five}
   (d) 124_{five}

7. The binary system uses base-2 numbers (i.e., the only allowable digits are 0 and 1). Which of the following base 2 numbers is divisible by 2?
   (a) 111
   (b) 110
   (c) 101
   (d) 011
   (e) All of the above are divisible by 2.
8. In the binary number system, what is 101 plus 110?
   (a) 211
   (b) 111
   (c) 1111
   (d) 1011
   (e) None of the above
9. In the hexadecimal number system, what is $1A + 2E$?
   (a) 26
   (b) 38
   (c) 48
   (d) 72
10. Find the numbers A, B, C, and D in the following base 6 addition.

$$\begin{array}{cccc} & 3 & A & B & 3 \\ + & & 2 & 5 & C \\ \hline & D & 0 & 0 & 2 \end{array}$$

    (a) $A = 1, B = 2, C = 3, D = 4$
    (b) $A = 3, B = 0, C = 5, D = 3$
    (c) $A = 3, B = 0, C = 5, D = 4$
    (d) none of the above
11. $43_{Ten} =$ _____$_{Negative\ Ten}$
    (a) 136
    (b) 163
    (c) 631
    (d) none of the above
12. If the number 86 in base ten is represented as 321 in base b, then the number 123 in base b can be represented in base ten by what number?
    (a) 12
    (b) 25
    (c) 35
    (d) 38

13. Assume that b and c are two integers that are greater than one. In base b, c^2 is written as 10. Then b^2, when written in base c is

    (a) 100

    (b) 101

    (c) 10000

    (d) 1010

    (e) It cannot be determined

Decimals

14. The number 0.125 (base 10) is represented by which of the following base 2 fractions?

    (a) 0.001_2

    (b) 0.01_2

    (c) 0.1_2

    (d) None of the above

15. Suppose b is a positive integer base that satisfies the equation $(.111\ldots)_7 = (.222\ldots)_b$ (where the subscript indicates the base in the representation). Then $b =$

    (a) 14

    (b) 13

    (c) 6

    (d) 8

    (e) None of these

16. The base-2 number (repeated decimal) $.\overline{01}_2 = .010101\ldots_2$ is equal to

    (a) $\frac{1}{3}$

    (b) $\frac{1}{4}$

    (c) $\frac{1}{5}$

    (d) $\frac{1}{6}$

    (e) None of the above

17. When converted to base 10, the infinite repeating base 3 number $0.\overline{12}_3$ is equal to

    (a) $\frac{1}{2}$

    (b) $\frac{4}{9}$

    (c) $\frac{5}{8}$

    (d) $\frac{5}{9}$

    (e) None of the above

18. Let $(0.xyxyxy\ldots)_b$ and $(0.yxyxyx\ldots)_b$ be the base b representations of the two numbers A and B respectively, where x and y represent base b digits, not both of which are zero. Then $\frac{A}{B} =$

    (a) $\frac{y+b}{x+b}$

    (b) $\frac{x+b}{y+b}$

    (c) $\frac{xb+y}{yb+x}$

    (d) $\frac{yb+x}{xb+y}$

    (e) None of the above