Mathematics for Elementary School Teachers
Final Exam
May 16, 2003

The point value of each problem is given in the margin. You must show all your work to receive full credit.

(8) 1. Identify each of the following sequences as arithmetic, geometric or neither and answer the questions asked.

(a) The population of a community is 5000 in the year 2003 and increasing by 5% each year, that is, the population increases by a factor of 1.05 each year. Type of sequence? __________ What is the population in 2019? (expressed in exponent notation.)

(b) Your salary this year (2003) is $30000 and it increases by $1200 each year thereafter. Type of sequence?__________ What is your salary in the year 2023?

(8) 2. Draw a Venn diagram to illustrate the three sets A, B, C below inside the universal set U={1,2,3,4,5,...,11,12}. (Indicate where each element of the universal set belongs in the diagram.)

A= the factors of 28 in U
B= the multiples of 4 in U
C= all primes in U

(8) 3. In a class of 36 students, 16 watched television last night, 22 did homework, 12 had pizza, 11 watched television and did homework, 7 watched television and ate pizza, 9 ate pizza and did homework and 5 did all three. Illustrate this information on a Venn diagram using T for students who watched television, H for those who did homework and P for those who ate pizza. (Note: When we say 11 students watched television and did homework, some of those students also ate pizza. Likewise for the other numbers.)
4. a) Write the following as a decimal. \( 10^5 + 2 \cdot 10^2 + 10^{-1} + 3 \cdot 10^{-2} = \)

b) Express the following number in words: 4000000.0033

c) Mark the decimals 1.33, .025 and 2.7 on the numberline below.

5. Express the following binary number in base-10: \( 101101_{two} = \)

6. Express the base-10 numeral 300 in base-5.

7. Determine whether the following sets are closed under the given operation. If not give a counterexample.
   (a) The set of primes under multiplication.
   (b) \( \{0, 1, 2, 3, 4, 5, 6, 8, 9, \ldots \} \), the set of whole numbers without 7 under addition.
   (c) The set of odd whole numbers under multiplication.

8. Estimate. (Do not calculate exact values.)
   (a) \( \frac{4500011}{902} \approx \)
   (b) \( 670013 - 20 \approx \)
   (c) \( \frac{1}{899} + \frac{301}{51} + \frac{5.5}{9.7} \approx \)
   (d) \( (2 + \frac{1}{3})^3 + (1.99)^2 \approx \)
   (e) \( 20.2\% \) of 498 \( \approx \)

9. A student is trying to understand why we multiply exponents in the law of exponents \( (b^n)^m = b^{nm} \). Explain it using a good example.
10. Use tests to determine whether 1000030020 is divisible by the following numbers. (Show clearly how the test works.)
   a) 4
   b) 6
   c) 11

11. In order to calculate 4.03 \times .025 one multiplies 403 by 25 and then moves the decimal point over 5 places. Explain why this procedure works. (You don’t need to carry out any calculation.)

12. Find the greatest common factor of 247 and 221 any way you like.

13. Find the least common multiple of 36 and 100 any way you like.

14. How many pieces of rope of length .08 cm can be cut from a piece of length 12.4 cm?

15. A class started with 5\frac{1}{2} gallons of ice cream and consumed 2\frac{5}{12} gallons. How much was left? (Express your answer as a mixed number in simplest terms.)
16. Draw a rectangle whose area is roughly one acre. (Indicate the units you are using.)

17. a) A computer hard drive holds 40 gigabytes of data. How many bytes is this?

b) 1200 millimeters is how many meters?

18. 15% of the students in a class were men.
   a) What fraction of the class were women?
   
   b) What was the ratio of men to women in the class?

19. Draw the reflection axes and indicate the rotation symmetry for the following shapes.
    a) 
    b) 

20. A recipe calls for 4 cups of flour and 3 cups of milk. If you only have $2\frac{1}{3}$ cups of flour, how much milk should you add?

21. A home valued at $50000 went up in value 10% the first year and down 10% the second year. What was its value at the end of the second year?
22. Simplify. a) \((1/2)^{-1} =\)

b) \(7 - 2(1 - 3) =\)

c) \((-1 - (-1)^2)^3 =\)

23. Let \(N=\)natural numbers, \(I=\)integers, \(Q=\)rationals and \(R=\)reals. Indicate all of the sets in the previous sentence that each of the following numbers belong to.

a) \(\frac{\pi}{2}\)

b) \(3\frac{1}{7}\)

c) \(3.0\overline{5} = 3.0505050...\)

d) \(\sqrt{64}\)

24. Express \(3.\overline{12} = 3.1212...\) as a mixed number in simplified form.

25. Define and draw a picture to illustrate.

a) Obtuse triangle.

b) Trapezoid

26. Find the area of the triangle pictured below.
27. Find the missing angles A, B in the following figures.
   a)  
   b)  
   c)  

28. A pile of sawdust measured 50 cubic yards. How many cubic feet is this?

29. Give estimates for the following.
   (a) 2 liters \approx \text{gallon(s)}
   (b) 10 meters \approx \text{feet}

30. The speed limit posted read 60 kph (kilometers per hour). Estimate the speed in miles per hour using the approximations \(1\text{mi} \approx 5000\text{ft.}, \ 1\text{m} \approx 3\text{ft}\).