Emmy Noether - Circle 1 for 2006-2007

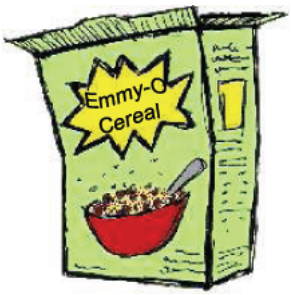
Part I: Problems

Problem 1

In the Grade 6 Students' 100 metre hurdle event, there are 10 hurdles. The first hurdle is 13 metres from the starting line. Consecutive hurdles are 8 metres apart. How far is the tenth hurdle from the finish line? (Note: 'consecutive' means one right after the other.)

Extension:
In an 80 metre hurdle race, the distances between hurdles are equal, the first hurdle is 12 metres from the starting line, and the last hurdle is 12 metres from the finish line. If there are 8 hurdles in all, how far apart are consecutive hurdles?

Problem 2



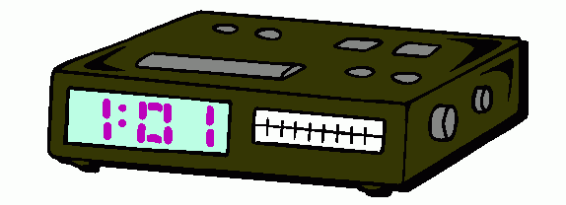
The area of one side of an Emmy-Os single-serving cereal box is 96 cm^2. The area of another side of the same box is 48 cm^2. The area of the top of the box is 32 cm^2. What is the volume of the box if the length of each edge is a whole number?

Problem 3

A 12-hour digital clock displays palindromic numbers many times each day (e.g., 1:01, 1:11, 2:32, ...).

a) What is the least length of time between two consecutive such numbers?

b) What is the greatest length of time between two consecutive such numbers?



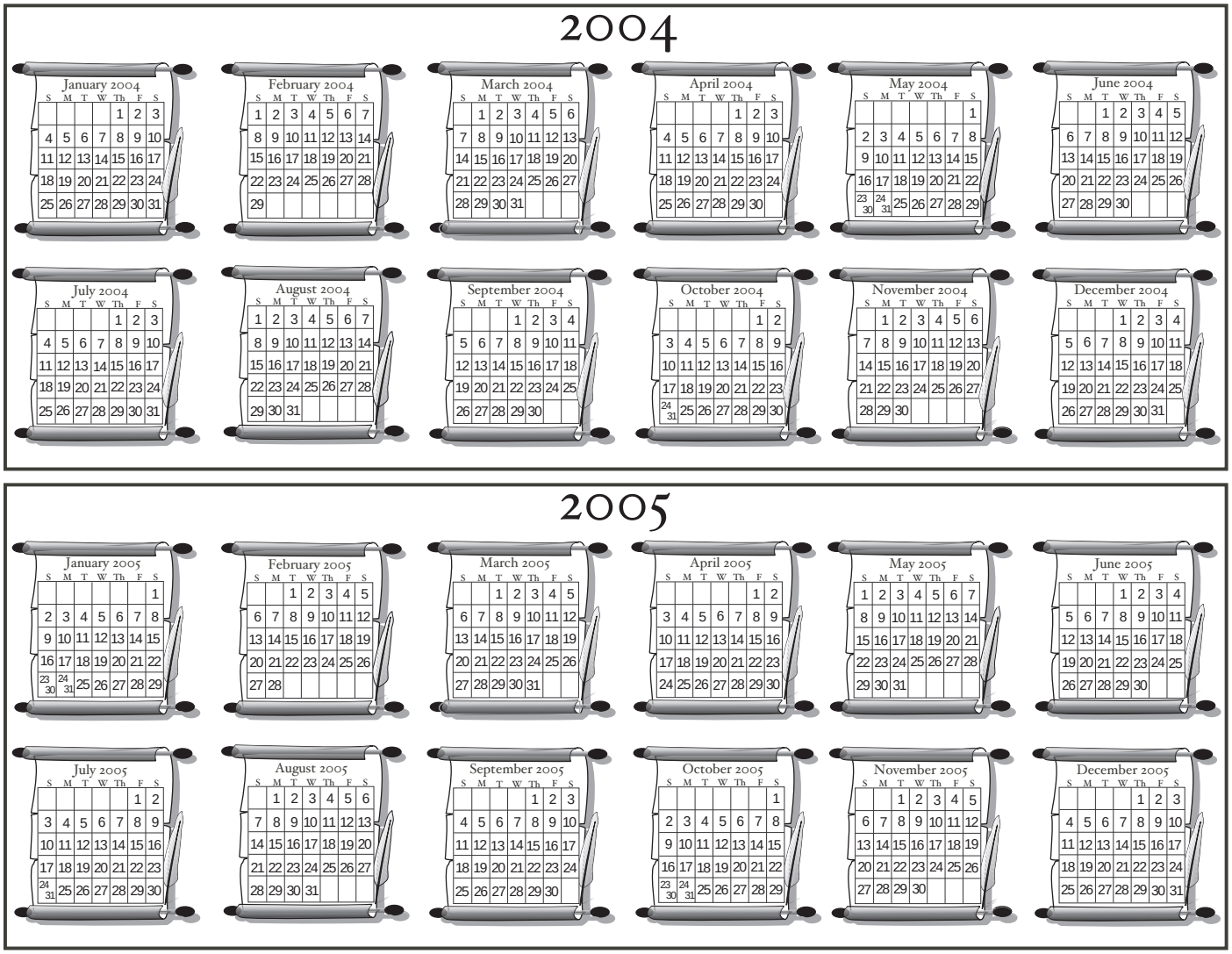
Extension:
Is the answer to question b) the same for a 24-hour clock?

Problem 4

Freddy felt that Friday the 13th was very bad luck. He was somewhat consoled by his belief that there could be only one Friday the 13th in a calendar year, until his buddy Hakim told him there could be two.

a) Was Hakim right? Explain how you know.

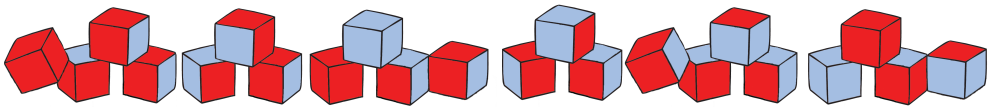
b) Could there be more than two Friday the 13ths?



Extension:
Does there have to be at least one Friday the 13th in any given year?

Problem 5

Reena is making cubes for a game in which the cubes are selected from a bag. She has red paint and blue paint. She paints each face of a cube either red or blue. How many different cubes can Reena make? (Two cubes are not considered different if one can be rotated to match the other.)



Extension:
Suppose Reena makes one face yellow. Could she make at least 10 different cubes with the remaining faces each painted either red or blue?

Problem 6

100 Challenges (Suggested for groups of 2 to 4 students)

For this game, form teams (pairs or small groups); each team needs one die (or number cube) and a score sheet (below).

To play, first roll the die five times and place the resulting five numbers in the five boxes at the top of the score sheet. The goal is to use these five numbers to form as many of the numbers from 1 to 100 as you can, using adding, subtracting, multiplying, dividing, and combining digits. (e.g., a 5 and a 2 could combine to form 52 or 25). Each number you form must use one or more of these five operations. None of the five digits rolled can be used more than once in forming a single number (unless you rolled two of that digit). For example, if you rolled 1, 2, 2, 5, 6, some of the numbers you could form are 1 $(2-1)$, 2 (2×1), 3 $(5-2)$, 4 $(6-2)$, 5 (5×1), 6 (6×1), 7 $(5+2)$, 8 $(5+2+1)$, 12, 21, 25, 52, 65, 22, 60 (12×5), 28 $(56\div 2)$, 61$(5\times 6\times 2+1)$, etc. As you form the numbers, write how you did it in the space beside that number on the chart. The team that forms the most numbers in a specified time wins the game. (A suitable time could be 20 or 30 minutes.)

SCORE SHEET FOR 100 CHALLENGES

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= 1	= 2	= 3	= 4	= 5
= 6	= 7	= 8	= 9	= 10
= 11	= 12	= 13	= 14	= 15
= 16	= 17	= 18	= 19	= 20
= 21	= 22	= 23	= 24	= 25
= 26	= 27	= 28	= 29	= 30
= 31	= 32	= 33	= 34	= 35
= 36	= 37	= 38	= 39	= 40
= 41	= 42	= 43	= 44	= 45
= 46	= 47	= 48	= 49	= 50
= 51	= 52	= 53	= 54	= 55
= 56	= 57	= 58	= 59	= 60
= 61	= 62	= 63	= 64	= 65
= 66	= 67	= 68	= 69	= 70
= 71	= 72	= 73	= 74	= 75
= 76	= 77	= 78	= 79	= 80
= 81	= 82	= 83	= 84	= 85
= 86	= 87	= 88	= 89	= 90
= 91	= 92	= 93	= 94	= 95
= 96	= 97	= 98	= 99	= 100