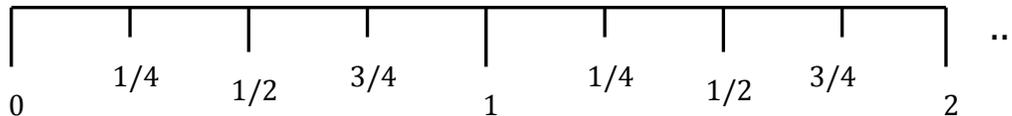**Rules: 90 minutes; no electronic devices.**

The positive integers are $1, 2, 3, 4, \ldots$

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1. A snail crawls on a vertical rock face that is 5 feet high. The snail climbs up 3 feet in a day and then rests through the night. Each night it slides down 2 feet while it rests. If it starts at the bottom on the morning of September 1, on what day of the month does it first reach the top of the rock face?

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2. (a) A tape measure's short, medium, and long marks indicate quarter-inches, half-inches, and whole inches, respectively. How many short marks fall between the 1-inch mark and the 7-inch mark?

(b) How many short marks fall between the 11-inch mark and the 413-inch mark?

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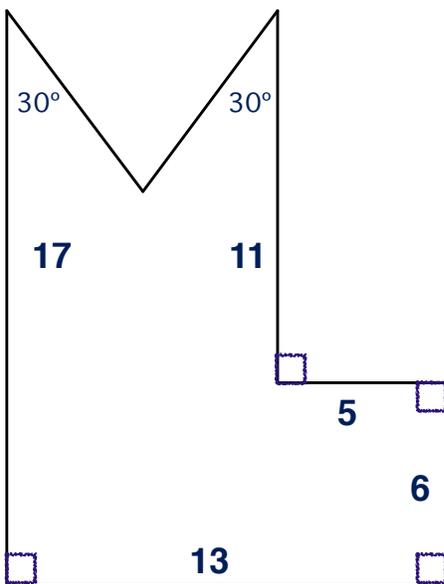
3. What is the perimeter (that is, the sum of the lengths of the sides) of the figure? The lengths of the lower sides are $17, 13, 6, 5,$ and 11. The two acute angles at the top each measure 30 degrees. There are four right angled corners in the figure, indicated by the small squares.

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4. A hog trading team <u>sells</u> two hogs for $120 each. They sell one of the hogs for 125% of the price they paid for the hog. They sell the other hog for 80% of the price they paid for it. Do they make a profit or a loss overall, and how much, in dollars, is that profit or loss?

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5. A box of 500 balls contains balls numbered $1, 2, 3, \ldots 100$ in each of five different colors. Without ever looking at any of the balls, you are to choose balls at random from the box and put them into a bag. If you must be sure that when you finish, the bag contains at least one set of five balls with identical numbers, then what is the smallest number of balls that you can put in the bag?

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6. Tutu, Jada, and Faith eat lunch together. Tutu contributes 9 sausages, Jada contributes 8 sausages, and the three girls divide the sausages equally. Faith has brought no food, but gives the other two girls 17 wupiupi coins in exchange for her share of the sausages. How many of the coins should Tutu get?

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7. What is the first time after midnight at which the hour hand and minute hand on an ordinary clock face are perpendicular to one another? Express the time in the format Hour, Minute, Second, with your answer rounded to the nearest second. Assume the clock is a 12 hour clock with hands that move at uniform speeds.

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8. How many integers greater than 0 and less than 100,000 are palindromes? An integer is a palindrome if its digits are the same when read left to right and right to left. For instance, 2134312 and 353 are palindromes; so are 1001, 99, 5, and 1. Reminder: do not count the number 0.

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9. A polynomial $P(x)$ satisfies the equation

$$P(P(x) - 1) = 1 + x^{16}.$$

What is $P(2)$? (The expression $P(P(x) - 1)$ on the left side of the equation means "plug $P(x) - 1$ into P." The parentheses in this case do not indicate multiplication.)

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10. How many different case-sensitive passwords can be created with at most 8 keystrokes, if each keystroke may touch either the "caps lock" key or any of the 10 alphabetic keys on the top row of the keyboard: Q W E R T Y U I O P ? Assume that password entry always begins with "caps lock" in lowercase mode, and assume that a password must contain at least one letter. Tapping the "caps lock" key toggles the mode of the keyboard between lowercase and uppercase. Assume that holding a key down does not produce multiple copies of a letter; that is, in the password field, holding a key down has no effect.

END OF CONTEST