

Some Mathematics Brain Teasers

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1. The greatest number of Mondays that can occur in the first 45 days of a year is ____?

Ans: 7

If the first day is a Monday, then every seventh day is also a Monday, and Monday falls on the following numbered days: 1, 8, 15, 22, 29, 36, and 43. In the first 45 days of the year, the maximum number of Mondays is seven.

2. The expression $(n-2)^2 + 7n$ is divisible by 7 when $n = 2$. What is the largest integer $n < 100$ for which $(n-2)^2 + 7n$ is divisible by 7?

Ans: 93.

Since n is an integer, and since the second term of the expression $(n-2)^2 + 7n$ is always divisible by 7, the whole expression is divisible by 7 whenever $(n-2)^2$ is a multiple of 7. The square of the integer $(n-2)^2$ is a multiple of 7 if and only if the integer $(n-2)$ is a multiple of 7. The possibilities are $(n-2) = 7, 14, 21, \dots, 91, 98$. The largest such integer such that n is less than 100 is $n = 93$.

3. If you have 3 weights, each with an integer value, you can measure food parcels weighing from 1 kg-13 kg (also integers). What are the possible values of the three weights (in ascending order)?

Ans: 1, 3 & 9.

It is basically power of 3. If you try process of elimination you will find that using the weights 1 kg, 3 kg, and 9 kg you can measure all weights from 1 kg-13 kg.

4. I wake up if and only if both of my alarm clocks ring at the same time. My alarm that's 3 minutes fast, first rings when it reads 10:14. It then rings every 9 minutes thereafter. My alarm that's 4 minutes fast, first rings when it reads 10:09. It then rings every 7 minutes thereafter. Where will the minute hand be when I wake up?

Ans: 47.

Let M be the number of minutes after 10:00 that the two clocks ring at the same time. Then $M = 11 + 9x = 5 + 7y$, or $6 = 7y - 9x$, for some non-negative integers x and y . From this last equation, y must be a multiple of 3. The least such y is 6, from which $x = 4$ and $M = 47$.

5. Tuesday's high temperature was 4 degrees Celsius warmer than that of Monday's. Wednesday's high temperature was 6 degrees Celsius cooler than that of Monday's. If Tuesday's high temperature was 22 degrees Celsius, what was Wednesday's high temperature?

Ans: 12 degrees Celsius.

If Tuesday's high temperature was 22 degrees Celsius then Monday's high temperature was 18 degrees Celsius. Wednesday's temperature was 12 degrees Celsius since it was 6 degrees Celsius than that of Monday's high temperature.

6. If a , b and c are distinct positive integers such that $abc = 16$, then the largest possible value of $a^b - b^c + c^a$ is_____.

Ans: 263.

If a , b and c are distinct then the correct factorization is $16 = 1 \times 2 \times 8$. Since a , b and c must be some permutation of 1, 2 and 8, there are exactly six possibilities which give the values -247 , -61 , 65 , 249 , 263 , and 63 . Of these, $8^1 - 1^2 + 2^8$ or 263 is the largest.

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