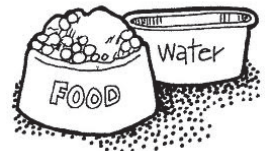


**SAMPLE MATERIAL**

1. Today's date is a palindrome when expressed as 31.5.13. How many such palindromes will occur this year? This century?

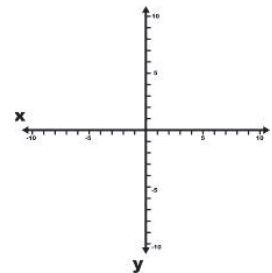
2. My pet dog, cat and piranha all eat the same pet food, but each gets a different (fixed) amount every day. The dog takes 30 days to eat one whole packet, the cat 40 days and the piranha 120 days. How long will three packets last?



3. Dr Blastem (who is quite definitely *not* a mad scientist) wants to test her new high-powered laser. She assembles solid metal cubes of side-length 10cm into a rectangular prism of sides 30cm by 50cm by 70cm. The laser then burns a hole of diameter 1cm from one vertex to the diagonally opposite vertex. How long overall is the hole drilled by the laser? How many cubes have a hole burned through them?

4. Write down the (positive integer) factors for each positive integer from 1 to 20. Which is the smallest positive integer with exactly six factors? Which is the smallest with seven factors?

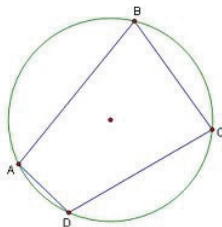
5. A function  $f$  has the property that  $f(x + y) = f(x) + f(y)$  for any real numbers  $x$  and  $y$ .



a) What is  $f(0)$ ?

b) Given that  $f(2) = 4$ , what is  $f(7)$ ? And  $f(\sqrt{2})$ ?

c) Answer parts a) and b) again, if  $f(x + y) = f(x) = f(y) - 2$  for all  $x$  and  $y$ .



A quadrilateral is called *cyclic* if its four vertices lie on a circle, like the one in the diagram.

6. Suppose the cyclic quadrilateral ABCD has two opposite sides of equal length. That is,  $AB=CD$ . Is it necessarily a rectangle? What if  $AB=CD$ , and also  $BC = AD$ ?

7. The quadrilateral ABCD is cyclic. Another circle has centre O somewhere on the side AB, and is tangent to the other three sides. Prove that  $AD + BC = AB$ . (1985 IMO)

