

# 1. Aquarius - The water bearer.

You have to measure exactly 4 liters of water, but you only have a 3-liter bottle and a 5-liter bottle. How do you do it?


Note: You do not have any other container apart from the two bottles.



## 2.The Triangular Inequality

The sum of two sides of a triangle is always greater than the third side. No matter what type of triangle it is.

**Give a convincing proof of this well-known theorem.**



## 3.The power of Sub-Zero

In an average Indian kitchen, the most common method of defrosting frozen meat/fish is by pouring water on them or holding them under the sink tap. This definitely is a direct application of the fact that if you pour water on ice, ice melts.

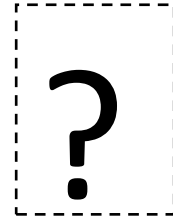
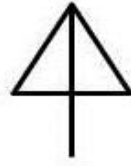
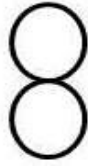
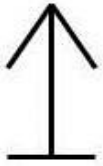
(note that the water here need not be hot or warmed and is regular tap water)

Is it possible to freeze water by dropping ice on it?

Give logical explanations of your answer. (Complimentary support through mathematics will be appreciated)

## 4.The NEXT Big Thing.

You can see a sequence of figures here. Your task is simple. Draw the next figure that should logically fit into the next slot.



Hints:

1. The most basic sequence.
2. The most common phenomenon.

A large, empty rectangular box with a solid black border, intended for the student to draw the next figure in the sequence.

## 5.The Pet-Detective.

A pet detective is one who helps clients find their beloved lost pets. Sounds like an easy job but pays very well. To be licensed as a pet detective you have to solve a given case successfully.

Three pets have been lost from three different owners at three different places. From the following clues, you must figure out who is the owner of each pet, and where the pet was lost.

1. A rabbit and a dog are two of the lost pets.
2. The pet lost in the garden is owned by Mary.
3. Robert does not own a dog.
4. John's pet was lost in the woods.
5. The cat was not lost in the woods or in the park.

Draft a detailed case study of how and on what basis you reached a particular conclusion about the owner of the pets and the place where the pet was lost.

## 6.The King's Son...s

A King has three children. The first born is a son. What is the probability that the king has three sons?



## 7.The Nomadic PIE

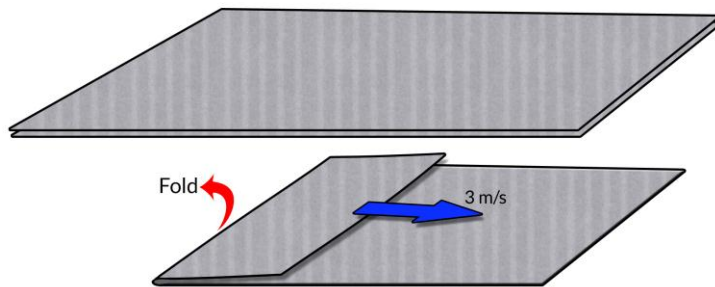
The famous number called Pie ( $\pi$ ) has lost his home on the number line. Sad and depressed he decided to subtract  $\frac{22}{7}$  from himself in order to earn a home.

Draw a number line and locate the home of  $(\pi - \frac{22}{7})$  on it.



## 8. The Folding Carpet

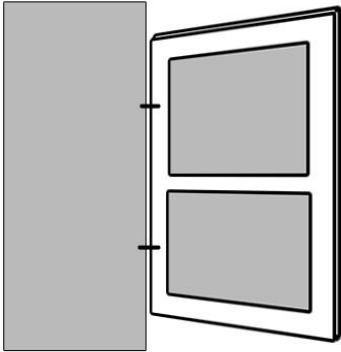
A heavy carpet is lying on a rough floor. One end of the carpet is folded back and pulled towards the other end with a constant speed of 3 m/s. Find the speed of the fold that is formed during this process.



## 9.Of Doors and Hinges ...

A force diagram is one where you draw an object and denote all forces acting on it in a particular situation. As forces are vectors so in a force diagram it is very important to show the direction of forces clearly.

Here we have a door with two hinges. Draw the force diagram of the door mentioning all forces acting on the door when it at rest.



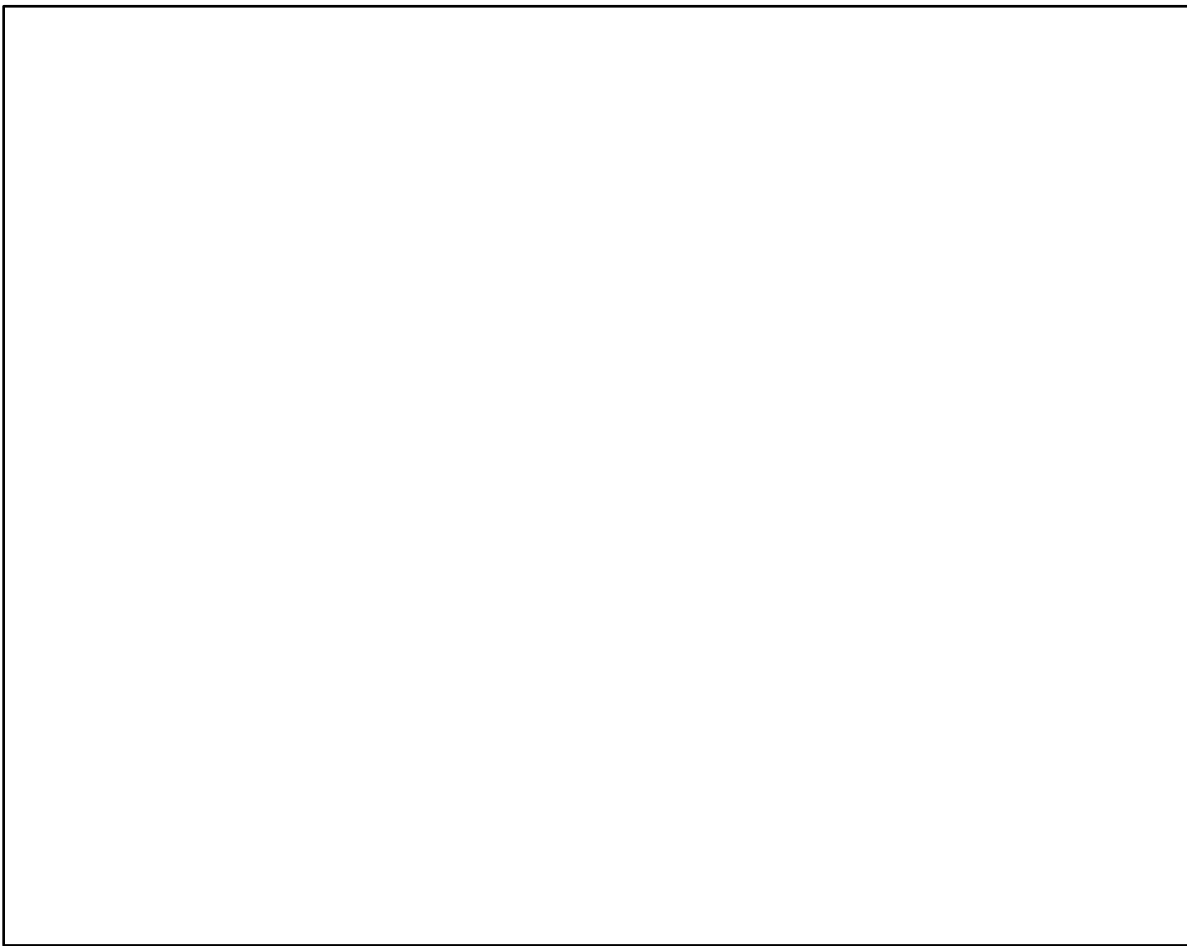
Note: a door in working condition is never in contact with the floor and actually is hanging by the frame attached to the wall.



## 10. Alternate Angles

Alternate angles are the angles formed by a line with two lines on either side of itself. It's very well-known and widely used that **alternate angles are equal if the lines are parallel**. So popular is this theorem that it's often taken for granted.

Give a comprehensive and diagrammatic proof of this widely used theorem.



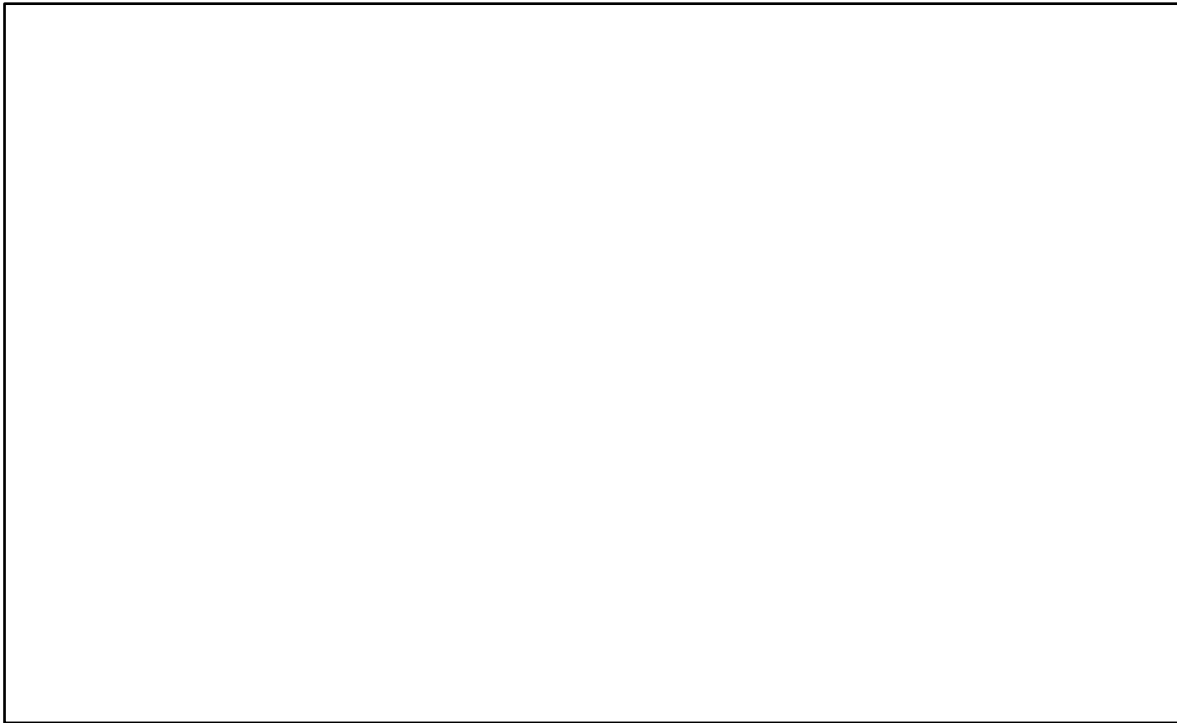
## 11. Being Positive

We know that product of two quantities is greater than zero if either both are greater than zero or both are lesser than zero.

If  $X$  is a real number, such that

$$(X - 2)(X - 3)^2 > 0$$

Find the possible values of  $X$ .



## 12.The Brotherhood

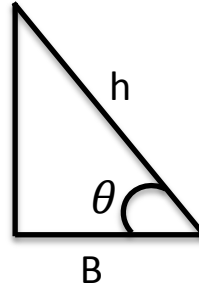
Your elder brother is  $\frac{22}{7}$  times your age on 22<sup>nd</sup> April 2012. Assuming that you both live long enough, when ( at what date) will he again be  $\frac{22}{7}$  times your age ?



## 13. The mystery of the radian.

In a right angled triangle as shown

$$\sin\theta = \frac{p}{h}$$



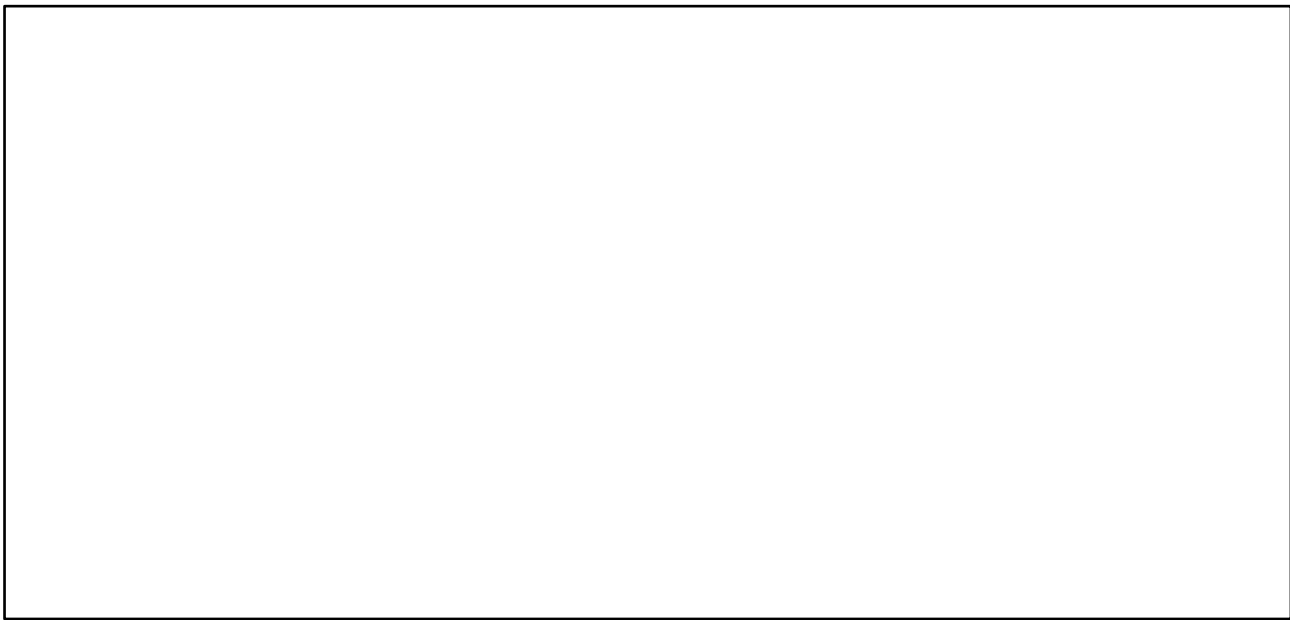
If we have the values of  $\sin\theta$  for three different angles **1, 2 and 3 radians**. Arrange the values of  $\sin 1$ ,  $\sin 2$  and  $\sin 3$  in increasing order.

## 14. Trigonometry or Quadratic?

If a real value  $x$  represents  $\sin\theta$

i.e  $x = \sin\theta$

Find the values of  $x$  if  $x^2 - x - 6 = 0$ .

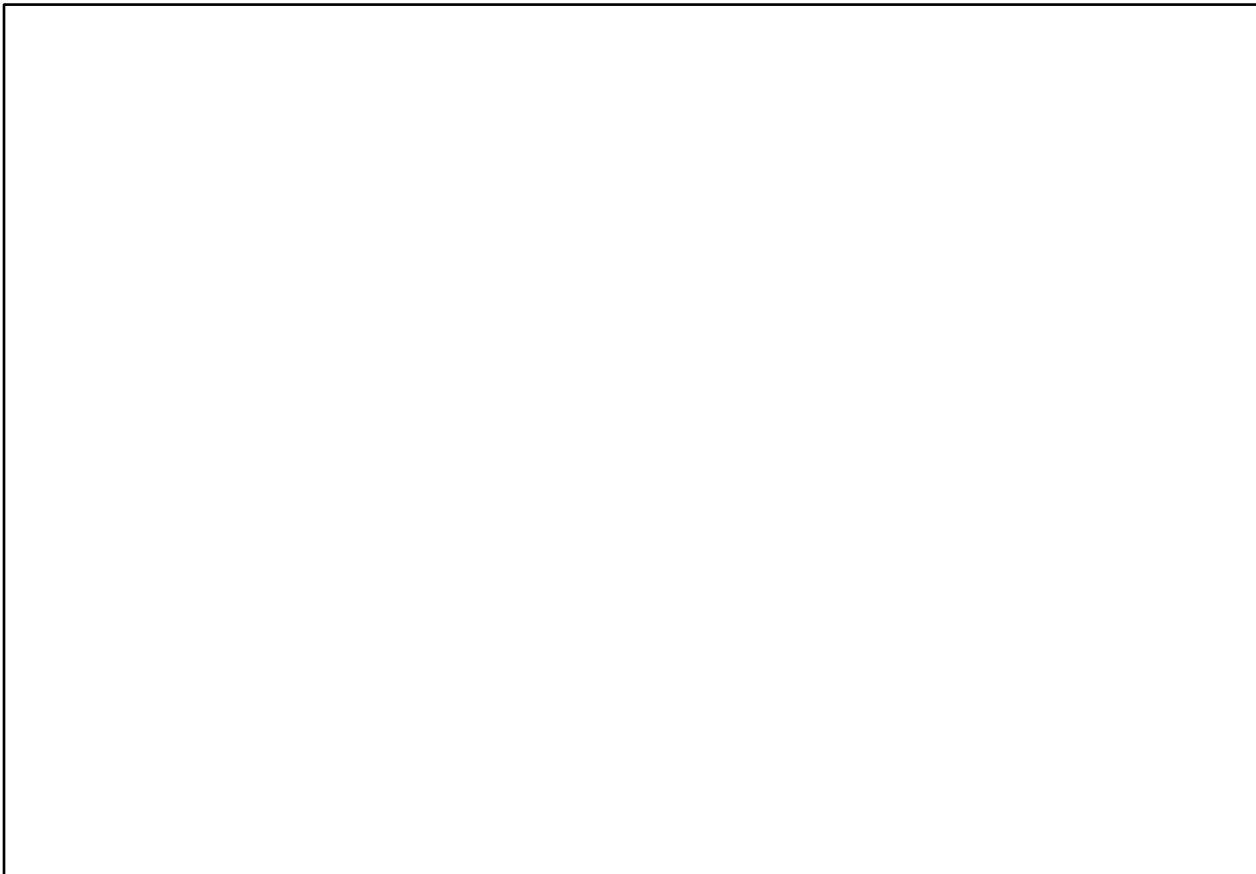


## 15. The Half Chicken Dilemma

The average statistics of a chicken farm reads that:

One and a half chicken lay one and a half egg in one and a half day.

Based on this information, how many chicken would you need to have a dozen of eggs in 6 days.



## 16. The mystery of the Bermuda Triangle

The Bermuda Triangle is a place in the Atlantic Ocean where ships and airplanes supposedly disappear without a trace.

In the picture below, a square appears when we rearrange the pieces of the upper triangle to form the lower triangle. The pieces in both pictures are identical. The grid at the back of the figure helps you observe that the pieces are all of identical size.

Can you explain where the square came from?

