Mathematics and the Universe

Here is the solution of the problem posed in my article which appeared in the last issue of the Medley.

Let me state the question again: given that the Universe is about 10 billion years old, how far away are the most distant objects we can hope to see?

Answer:

Let's assume that a ray of light moves along the x axis towards us from some event "near" the Big Bang, as shown. We want to find the coordinate H in terms of T, the present time since the Big Bang. The space-time distance along a curve representing a ray of light is zero, so we have

$$0 = -(dt)^2 + A^2 t^{4/3} (dx)^2$$

where A is some constant. Thus

$$dx = -\frac{1}{A} t^{-2/3} dt$$

and so integrating from right to left we have

$$-H = \int_H^0 dx = -\frac{1}{A} \int_0^T t^{-2/3} dt = -\frac{3}{A} T^{1/3}.$$

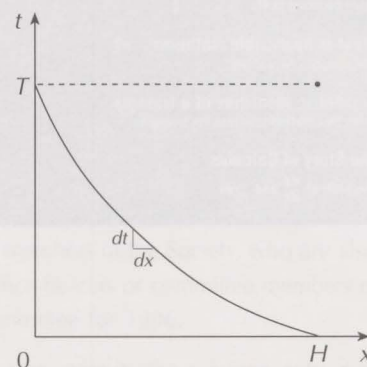The PRESENT distance to the point with coordinate H is therefore

$$D = AT^{2/3} H = AT^{2/3} \left(\frac{3}{A} T^{1/3}\right) = 3T.$$

Remember that our unit of time is years, and our unit of distance is light years, so

$$D = 3T = 30 \text{ billion light years.}$$

By the way, on page 7, line 7 of the article (in Mathematical Medley Vol. 23 No. 1 March 1996), $\left|\frac{\delta s}{\delta t}\right| = 1$ should read $\left|\frac{\delta x}{\delta t}\right| = 1$.

Brett T. McInnes

Letters to the

Editor

Editorial

The 37th International Mathematical Olympiad (IMO) held in India this year has special significance to the mathematics community of Singapore – Senkodan Thevendran of the Singapore IMO Team won the first gold medal for Singapore since it took part in the IMO in 1989.

While one main objective in mathematics is to establish a general theory which can be applied to various situations, it is always a challenge and joy to solve problems which require acquired skill, ingenuity and imagination. And our Society's record shows that successful competitors in mathematical competitions do indeed become accomplished mathematicians. The selection and training of our national team to the next IMO is already underway. On the other hand, the Mathematical Olympiads 1996 organised by the Society had once again received overwhelming response and support. We believe that interest in participating in mathematical competitions should be sustained and that it would help to promote the level of mathematics in Singapore.

The present issue of the Medley marks the end of the second year of publication of the "new" Medley. We would like to take this opportunity to remind you that the Medley is published to serve all those who are interested in mathematics, especially those of you who are in schools and junior colleges in Singapore. We welcome your feedback and contributions to the Medley.