

# Express Riddler

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## Riddle:

Channeling your inner Marty McFly, you travel one week back in time in an attempt to win the lottery. It's worth \$10 million, and each ticket costs a dollar. Note that if you win, your ticket purchase is not refunded. All of this sounds pretty great.

The problem is, you're not alone. There are 10 other time travelers who *also* know the winning numbers. You know for a fact that each of them will buy exactly one lottery ticket. Now, according to the lottery's rules, the prize is evenly split among all the winning *tickets* (i.e., *not* evenly among winning people). How many tickets should you buy to maximize your profits?

## Solution:

If the number of tickets you purchase is  $n$ , then your final amount of money  $x$  is:

$$x(n) = -n + \frac{10^7 n}{10 + n}$$

Taking the derivative gives

$$\frac{dx}{dn} = -1 + \frac{10^7}{10 + n} - \frac{10^7 n}{(10 + n)^2}$$

Setting this equal to zero and solving for  $n$  gives a positive solution of 990. Luckily, this is a whole number, so the solution is 990.