People often complain about getting stuck in work-rate problems. Hence, I would like to take some 700+ level questions on rate today. I have discussed the basic concepts of work-rate (using ratios) in a previous post:

Cracking the Work Rate Problems

You might want to go through that post before you set out to work on these problems. Ensure that you are very comfortable with the relation: Work = Rate*Time and its implications: If rate doubles, work done doubles too if the time remains constant; if one work is done, rate = 1/time etc. Thorough understanding of these implications is fundamental to 'reasoning out' the answer.

Question 1: Machine A and Machine B can produce 1 widget in 3 hours working together at their respective constant rates. If Machine A's speed were doubled, the two machines could produce 1 widget in 2 hours working together at their respective rates. How many hours does it currently take Machine A to produce 1 widget on its own?

(A) 1/2
(B) 2
(C) 3
(D) 5
(E) 6

Solution: Tricky, eh? It is a little cumbersome if you get into variables. If you just try to reason it out, it could be done rather quickly and easily. Let's see!

Machine A and B together complete 1 work in 3 hrs i.e. together, they do 1/3rd work every hour.

If machine A's speed were double, they would do 1/2 work in 1 hour together. How come they do (1/2 – 1/3 =) 1/6thwork extra in 1 hour now? Because machine A's speed is double the previous speed. The extra speed that machine A has allows it to do 1/6th work extra. This means, at normal speed, machine A used to do 1/6 work in an hour (its speed had doubled so work had doubled too). Hence, at usual speed, it will take 6 hrs to produce 1 widget.

Answer (E)

Consider the amount of time and effort you would have spent on this question had you tried to use two variables to figure out the answer. You would have made equations like this: 1/a + 1/b = 1/3 and 2/a + 1/b = 1/2 and then you would have solved them simultaneously to get the value of a. Whereas in the solution above, we have done all the work orally!

Question 2: One woman and one man can build a wall together in two hours, but the woman would need the help of two girls in order to complete the same job in the same amount of time. If one man and one girl worked together, it would take them four hours to build the wall. Assuming that rates for men, women and girls remain constant, how many hours would it take one woman, one man, and one girl, working together, to build the wall?

(A) 5/7
(B) 1
(C) 10/7
(D) 12/7
(E) 22/7

Solution: This question is certainly quite tricky but if you understand the relation between work and rate, you can still solve this question easily. Mind you, we are using variables here only because I don't want to write man, woman and girl again and again. Notice that there are no '=' signs i.e. we are not making equations so we are not doing any algebraic manipulations.

The question is long so take one line at a time and analyze it. We will keep condensing the information we get from each sentence and figuring out the implications of new and previous information as we go along.

‘‘One woman and one man can build a wall together in 2 hrs,”
1w + 1m -> 2 hrs ……(I)

‘‘but the woman would need the help of 2 girls in order to complete the same job in the same amount of time.”
1w + 2g -> 2 hrs …..(II)

From (I) and (II), we can say that 1m is equivalent to 2g (i.e. 1 man does the same work as 2 girls do in the same amount of time; 1m ≡ 2g)

‘‘If 1 man and 1 girl worked together, it would take them four hours to build the wall.”
1m + 1g -> 4hrs (Since 1m ≡ 2g, we can say that 3g will take 4 hrs to build the wall.)
or 2m + 2g -> 2 hrs …..(III) (If number of workers double, time taken to do the work becomes half)

From (II) and (III), 1w ≡ 2m (i.e. 1 woman does the same work as 2 men do in the same amount of time)
Hence, 1w ≡ 2m ≡ 4g

‘‘Assuming that rates for women, men and girls remain constant, how many hours would it take 1 woman, 1 man and 1 girl working together to build the wall?”
1w + 1m + 1g ≡ 4g + 2g + 1g ≡ 7g. Since 3g take 4 hrs to build the wall, 7g will take 3*4/7 = 12/7 hrs to complete the wall.

Answer (D)

We have done most of the work while reading the question only. Had we tried to solve it algebraically, we would have made 3 equations using 3 variables and then tried to solve them.