CHAPTER 1

Additions and Subtractions (As an Extension of Additions)

IDEAS FOR ADDING AND SUBTRACTING WELL

Addition is perhaps the most critical skill when it comes to developing your calculations. As you would see through the discussions in the remaining chapters of this section of the book, if you have the ability to add well you would be able to handle all the other kinds of calculations with consummate ease.

Skill 1 for addition: The ability to react with the addition of two numbers when you see them.

The first and foremost skill in the development of your addition abilities is the ability to react to 2 two digit numbers when you come across them. You simply have to develop the ability to react with their totals whenever you come across 2 two digit numbers.

For instance, suppose I were to give you two numbers at random—5, 7 and ask you to **STOP!! STOP YOUR MIND BEFORE IT GIVES YOU THE SUM OF THESE TWO NUMBERS!!** What happened? Were you able to stop your mind from saying 12? No! of course not you would say.

TRY AGAIN: 12 + 7 STOP YOUR MIND!! You could not do it again!!

TRY AGAIN: 15+12 STOP!! Could not?

TRY AGAIN: 88+ 73 = ?? STOP!! If you belong to the normal category of what I call "addition disabled aspirants" you did not even start, did you?

TRY AGAIN: 57 + 95 =??

TRY AGAIN: 78+88 =??

What went wrong? You are not used to such big numbers, you would say. Well, if you are serious about your ability to crack aptitude exams, you better make this start to happen in your mind. You would know what I mean if you just try to look at a 5 year old child who has just learnt to add, struggle with a calculation like 12 + 7 on his fingers or his abacus.

His struggle with something like 12 + 7 or even 15 + 12 would be akin to the average aspirant's ability to react to 88+ 78. However, just as you know 15 + 12 is not a special skill so also 88+78 is not a special skill. It is just a function of how much you practice your calculations especially in the domain of 2 digit additions.

So what am I trying to tell you here?

All I am trying to communicate to you is to tell you to work on developing your ability to react to 2 two digit numbers with their addition as soon as these numbers hit your mind. What I am trying to tell you that the moment you make your mind adept at saying something like 74 + 87 = 161 just the way you would do 9 + 6 =15 you would have made a significant movement in your mind's ability to crack aptitude exams.

Why do I say that—you might be justified in asking me at this point of time? In order to answer your question I would like to present the following argument to you:

In numerical questions, a normal student/aspirant would be roughly calculating for approximately 50% of the time that he/she takes to solve a question. This means that half the total time that you would spend in solving questions of Quantitative Aptitude or data interpretation would essentially go into calculations.

Thus, in the current pattern of the CAT, where you solve QA for 60 minutes and DI for 30 minutes approximately, out of the total 90 minutes solving numerical questions, you would use close to 40-45 minutes calculating—if your calculating ability is similar to most average CAT aspirants.

So, the contention is this: If you can improve your calculation speed to 5 times your current calculation speed, the calculations you would be doing in 40 to 45 minutes currently, would get done in 8 to 9 minutes—giving you a whopping 32 to 36 minutes extra inside the exam. In an exam like the CAT (or for that matter any other parallel aptitude exam you might be preparing for), an extra 30 minutes converts straight to extra questions solved—and hence extra marks. On a conservative estimate, if you are in the category of students who are attempting 15-20 questions in one hour in the QA section, you are solving one question in 3-4 minutes. In this context, an extra 30 minutes available in the exam, would straight away convert to an extra

8-10 attempts—the difference between an 85 and a 95 percentile in the exam!

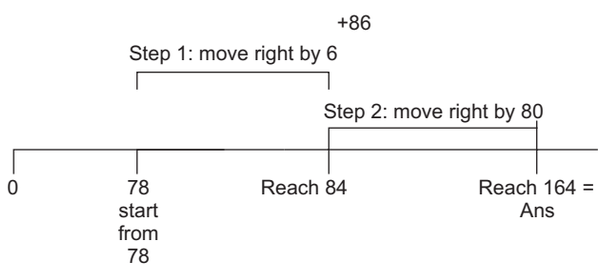
Addition being the mother of all calculations has the potential of giving you the extra edge you require to dominate this all important examination.

Over the next few chapters in this section of the book, all I am going to show you is how knowing additions well would have an impact on each and every calculation type that you might encounter in this exam and indeed for all aptitude tests. However, before we go that far you need to develop your ability to add well.

Let us look at the simple calculation of 78 + 88. For eternity you have been constrained to doing this as follows using the carry over method:

$$\begin{array}{r} {\scriptstyle 1\ \ } \\ 7\ 8 \\ +\ 8\ 6 \\ \hline 1\ 6\ 4 \end{array}$$

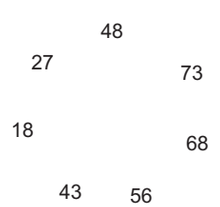
The problem with this thought is that no matter how many times you practice this process you would still be required to write it down. The other option of doing this same addition is to think on the number line as this:



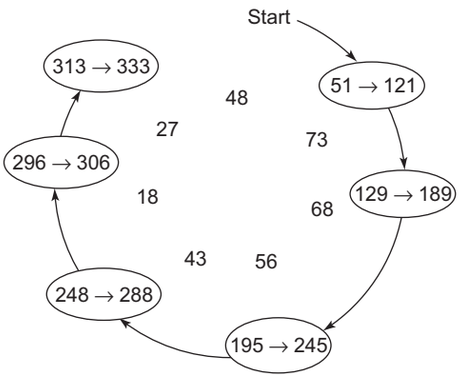
78 + 86 – how to think of this addition problem

As you can see, the above thinking in an addition situation requires no carry over and after some practice would require no writing at all. It is just an extension of how you are able to naturally react to 5+11 so also you can train your mind to react to 58+63 and react with a two step thought (as 61 → 121—with practice this can be done inside a fraction of a second. It is just a matter of how much you are willing to push your mind for this). Once you can do that your next target is to be able to add multiple 2 digit numbers written randomly on a single page:

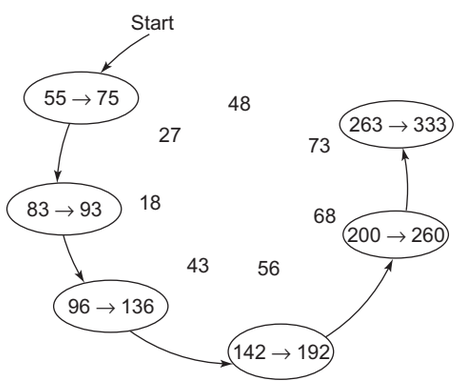
Try this: Add the following



In order to do this addition your thinking should go like this:



Alternately you may also do this the other way. The result would be quite the same:



While you are trying to work on this addition you would realize the following about your abilities to add (if you belong to the normal category of aspirants')

1. Something like 121 + 68 would be easier than 189 + 56 because the latter requires you to shift hundreds—something that the former does not require you to do.
2. Something like 48 + 27 would be easier for you to do initially than 136 + 56; and 136 + 56 would be easier than 543 + 48 because your mind would be more comfortable with smaller numbers than you would be with larger numbers.

However as you start practicing your additions, these additions would become automatic for your mind—as they would then fall into the range where your mind can react with the answers. That is the point to which we would want you to target your skill levels for additions.

To put it in other terms, you would need to work on your additions in such a way that 10 numbers written around a circle (as shown above) should be done in around 10-12 seconds in your mind.

Till the time your addition skill levels reach that point, I would want you to work aggressively on your addition ability.

The following 10 × 10 table done at least once daily might be a good way to work on your additions:

	59	*68*	*77*	*96*	*84*	*32*	*17*	*69*	*81*	*38*	*TOTALS*
48											
54				= 96 + 54 = 150							
67											
89											
56											
73						105					
88											
24											
47											
96											
TOTALS											

Inside the table you would broadly do two things:

(a) For each cell you would add the values in the corresponding row and the corresponding column in order to get the value inside the cell. Thus, the second row and 4th column intersection would give you 54+96=150, the sixth row and the sixth column would add to 73+32 = 105 as shown in the table.

(b) Add the total of the 10 numbers seen in each row after you finish doing the values inside the cells in the total. This would give you the final total of the row. Repeat the same process for the addition of the 10 numbers in the columns.

By this time, I guess you would have realized that we are targeting two broad addition skills—

(i) Your ability to react with the total when you see two 2 digit numbers (like 57+78=135)

(ii) Your ability to add multiple 2 digit numbers if they are given to you consecutively (like 57+78+43+65 +91+38+44+18+64+72=570 in 8–10 seconds)

You might require around 1–2 months of regular practice to get proficient at this. However once you acquire this skill, every conceivable calculation that any aptitude exam can throw at you (or indeed has thrown at you over the past 20 years) would be very much within your zone.

How do you do larger additions?

One you have the skills to handle two digit additions as specified above handling bigger additions should be a cakewalk.

Suppose you were adding:

57436 + 64123 + 44586 + 78304 + 84653 + 5836. In order to do this, first add the thousands. 57 + 64 (=121) + 44 (=165) + 78 (=243) + 84 (=327) + 5 (=332). Thus, you have an interim answer of 332 thousands. At this stage you know that your answer would be 332000 + a maximum of 6000 (as there are 6 numbers whose last 3 digits you have neglected). If a range of 332000 to 338000 suffices for you in the addition based on the closeness of the options, you would be through with your calculation at this point. In the event that you need to get to a closer answer than this, the next step would involve taking the 100s digit into account.

Thus for the above calculation: 57**4**36+ 64**1**23 +44**5**86+78**3**04+84**6**53 +5**8**36 when you add the hundreds, you get 4+1+5+3+6+8 = 27 hundreds. Your answer gets refined to 334700 and at this point you also know that the upper limit of the addition has to be a maximum of 600 more than 334700 i.e. the answer lies between 334700 to 335300. In case this accuracy level is still not sufficient you may then look at the last 2 digits of the numbers. Our experience tells us that normally that would not be required.

However, in case you still need to add these digits-it would amount to 2 digit additions again. So you would need to add 574**36**+641**23**+445**86**+783**04**+846**53** +58**36** → **36+23 (=59) +86 (=145) + 4 (=149) + 53 (=202) +36 (=238).**

Thus, the correct total would be 334700 + 238 = 334938 and while doing this entire calculation we have not gone above 2 digit additions anywhere.

Apart from that, the biggest advantage of the process explained above is that in this process, you could stop the moment you had an answer that was sufficient in the context of the provided options.

SUBTRACTIONS—JUST AN EXTENSION OF ADDITIONS

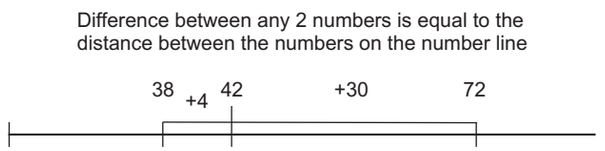
The better your additions are, the better you would be able to implement the process explained for subtractions. So, a piece of advice from me—make sure that you have worked on your additions seriously for at least 15 days before you attempt to internalize the process for subtractions that is explained in this chapter.

Throughout school you have always used the conventional carry over method of subtracting. But, I am here to show you that you have an option—something that would be much faster and much more superior to the current process you are using. What is it you would ask me? Well what would you do in case you are trying to subtract 38 from 72?

The conventional process tells us to do this as:

		Carry over 1
	7	2
–	3	8
	3	4

Well, the alternative and much faster way of thinking about subtractions is shown on the number line below:



The principle used for doing subtractions this way is that the difference between any two numbers can be seen as the distance between them on the number line.

Thus, imagine you are standing on the number 38 on the number line and you are looking towards 72. To make your calculation easy, your first target has to be to reach a number ending with 2. When you start to move to the right from 38, the first number you see that ends in 2 is the number 42. To move from 38 to 42 you need to cover a distance of +4 (as shown in the figure).Once you are at 42, your next target is to move from 42 to 72. The distance between 42 to 72 is 30.

Thus, the subtraction's value for the numbers 72–38 would be 34.

Consider, the following examples:

Illustration 1 95 – 39

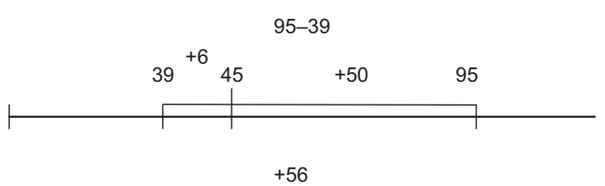
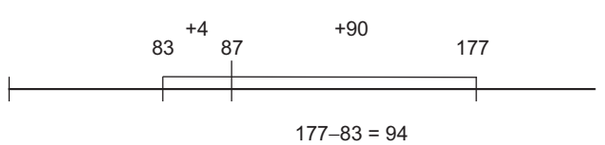


Illustration 2 177 – 83



Alternately:

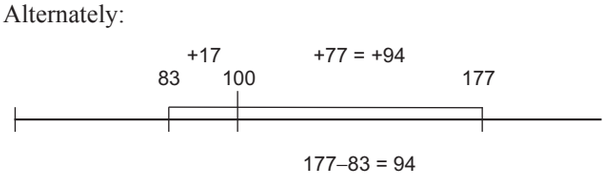
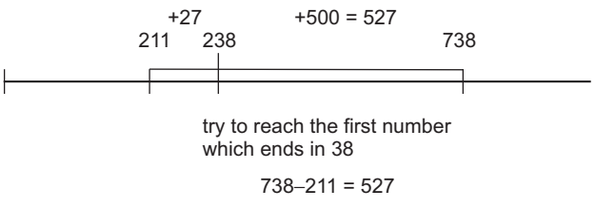


Illustration 3 738 – 211



In this case the first objective is to reach the first number ending in 38 as you start moving to the right of 211. The first such number to the right of 211 being 238, first reach 238 (by adding 27 to 211) and then move from 238 to 738 (adding 500 to 238 to reach 738)

In case you need an intermediate number before reaching 238 you can also think of doing the following:

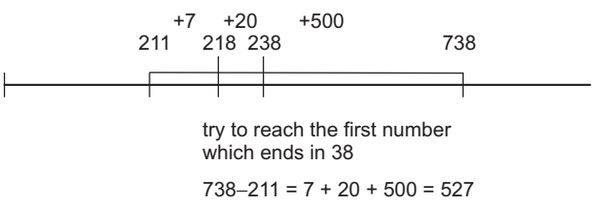
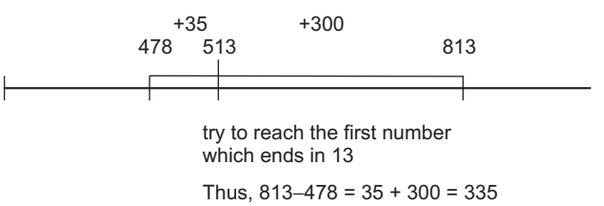
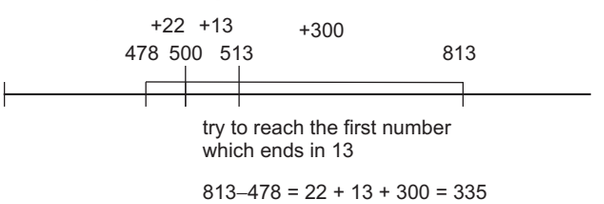


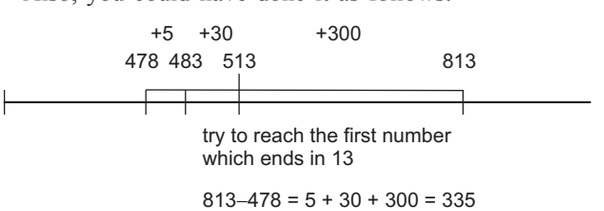
Illustration 4 813 – 478



Alternately, this thought can also be done as:



Also, you could have done it as follows:



Even if we were to get 4 digit numbers, you would still be able to use this process quite easily.