Mental Math Handout

Introduction

- I will explain two valuable techniques to help your mental math game: Anchoring and Chunking.
- These two techniques are often most useful when paired together.
- To get good at this, you need some practice. Once you start getting good at working with multiples of 10 in your head, things will progress faster.
- There are many different ways of doing mental math, even within the techniques explained here. You will hit your stride and figure out what things you like to do. In the beginning, you may feel a bit overwhelmed.
- A good foundation in multiplication tables is also essential. Mental math relies on breaking up the larger parts of calculations to get to where you only need to use single-digit multiplication, addition, and subtraction.

Technique: Anchoring

It is the simplest to explain with an example:

$$49 \cdot 4$$

1. Find an easier version of the calculation. This is generally done by adding 1 or 2 to a number. In this case, the easiest thing to do would be change it to $50 \cdot 4$, so that is our easy version.
2. Do the easier calculation, and keep the result in your mind. You need to remember it because you will be calculating the offset and adding or subtracting from this number. $50 \cdot 4 = 200$, so we want to keep 200 floating in our mind.
3. Calculate the offset. This is the trickiest part. We have found $50 \cdot 4$, but $49 \cdot 4$ is the original question. 50 is 1 away from 49, but don't forget that we are multiplying it by 4. This means that our easy calculation is $1 \cdot 4$ greater than what we actually want. So, to find the answer, we subtract $200 - 4 = \boxed{196}$

Here is another example:

$$18 \cdot 8$$

- We start with $18 \cdot 10 = 180$
- We want to find the number that is two *18s* away from 180, expressed mathematically that is $180 - 18 - 18$
- It's hard to do $180 - 36$ directly in our head, so a potentially easier approach is to do $180 - 40 + 4$. These two are equal because $40 - 4 = 36$.
- Doing that, our final answer is $140 + 4 = \boxed{144}$.

A third example:

$$19 \cdot 6$$

- Anchor with $19 \cdot 5$
- $19 \cdot 5 = \frac{190}{2} = 95$
- $95 + 19 = 95 + 20 - 1 = 115 - 1 = \boxed{114}$

Technique: Chunking

Chunking involves *chunking* calculations into smaller, more manageable pieces.

Example:

$$20 \cdot 15$$

Instead of trying to do the whole thing at once, we break it down[1]. We first do $20 \cdot 10 = 200$, then we do $20 \cdot 5 = 100$. We then add our pieces together, and we get the final answer of $\boxed{300}$.

Popular chunks are 10, 5, and 1. Let's look at another:

$$16 \cdot 7$$
$$= 16 \cdot 5 + 16 + 16$$
$$= 80 + 32$$
$$= \boxed{112}$$

Let's revisit a previous example from the *Anchoring* section and see if we can solve it with the *Chunking* method.

$$49 \cdot 4$$

- We will chunk the 49, not the 4
- The product can be rewritten as $(40 + 9) \cdot 4$
- It is then distributed as $40 \cdot 4 + 9 \cdot 4$
- We multiply and get the final answer $160 + 36 = \boxed{196}$

Combining Techniques

Here is a good example:

$$23 \cdot 14$$

- We can anchor this calculation as $23 \cdot 15$
- We then split it as $23 \cdot 10 + 23 \cdot 5$, finally subtracting 23 from the result to get the answer.
- $23 \cdot 10 = 230$
- $23 \cdot 5 = 115$
- $230 + 165 = 345$
- $345 - 23 = 345 - 20 - 3 = 325 - 3 = \boxed{322}$

Tips

- Go iteratively. By this, I mean to discard the old values in your mind when you get to a new one. So if you need to calculate $160 + 80 + 13$, after you add $160 + 80$ to get 240 only focus on doing $240 + 13$. Remove the 160 and 80 from your mind.
- Always try to work in groups of 10 until you cannot any longer.
- When finding the product of something and 5, say $17 \cdot 5$, it's good to do the easier $17 \cdot 10$ and then divide that by 2.
- When calculating an odd number times 5, you can move it down one to an even number, multiply by 10, divide by 2, then add 5. For example: $27 \cdot 5 = \frac{26 \cdot 10}{2} + 5 = \frac{260}{2} + 5 = 130 + 5 = \boxed{135}$

[1] This works because of the distributive property: $20 \cdot 15 = 20 \cdot (10 + 5) = 20 \cdot 10 + 20 \cdot 5$

Practice

$12 \cdot 8$	$31 \cdot 4$	$17 \cdot 19$	$14 \cdot 6$	$81 \cdot 5$
$14 \cdot 15$	$9 \cdot 13$	$5 \cdot 35$	$12 \cdot 21$	$40 \cdot 11$
$48 \cdot 14$	5			