Name: _________________ (   )   Class: ____

INVESTIGATE DIVISIBILITY RULES

Practice 2

Objective:
To investigate and generate divisibility rules for 3 and 6

Instructions:
In this task, you are required to:

- select and apply mathematical problem-solving techniques to recognize divisibility rules for 3 and 6.
- describe the multiples of 3 and 6 as relationships or general rules
- verify whether your divisibility rules works for other examples.

Hints:

1. List some 3-digit numbers, which are multiples of 3 or 6.
2. Investigate the numbers see if you can recognize simple pattern between these numbers.
3. You might find out more than 1 rule to test if a number is completely divided by 3 or 6.
4. Describe your rule in mathematical language (words, sentence, symbol, diagrams, tables, etc.)
5. Test your rule with other bigger numbers (say 4-digit numbers, some divisible by 3 or 6 and some do not).
6. You might use calculator to avoid careless calculation mistake.
7. Present your work neatly, tidily and logically.

Suggested Solution:

Investigate and generate divisibility rules for 3

Step 1: List some small numbers that are multiples of 3 to find the pattern of divisibility rules for 3
3, 6, 9, 12, 15, 18, 21, 24, 27, 30
33, 99, 102, 75, 96, 78, 198, 1311

Step 2: Check the final digits for pattern
By looking at the last digit of the above numbers, they are not clear rules since it can be any of the numbers from 0 to 9.

Step 3: Try adding digits

12	1+2=3	102	1+0+2=3
15	1+5=6	75	7+5=12
18	1+8=9	96	9+6=15
33	3+3=6	198	1+9+8=18
99	9+9=18	1311	1+3+1+1=6

Step 4: Describe patterns and rules
From the above step 1, step 2 and step 3, I found out that to test if a number is divisible by 3 or not, the last digit doesn't matter.

But when I add the digits, I found out that the sum would always be a multiple of 3, such as: 3, 6, 9, 12, 15, 18…

The divisibility rules for 3 can be when the sum of the digits of a number is divisible by 3, then that number will be divisible by 3.

Step 5: Test my rule with bigger numbers

Examples	**Adding the digits**	**Applying the rules**	**Divide the number by 3**
37	3+7=10	37 is not divisible by 3 since the sum 10 is not a multiple of 3	37÷3=12 R 1
111	1+1+1=3	111 is divisible by 3 since the sum 3 is a multiple of 3	111÷3=37
2222	2+2+2+2=8	2222 is not divisible by 3 since the sum 10 is not a multiple of 3	2222÷3=740 R 2
111111111	1+1+1+1+1+1+1+1+1=9	111111111 is divisible by 3 since the sum 9 is a multiple of 3	111111111÷3=37037037
37037037	3+7+0+3+7+0+3+7=30	37037037 is divisible by 3 since the sum 30 is a multiple of 3	111111111÷3=12345679

My divisibility rule for 3 is adding the digits of the number and if the sum is divisible by 3, the number will be divisible by 3 too.

I have verified my rules are correct since the sum of 111, 111111111 and 37037037 are 3, 9 and 30, which are divisible by 3. Meanwhile, 37 and 2222 are not divisible by 3 and they don't fulfill the divisibility rules of 3, their sums of digits are 10 and 8, which are not divisible by 3.

Investigate and generate divisibility rules for 6

Step 1: List some small numbers that are multiples of 6 to find the pattern of divisibility rules for 6
6, 12, 18, 24, 30
102, 96, 78, 198

Step 2: Check the final digits for pattern
By looking at the last digit of the above numbers, they are 0, 2, 4, 6 or 8 and they are all even number. BUT it doesn't mean that all even numbers are divisible by 6, it only tell us that all odd numbers are not divisible by 6.

Step 3: Try adding digits

12	1+2=3	102	1+0+2=3
18	1+8=9	96	9+6=15
24	2+4=6	78	7+8=15
30	3+0=3	198	1+9+8=18

Step 4: Describe patterns and rules
From the above step 1, step 2 and step 3, I found out that to test if a number is divisibly by 6 or not, the number must be an even number and at the same time the sum of their digits are divisibly by 3, such as: 3, 6, 9, 15, 18.

The divisibility rules for 3 can be when the sum of the digits is divisible by 3 and the number is an even number. That means if any number can be divisible 2 and 3, then that number will be divisible by 6 also.

Step 5: Test my rule with bigger numbers

Examples	**Adding the digits**	**Applying the rules**	**Divide the number by 6**
37	3+7=10	37 is not divisible by 6 since it is an odd number	37÷6=6 R 1
111	1+1+1=3	111 is not divisible by 6, since it is a odd number	111÷6=18 R 3
4734	4+7+3+4=18	4734 is divisible by 6 since the sum 18 is a multiple of 6 and it is an even number	4734÷6=789
101011110	1+0+1+0+1+1+1+1+0=6	101011110 is divisible by 6 since the sum 6 is a multiple of 3 and it is an even number	101011110÷6=16835185

My divisibility rule for 6 is adding the digits of the number and if the sum is divisible by 3 and the number is an even number, then that number will be divisible by 6 too.

I have verified my rule is correct since the digits' sum of 4734 and 10101110 are18 and 6, which are divisible by 3, and both numbers are even numbers; therefore they are divisible by 6. Meanwhile, 37 and 111 are not divisible by 6, even though their digits' sum can be divided by 3, but they are odd numbers, they don't fulfill both divisibility rules of 6.

As a conclusion, if a number is an even number and the sum of all its digits are divisible by 3, then that number is divisible by 6.