M1 Blanc version

01 | A strange calculation

Introduction to problem

1. Choose a number.
2. Multiply it by 3.
3. Add 6.
4. Divide this result by 3.
5. Subtract the number chosen in step 1 from the answer in step 4.

Exploration

Test the instructions on at least 3 examples. Can you give other examples?

Conjecture

Based on the results of the previous exploration, try to formulate a general rule.

A proof?

Try to explain why your rule always works, or look for counterexamples. You can use the technological tools at your disposal.

Conclusion

Write a short commentary summarising your observations and thoughts.

02 | Happy Birthday!

Introduction to problem

Take the number of the month of your birthday (1 for January, 2 for February, ...) and multiply it by 2. Add 5, then multiply the result by 50. Add the day of the month of your birthday. Subtract 250 to get a 4- or 3-digit number.

Exploration

Analyse a few examples.

Conjecture

Based on the results of the previous exploration, try to formulate a general rule.

A proof?

Try to explain why your rule always works or look for counterexamples. You can use the technological tools at your disposal.

Conclusion

Write a short commentary summarising your observations and thoughts.

03 | Multiply by 9

Introduction to problem

Choose a number between 1 and 10. Multiply it by 9. Add the digits of the new number and add 4. What happens ?

Exploration

Analyse a few examples.

Conjecture

Based on the results of the previous exploration, try to formulate a general rule.

A proof?

Try to explain why your rule always works or look for counterexamples. You can use the technological tools at your disposal.

Conclusion

Write a short commentary summarising your observations and thoughts.

04 | Multiply by 6

Introduction to problem

Take an even number and multiply it by 6. Compare the units digit of the result with the units digit of the number you started with. What do you find?

Exploration

Analyse a few examples.

Conjecture

Based on the results of the previous exploration, try to formulate a general rule.

A proof?

Try to explain why your rule always works, or look for counterexamples. You can use the technological tools at your disposal.

Conclusion

Write a short commentary summarising your observations and thoughts.

05| Three figures become six figures

Introduction to problem

1. Choose a three-digit number and write it twice to make a six-digit number. For example, 371371 or 552552.
2. Divide the number by 7.
3. Divide the result by 11.
4. Divide the result by 13.

Exploration

Analyse some examples. You can use a spreadsheet or a calculator to do the calculations.

Conjecture

Based on the results of the previous exploration, try to formulate a general rule.

A proof?

Try to explain why your rule always works or look for counterexamples. You can use the technological tools at your disposal.

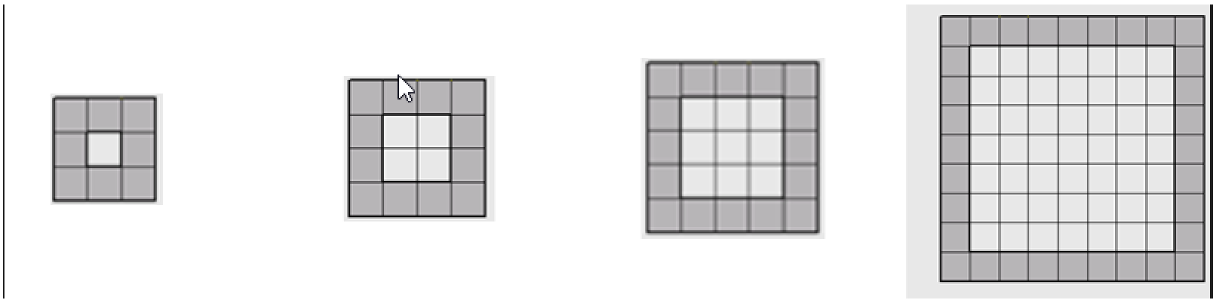
Conclusion

Write a short commentary summarising your observations and thoughts.

06 | Mosaic tiles

Introduction to problem

Here are some mosaic tiles consisting of white tiles forming squares of different sizes. Every white square is surrounded by a frame of grey tiles. Here are four examples.



Count the grey squares. What do you notice?

Exploration

Analyse some examples. You can use a spreadsheet or a calculator to do the calculations.

Conjecture

Based on the results of the previous exploration, try to formulate a general rule.

A proof?

Try to explain why your rule always works or look for counterexamples. You can use the technological tools at your disposal.

Conclusion

Write a short commentary summarising your observations and thoughts.

07 | The calendar

Introduction to problem

The numbers for each month in the calendar can be grouped into squares of different sizes:

January

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

February

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29					

March

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

April

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

May

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

June

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Step 1: Draw a few squares on the calendar.

- Start by drawing squares of 2 by 2 days.
- Then try squares of 3 by 3 days.

Step 2: For each square you have drawn:

- Multiply the number in the top right-hand corner by the number in the bottom left-hand corner.
- Multiply the number on the top left with the number on the bottom right.
- Calculate the difference between these two products.

Here are two examples:

February

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29					

$$11 \cdot 17 - 10 \cdot 18 = 7$$

April

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

$$14 \cdot 26 - 12 \cdot 28 = 28$$

What do you notice?

Exploration

Analyse some examples. You can use a spreadsheet or a calculator to do the calculations.

Conjecture

Based on the results of the previous exploration, try to formulate a general rule:

A proof?

Try to explain why your rule always works or look for counterexamples. You can use the technological tools at your disposal.

Conclusion

Write a short commentary summarising your observations and thoughts.

08 | Sum of odd numbers

Introduction to problem

$$1 = 1$$
$$1 + 3 = 4$$
$$1 + 3 + 5 = 9$$
$$1 + 3 + 5 + 7 = 16$$
$$1 + 3 + 5 + 7 + 9 = 25$$

Do you spot a pattern?

Exploration

Analyse more examples:

Conjecture

Based on the results of the previous exploration, try to formulate a general rule:

A proof?

Try to explain why your rule always works or look for counterexamples. You can use the technological tools at your disposal.

Conclusion

Write a short commentary summarising your observations and thoughts.

09 | Add 41

Introduction to problem

Choose a natural number n. Multiply it by itself. Add to the result the number you chose at the start, then add 41. Start with $n = 0$, then $n = 1$ and so on. What do you find?

Exploration

Analyse some examples.

Conjecture

Based on the results of the previous exploration, try to formulate a general rule.

A proof?

Try to explain why your rule always works or look for counterexamples. You can use the technological tools at your disposal.

Conclusion

Write a short commentary summarising your observations and thoughts.

10 | 3's followed by a 1

Introduction to problem

What are the divisors of 31? 331? And 3331? What do you find?

Exploration

Analyse some examples.

Conjecture

Based on the results of the previous exploration, try to formulate a general rule.

A proof?

Try to explain why your rule always works or look for counterexamples. You can use the technological tools at your disposal.

Conclusion

Write a short commentary summarising your observations and thoughts.

11 | Some rather unusual powers of 2

Introduction to problem

Take a natural number n. Raise 2 to the power of n to obtain the result m. Then raise 2 to the power m. Add 1 to the result.

Start with $n = 0$, then move on to $n = 1$ and so on. What do you notice?

Exploration

Analyse some examples.

Conjecture

Based on the results of the previous exploration, try to formulate a general rule.

A proof?

Try to explain why your rule always works or look for counterexamples. You can use the technological tools at your disposal.

Conclusion

Write a short commentary summarising your observations and thoughts.

12 | Finding common divisors

Introduction to problem

Take a natural number n. Calculate the value of $A = n^2 + 7$ and $B = (n + 1)^2 + 7$, then try to find common divisors of A and B. Start with $n = 0$, then move on to $n = 1$ and so on. What do you find?

Exploration

Analyse some examples.

Conjecture

Based on the results of the previous exploration, try to formulate a general rule.

Any proof?

Try to explain why your rule always works or look for counterexamples. You can use the technological tools at your disposal.

Conclusion

Write a short commentary summarising your observations and thoughts.

13 | Even numbers and prime numbers

Introduction to problem

$$
\begin{aligned}
4 &= 2+2\\
6 &= 3+3\\
8 &= 5+3\\
10 &= 7+3\\
12 &= 7+5\\
14 &= 7+7\\
16 &= 11+5
\end{aligned}
$$

Can you spot a pattern?

Exploration

Aanysle some more examples.

Conjecture

Based on the results of the previous exploration, try to formulate a general rule.

A proof?

Try to explain why your rule always works or look for counterexamples. You can use the technological tools at your disposal.

Conclusion

Write a short commentary summarising your observations and thoughts.

14 | An algorithm that always finishes?

Introduction to problem

Choose a strictly positive integer.

- If it is even, divide by 2.
- If it is odd, multiply it by 3 and add 1 to the result.

Repeat this operation a large number of times to make the result as small as possible.

Exploration

Analyse some examples.

Conjecture

Based on the results of the previous exploration, try to formulate a general rule:

A proof?

Try to explain why your rule always works or look for counterexamples. You can use the technological tools at your disposal.

Conclusion

Write a short commentary summarising your observations and thoughts.

15 | A sum of 4 cubes

Introduction to problem

$$1 = 1^3 + 0^3 + 0^3 + 0^3$$
$$2 = 1^3 + 1^3 + 0^3 + 0^3$$
$$3 = 1^3 + 1^3 + 1^3 + 0^3$$
$$4 = 1^3 + 1^3 + 1^3 + 1^3$$
$$5 = 2^3 + (-1)^3 + (-1)^3 + (-1)^3$$

What do you notice?

Exploration

Analyse some examples.

Conjecture

Based on the results of the previous exploration, try to formulate a general rule.

A proof?

Try to explain why your rule always works, or look for counterexamples. You can use the technological tools at your disposal.

Conclusion

Write a short commentary summarising your observations and thoughts.