CALENDAR PATTERNS

September 2015 < Today >

Mon	Tue	Wed	Thu	Fri	Sat	Sun
24	25	26	27	28	29	30
31	1 Sep	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	1 Oct	2	3	4

On a calendar put a box around four numbers.

Add the numbers in opposite corners.
For example 8+16 and 9+15.
What do you notice about the answers?

Put a box around another set of four numbers and try this again.
What happens and why?
Try multiplying – perhaps you could use a calculator to help.

What happens in other months?

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	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Use a 100 square and again put a box around four numbers.

Add the numbers in opposite corners.
What do you notice about the answers?
Explain why this happens.

Try multiplying and explain what happens.

Help

In order to focus on which numbers you are dealing with at each moment you could use a frame exactly the right size to show just four numbers. Cut your frame from scrap paper.

Add the two pairs of numbers at opposite corners of the square. What do you notice about these two totals? Does the same sort of thing happen when you move your frame to shown four different numbers?

Extension

Work with a partner and discuss your discoveries. Suggest new things to try. For example, what happens if the square box is enlarged to include nine numbers, or a rectangular frame of six numbers? Test discoveries on other months.

What would happen if we lived somewhere where a week consisted of 6, 5, or just 4 days?

Notes for teachers

Solution

The sums of the numbers in diagonally opposite corners in both the calendar and the 100 square will always be equal.
The products of the numbers in diagonally opposite corners will always differ by 7 in the calendar and 10 in the 100 square.

<table>
<tr><td colspan="2">Calendar</td><td rowspan="3">Look at the number in the left hand top corner. The other numbers are 1 more, 7 more and 8 more than that number. So the sum is always twice that number plus 8.
$n + (n + 8) = (n + 1) + (n + 7) = 2n + 8$.
The products are $n(n+8) = n^2 + 8n$ and
$(n + 1)(n + 7) = n^2 + n + 7n + 7 = n^2 + 8n + 7$</td></tr>
<tr><td>n</td><td>n+1</td></tr>
<tr><td>n+7</td><td>n+8</td></tr>
<tr><td colspan="2">100 Square</td><td rowspan="3">The sum of the numbers in the diagonally opposite boxes is always the same. It will be $2n+ 11$.
The products of the numbers will be n^2+11n and $n^2 +11n +10$ so they will always differ by 10.</td></tr>
<tr><td>n</td><td>n+1</td></tr>
<tr><td>n+10</td><td>n+11</td></tr>
</table>

Diagnostic Assessment For Older Learners.

This should take about 5–10 minutes.

This is a good pre-algebra activity so omit this diagnostic question for younger learners.

1. Write the question on the board, say to the class:
   "Put up 1 finger if you think the answer is A, 2 fingers for B, 3 fingers for C and 4 fingers for D".
2. Notice how the learners responded. Ask a learner who gave answer A to explain why he or she gave that answer and DO NOT say whether it is right or wrong but simply thank the learner for giving the answer.
3. Then do the same for answers B, C and D. Try to make sure that learners listen to these reasons and try to decide if their own answer was right or wrong.
4. **Ask the class again to vote for the right answer by putting up 1, 2, 3 or 4 fingers. Notice if there is a change and who gave right and wrong answers.** It is important for learners to explain the reason for their answer otherwise many learners will just make a guess.
5. If the concept is needed for the lesson to follow, explain the right answer or give a remedial task.

Expand and simplify $(x-5)(x+11)$

A $x^2 - 49x$

B $x^2 + 6x - 55$

C $62x^2$

D $x^2 - 55$

B. is the correct answer.

Common Misconceptions

A. and **C.** These learners have no idea what to do and just guessed.

D. These learners multiplied the first terms in each brackets together and the last terms and failed to cross multiply.

https://diagnosticquestions.com

Why do this activity?

Learners will be able to investigate number patterns in an everyday context. It is very easy to spot the pattern and some learners will ask themselves "does this always happen, and if it does, why?" You may need to encourage other learners to try and explain the patterns that they find.

The activity leads naturally to algebra for older learners but it can be 'talked through' without algebra as a step on the road (often called pre-algebra). This will help learners to develop their powers of reasoning.

The activity is good for all learners in a class. Some learners may benefit from practice in addition and multiplication and just spotting the patterns will be ‘success’ for them. Other learners may be able to give good explanations in words without algebra and the high flyers may benefit from using algebra. Some learners can stop at calendar patterns and others will go on to investigating similar patterns on a 100 square.

Intended Learning Outcomes

Younger learners will practise simple arithmetic and improve their ability to recognise patterns.
Learners will develop mathematical thinking and problem solving skills by trying to explain the reasons for the patterns appearing.
Older learners will have experience of expressing numerical relationships in algebraic terms.

Generic competences

In doing this activity students will have an opportunity to:

- **think mathematically**, reason logically and give explanations;
- **think flexibly**, be creative and innovative and apply knowledge and skills;
- **visualize** and develop the skill of linking visual images to concepts and situations;

Suggestions for Teaching

This investigation would work well with the learners in pairs, each pair with their own copy of a page from a calendar. (You could keep old calendars from past years for this and similar activities.) Using different months gives a point for discussion about what changes from month to month and what stays the same.

If you go round the class observing what the learners are doing and asking them for explanations there will be plenty of opportunity for you to praise and encourage learners for their work. Then later on you could ask learners who can give good explanations to explain the patterns to the whole class and give their reasons. If appropriate, guide the learners to try multiplying the numbers and looking for patterns.

This investigation could be revisited several times, trying different approaches each time. You could use this activity to give practice in addition and multiplication, or for older learners to give practice in using algebra. Alternatively, your learning objective may be to develop reasoning and mathematical language, and learners may understand the basic concept of multiplication but can't readily manage the calculations, in which case it would be appropriate to use calculators (if available).

Key questions

- Tell me about the numbers you've found.
- What have you done to get these answers?
- Have you found any patterns?
- Does that always happen?
- What do you notice?
- Why is that?

Follow up

Hundred Square: https://aiminghigh.aimssec.ac.za/years-4-7-hundred-square/
Multiplication Squares: https://aiminghigh.aimssec.ac.za/years-4-7-multiplication-squares/

Note: The Grades or School Years specified on the AIMING HIGH Website correspond to Grades 4 to 12 in South Africa and the USA, to Years 4 to 12 in the UK and up to Secondary 5 in East Africa.
Note: The mathematics taught in Year 13 (UK) and Secondary 6 (East Africa) is **not** included in the school curriculum for Grade 12 SA.

	Lower Primary or Foundation Phase Age 5 to 9	Upper Primary Age 9 to 11	Lower Secondary Age 11 to 14	Upper Secondary Age 15+
South Africa	Grades R and 1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
USA	Kindergarten and G1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
UK	Reception and Years 1 to 3	Years 4 to 6	Years 7 to 9	Years 10 to 13
East Africa	Nursery and Primary 1 to 3	Primary 4 to 6	Secondary 1 to 3	Secondary 4 to 6