



AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES
SCHOOLS ENRICHMENT CENTRE (AIMSSEC)
AIMING HIGH

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

HUNDRED SQUARE

A hundred square has been printed on both sides of a piece of paper.

One square is directly behind the other.

What is on the back of 100? 58? 23? 19?

Can you see a pattern?

HELP

This task might seem easier if you have a real copy of a hundred square to use and annotate.

You could use a mirror on the hundred square and note all the patterns that you find. What happens if you add each number on the front to the number behind it?

NEXT

Using a different square such as a [64] 8 by 8 square will produce a different, if related, set of numbers. Describe these patterns.

Investigate similar patterns on a 1-400 square and what numbers are behind others when the square is printed back to back on a single sheet of paper.

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

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
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260
261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280
281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320
321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340
341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360
361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380
381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400

NOTES FOR TEACHERS

SOLUTION

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

91 is behind 100, 53 behind 58, 28 behind 23 and 12 behind 19.

This can be explained in the following ways:

(1) If you fold the 100 square down the middle, or see this as a mirror line, then the number and the number behind it are reflections in the mirror line. Imagine rotating the paper about this line through 180° keeping this line fixed.

(2) The number and the one behind it are on the same row and the tens digits are the same except for the first and last columns.

(3) The units digits add up to 11, except for the first and last columns.

(4) The number and the one behind it are the same distance from the mirror line, for example 53 and 58 are 3 squares from the mirror line.

(5) The number and the one behind it are the same distance from the right hand and left hand edges, example 12 and 19 are 2 squares from the edges

Why do this activity?

This activity is an unusual way to explore number patterns in a well-known context. The activity will reinforce the concept of place value underlying the construction of the hundred square, and increase learners' familiarity with the sequences contained within it. Using a common resource, such as a hundred square, is a good way for learners to begin to use visualisation, which they may find quite difficult at first. The act of visualising in this problem tests understanding of how the number square is created.

Learning objectives

In doing this activity students will have an opportunity to:

- reinforce number sense and recognition of the place value of digits in whole numbers.
- develop mathematical vocabulary and language.

Generic competences

In doing this activity students will have an opportunity to develop visualization and communication skills.

DIAGNOSTIC ASSESSMENT

This should take about 5–10 minutes.

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 for D".

1. Notice how the learners respond. Ask a learner who gave answer A to explain why he or she gave that answer. DO NOT say whether it is right or wrong but simply thank the learner for giving the answer.
2. It is important for learners to explain the reasons for their answers. Putting thoughts into words may help them to gain better understanding and improve their communication skills.
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 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.
5. **This is another question about place value. If the learners do not get it right it is crucially important to follow this diagnostic quiz with some work on the language used to read large numbers out loud and how to write them down when they hear the number spoken.**

Write in figures:

Two hundred and four thousand, and fifty

A 200400050

C 204050

B 20400050

D 2040050

The correct answer is: C

Learners who give other answers do not understand the language and way of writing down numbers.

<https://diagnosticquestions.com>

Suggestions for teaching

Start with the diagnostic quiz. Then explain that, in the lesson, they are going to investigate and review how numbers are organised in a base 10 number system. Ask them questions about what they remember of first learning to count and about counting through the list of whole numbers goes on indefinitely. Write down some 6, 7 and 8 digit numbers and ask the learners to read them out. Then read out some numbers and ask learners to write them down. Make sure as far as you can that all the learners can use the language correctly. Do not introduce or discuss billions and trillions at this stage. Say that, having thought about big numbers you are now going to focus on the numbers 1 to 100.

Show the learners a hundred square and ask questions about it. Tell them you want them to look at it so that they will remember where the numbers occur on it. Then ask them to close their eyes and try to see a hundred square in their heads. Ask some questions such as "What number comes first and what is below it?"; "What number is below 10?"; "What number is two places to the right of 34?". Encourage them to justify their responses before using a real hundred square to check.

You could then pose the question in the problem and encourage the group to work in pairs. Give them time to talk to each other about possible solutions without making a hundred square available at first. Asking learners to work in pairs on this task will encourage them to begin to argue mathematically. Listening to their explanations and justifications of which numbers are where would be an excellent assessment exercise for you.

When it comes to explaining their method, it is a chance for you to see how well they can put into words what they notice and how they use mathematical understanding and vocabulary to support this. Once the whole group has shared some ways of coming to a solution, pose some further questions for pairs to work on. It is interesting to find out whether some children adopt ways of working on the problem that they learnt from their classmates rather than sticking to their original method. There are many different ways of 'seeing' a solution.

Key questions


- If you turned over the hundred square, where would you write the 1 of the new hundred square?
- Which number would this 1 be behind?
- Where would the 2 be? And the 3?
- What number is below 1 on the hundred square?
- Can you imagine the square on the back?
- Where will its 1 be? Where will its 10 be?
- What is on the back of 100? 58? 23? 19?

Follow up

Click here for an [NRICH poster](#) for your classroom wall.

This problem is also [available in French](#).

[This sheet](#) has two hundred squares on it.



Go to the **AIMSSEC AIMING HIGH** website for lesson ideas, solutions and curriculum links: <http://aiminghigh.aimssec.ac.za>

Subscribe to the **MATHS TOYS YouTube Channel**
<https://www.youtube.com/c/MathsToys/videos>

Download the whole AIMSSEC collection of resources to use offline with the **AIMSSEC App** see <https://aimssec.app> or find it on Google Play.

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 school years up to Secondary 5 in East Africa.

New material will be added for Secondary 6.

For resources for teaching A level mathematics (Years 12 and 13) see <https://nrich.maths.org/12339>

Mathematics taught in Year 13 (UK) & Secondary 6 (East Africa) is beyond the SA CAPS curriculum for Grade 12

	Lower Primary Approx. Age 5 to 8	Upper Primary Age 8 to 11	Lower Secondary Age 11 to 15	Upper Secondary Age 15+
South Africa	Grades R and 1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
East Africa	Nursery and Primary 1 to 3	Primary 4 to 6	Secondary 1 to 3	Secondary 4 to 6
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