Hide the Pixels
Day 2

Introduction

This activity allows students to try their hand at optimization by exploring the relationship between area and number. In this visual problem students can be creative in finding different solutions and comparing them to each other, as well as in creating their own designs as game boards for other students to play with.

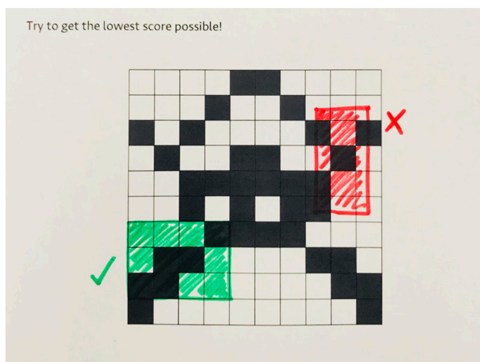
Agenda

Activity	Time	Description/Prompt	Materials
Mindset Message	10 min	Play the mindset video, ***Believe in Yourself***, https://youcubed.org/weeks/week-4-grade-3-5/	Mindset Video day 2, ***Believe in Yourself***
Explore Pixel Aliens	15 min	• Introduce the problem. • Let students explore one or both of the Pixel Aliens. What is the lowest score they can get for each?	• Pixel Aliens Handouts • Math journal • Colored pencils (optional) • Calculator (optional)
Discussion of Pixel Aliens	10 min	• Encourage students to share what they found. What is the lowest score they found for each alien? What strategies did they use? Did they notice any useful patterns or ways of organizing their data?	• Document camera
Make and Share Boards	15 min	• Invite students to create their own pixel designs in the Blank Handout and exchange designs for their peers to find the lowest scores they can on these new boards.	• Hide the Pixels Blank Handout
Debrief Mindset Message	5 min	Ask students to reflect on the importance of believing in themselves. Ask for some volunteers to share a time when they believed in themselves during the activity or a time when they surprised themselves in what they could do during the activity!	

Activity

Introduce the problem to students by sharing information about pixel art with them. For example, you might tell them about how before computers were as powerful as they are today, the only way to make images was to create them pixel by pixel. Each pixel a little square that would be individually colored. Entire video games were created this way. We don't do it this way anymore, but it has become a style artists use and call Pixel Art. You can project the examples below for them to see. For more background, here is a more in-depth article on pixel art: https://design.tutsplus.com/articles/what-is-pixel-art--cms-21759

Give students one or both of the Pixel Alien Handouts and have them work in groups to find the lowest scores they can earn. The rectangles they make must cover squares fully, as you can see below. Feel free to provide calculators so they can focus their thinking on the strategy and not on calculations.



You might want to discuss with students the different parts of the score. They might recognize the first part as the area of the rectangles they draw, and the second as the square of the number of rectangles. If they don't, this could be a good place to introduce one or both of those ideas. They might want to think of the squares not just as a number times itself, but also as the diagonal of the multiplication table as you can see here:

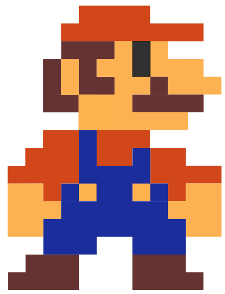
x	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

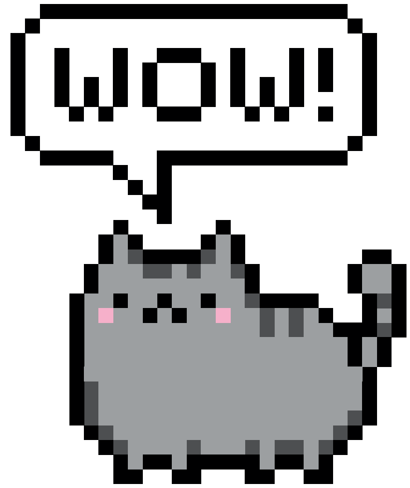
We are including a multiplication table handout so students can explore and notice that pattern.
As students work on their optimization task, notice what strategies are they using to optimize their score. We have included a table for data collection that may help students organize their data and see patterns in it.

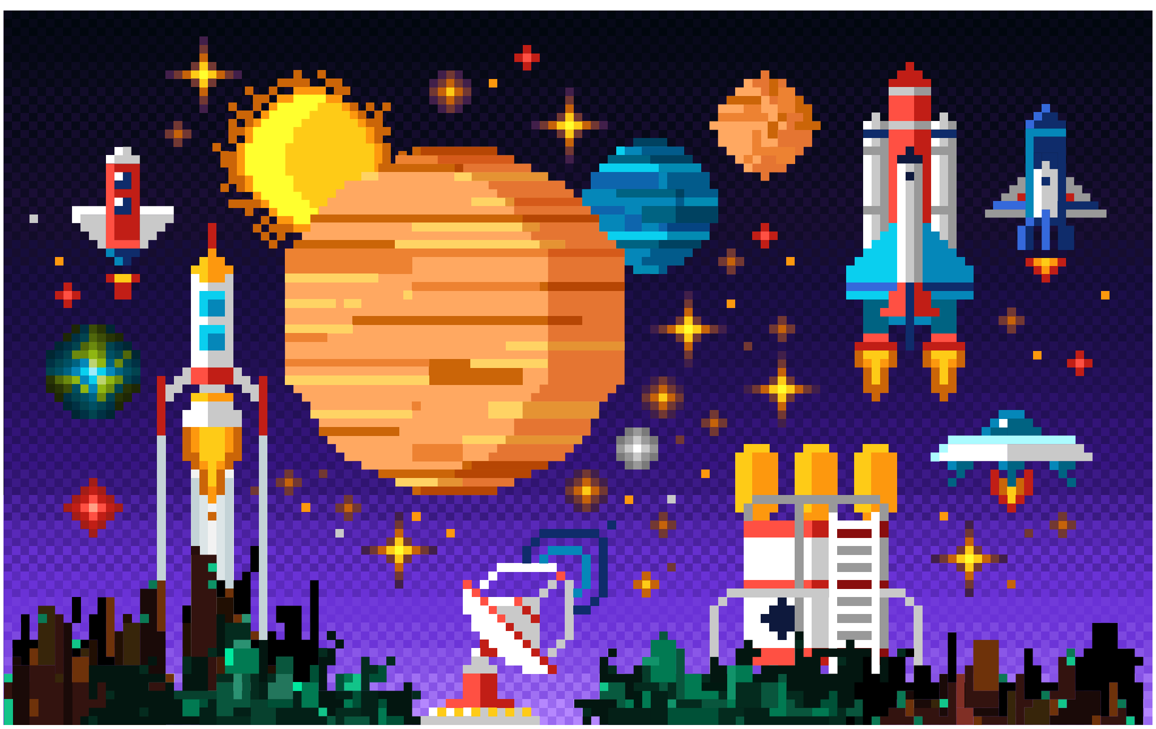
Number of Rectangles Used	Square of Number of Rectangles Used	Area of Rectangles	Score

Once students have had some time to explore these cases, invite students to share with the rest of the class what they found. Not only the lowest score they found for each alien, but also the strategies they used to optimize the score and if they notice any useful patterns or ways of organizing their data. This is a good time to introduce the idea of “optimizing” as a mathematical concept used in mathematical modeling. When you optimize something, you are “making it the best”. Optimization problems are common in areas like engineering and economics where you want to design to get the best performance possible.

Following this discussion give students some time to make their own pixel art on the Hide the Pixel Blank Handout. Encourage them to be creative and try out some different ideas. It is helpful to have extra blank sheets so students can make mistakes (and share them proudly!) and share their art with their peers. Then they can sit in small groups and try to optimize the scores for each of their pieces of pixel art together. Notice different ways groups are approaching the problem and any ‘Aha!’ moments they might have as they work together.




WOW!



Hide the Pixels

Cover all of the colored pixels using rectangles. Your rectangles may cover black and white squares.

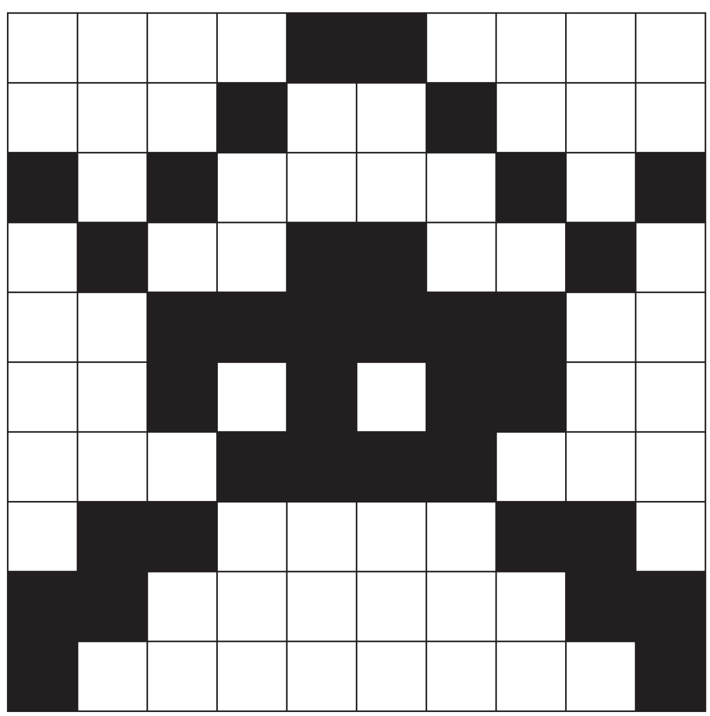
To calculate your score, do the following.

- How many small squares did you cover with rectangles?
- How many rectangles did you use?
- Multiply the number of rectangles times itself x =

Add the number of small squares you covered with rectangles to the square of the number of rectangles. + =

Your Score

Try to get the lowest score possible!



Inspired by NRich.maths.org

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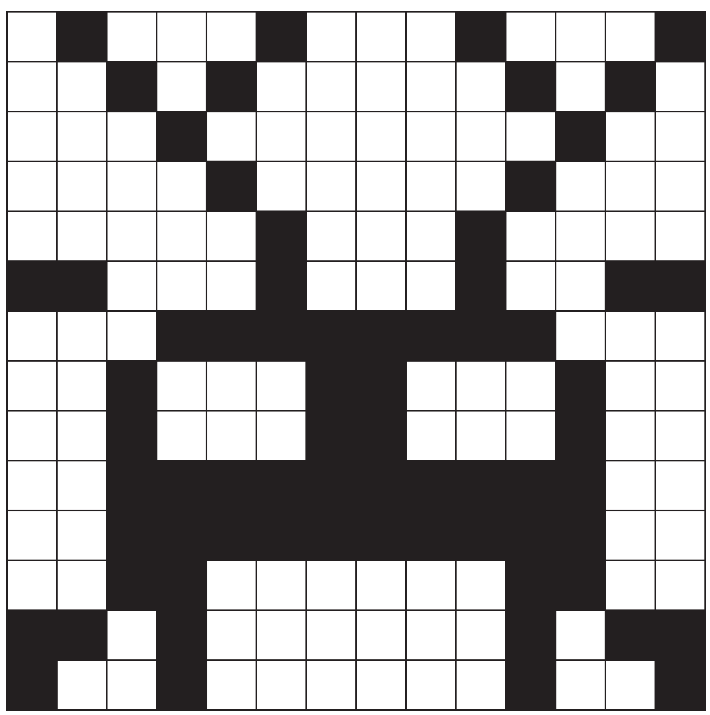

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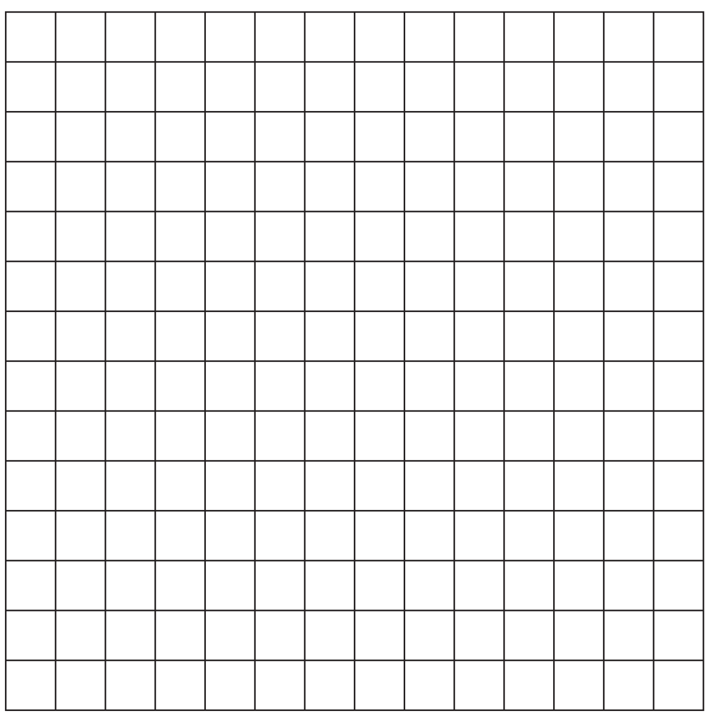
Try to get the lowest score possible!



Inspired by NRich.maths.org

Hide the Pixels

Cover all of the colored pixels using rectangles. Your rectangles may cover black and white squares.

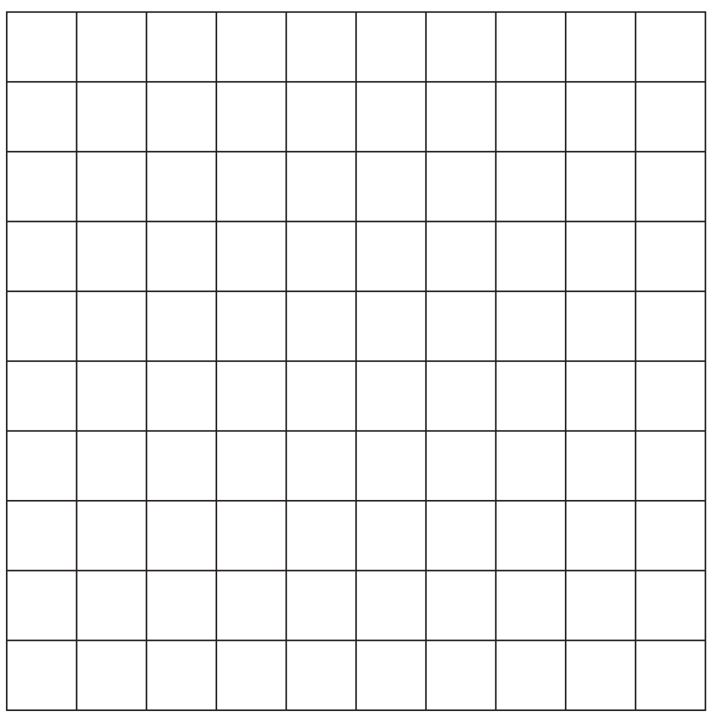
To calculate your score, do the following.

- How many small squares did you cover with rectangles? △
- How many rectangles did you use? □
- Multiply the number of rectangles times itself □ x □ = ○

Add the number of small squares you covered with rectangles to the square of the number of rectangles. △ + ○ =

Your Score

Try to get the lowest score possible!



Inspired by NRich.maths.org

x	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
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5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100