

# Wood Shop

## SQUARING UP

**Ahoy, landlubbers!**  
By now, you've all finished buildin' your ships. 'Tis time to sew your sails.

Me first piratin' ship be havin' only one small sail...

...sixteen square patches sewn together to make one 4 by 4 square.  
As me piratin' skills grew, so did me ship and her sails. I was always addin' more squares to embiggen me sail.



Each time I grew me sail, I added squares to the side and to the top.



To make me 4 by 4 sail into a 5 by 5 sail, I stitched a column of 4 squares on the side...



...and a row of 5 on top.

After addin' more squares, 'twas finally time to build a bigger ship and add a second sail.

Me new ship had one 10 by 10 sail and one 11 by 11 sail.

How many total squares be there in the bigger sail?



10×10 is 100... but what is 11×11?

I know! We can get from 10×10 to 11×11 the same way Captain Kraken made his sails.

To get from a square that is 10 by 10 to a square that is 11 by 11...

...we just add 10 squares on the side...

...and 11 squares on top.

+10

+11

So 11×11 is just 10×10+10+11.

That makes 100+10+11=121 squares in the larger sail!

Aye! 121 stitched squares.

She be a sleek 'n nimble ship, able to turn on a dime.

Was it a fast ship?

Fast? She made the Kessel Run in less than 12 parsecs!

Alas, she was a puny vessel compared to...

...the *Angela Viathan*,  
the largest ship to ever  
sail the seven seas.



She had four  
masts, each holding  
six square sails. The  
smallest sail atop each  
mast was 40 squares  
wide and tall!

So the *smallest*  
sail was made from  
 $40 \times 40 = 1,600$  fabric  
squares!

Each o'  
the two sails  
beneath it be one  
square wider 'n  
taller.

41 by  
41?

Aye.  
What be the number  
o' fabric  
squares in  
a 41 by 41  
sail?



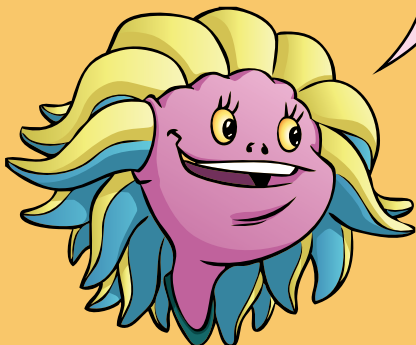
Can you  
find the  
number of  
squares?



We already  
know 40 squared  
is  $40 \times 40 = 1,600$ .

To get from a  
 $40 \times 40$  square to a  
 $41 \times 41$  square, we just add  
40 squares on the side  
and 41 on top...

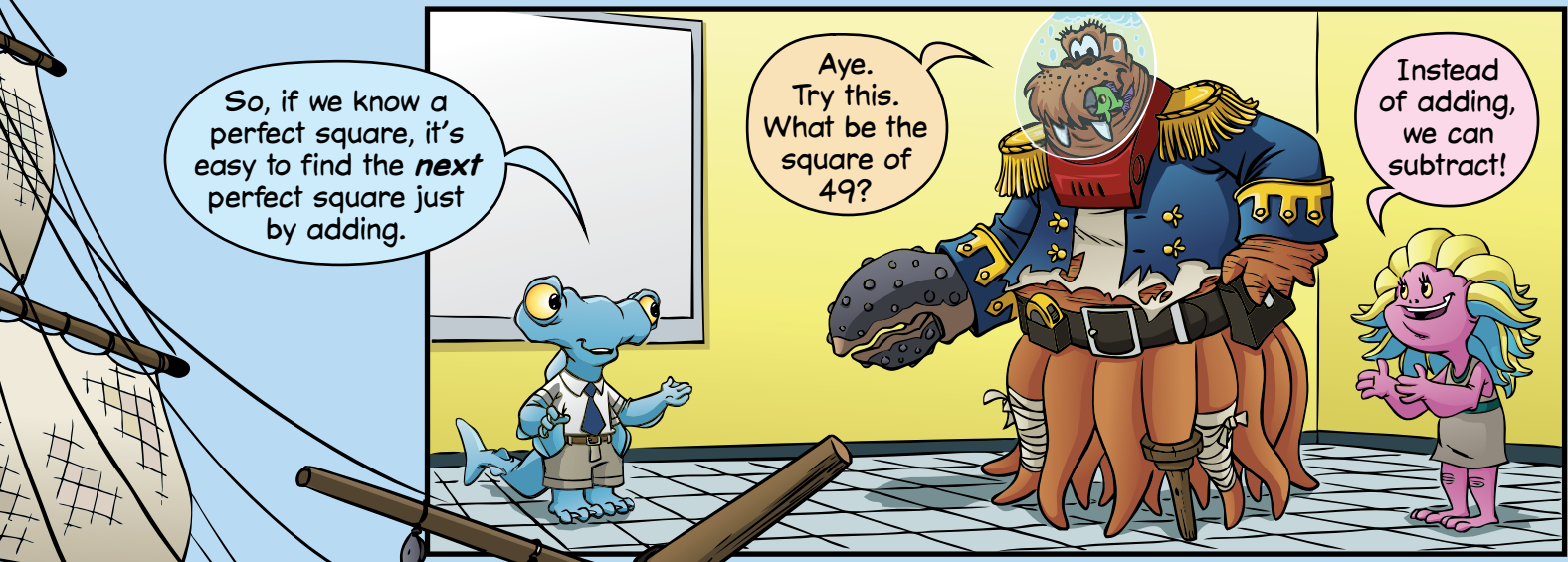
...41  
squared is  
1,681!



$$40 \times 40 = 1,600$$

$$+41$$

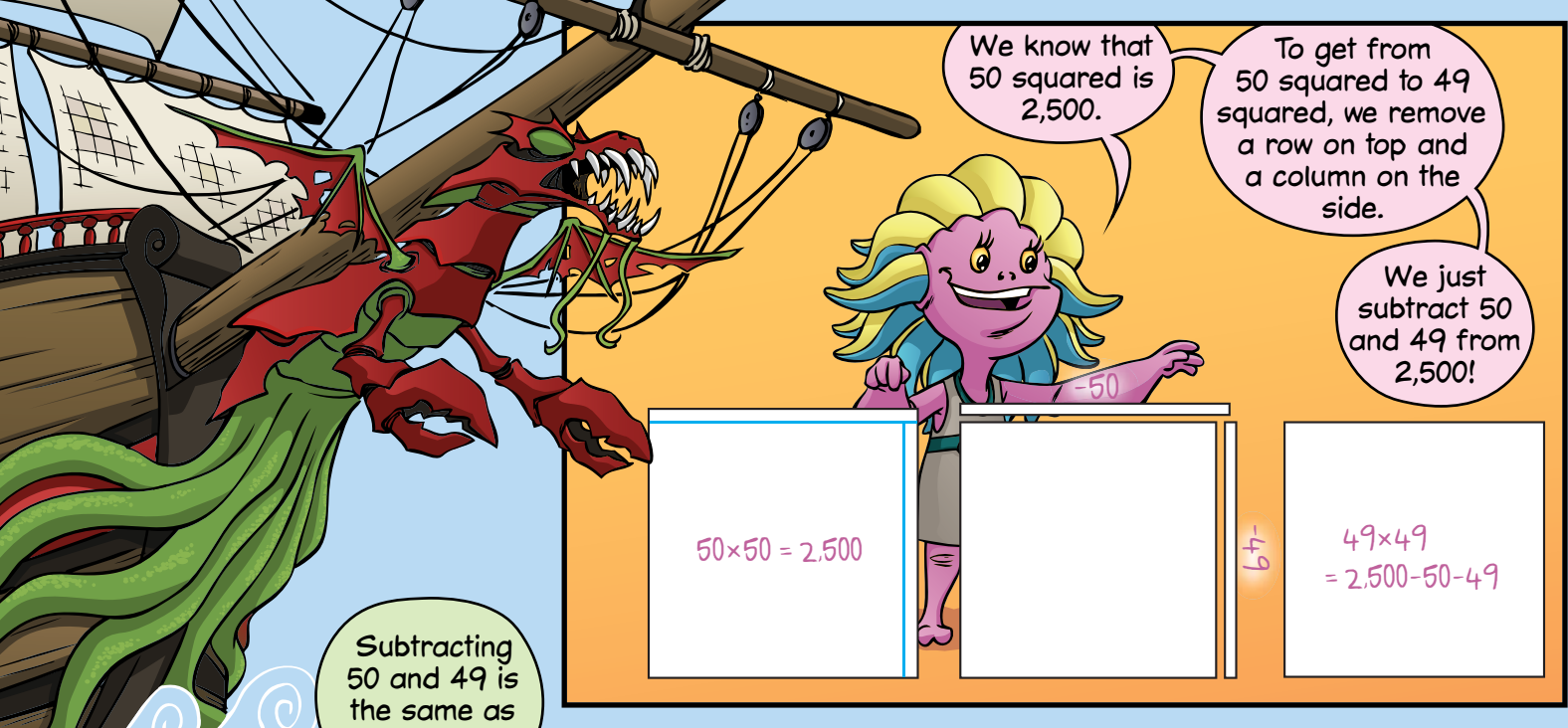
$$41 \times 41 = 1,600 + 40 + 41 = 1,600 + 81 = 1,681$$



So, if we know a perfect square, it's easy to find the *next* perfect square just by adding.

Aye. Try this. What be the square of 49?

Instead of adding, we can subtract!



We know that 50 squared is 2,500.

To get from 50 squared to 49 squared, we remove a row on top and a column on the side.

We just subtract 50 and 49 from 2,500!

$$50 \times 50 = 2,500$$



$$\begin{array}{r}
 64- \\
 49 \times 49 \\
 = 2,500 - 50 - 49
 \end{array}$$

Subtracting 50 and 49 is the same as subtracting 99...  
 ...so 49 squared is  
 $50 \times 50$  minus 99:  
 $2,500 - 99 = 2,401!$

Very good!

Now, choose your fabric squares 'n' select a sew-bot.

