Tiling Spacecraft
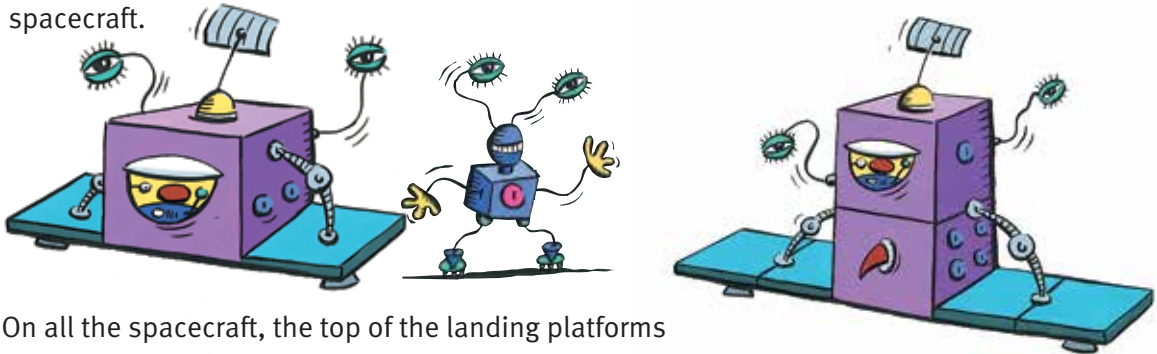
Spacecraft on Planet Aras are made of cubes and come in various sizes. When they come in to land, they eject two landing platforms that are the same size as the side faces of their spacecraft.

On all the spacecraft, the top of the landing platforms and the 5 visible faces are made up of square tiles.

1. Jeff counts 1 + 4 x 3 + 2 x 3 = 19 square tiles on a spacecraft on display at the National Space Centre.
   a. Draw the spacecraft on isometric dot paper. Show the landing platforms.
   b. Predict the number of square tiles on a 5-cube spacecraft. Draw it to check your calculations.

2. Jeff has a rule for predicting the number of square tiles for a spacecraft of any size.
   He writes the rule as $1 + 4 \times n + 2 \times n$.
   Explain how this rule works.

3. Fran works out a different rule from Jeff's.
   She completes this table and then notices a pattern.

Craft size (number of cubes)	1	2	3	4	5
Number of square tiles			19		
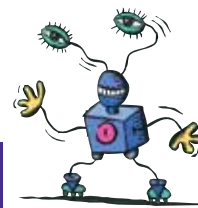
   a. Complete the table.
   b. Write Fran's rule and explain how you worked it out.

4. Suppose spacecraft eject landing platforms on all 4 sides.
   a. Complete the following table for these spacecraft.
      Fran and Jeff use different short cuts.

Craft size (number of cubes)	Number of square tiles	
	Jeff's predictions	Fran's predictions
1		
2		
3	1 + 4 x 3 + 4 x 3 = 25	
4		
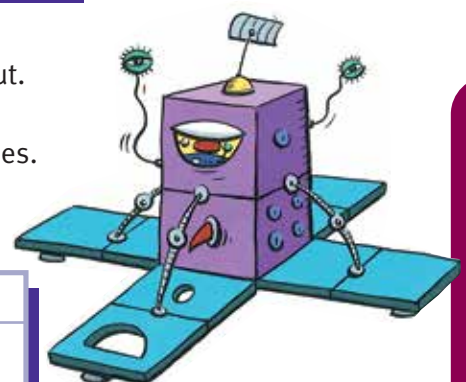
   b. Write Jeff's rule and Fran's rule.
   c. Use each rule to predict the number of tiles for a 100-cube spacecraft.
   d. A spacecraft has 193 square tiles. Work out the size of the spacecraft.