Game

Games are a great resource. They support talk in maths and, just as important, they motivate us to persevere.

Red – Amber – Green

(adapted from *Traffic Lights* at nrich.org)

Aims:

- Visualise position and direction.
- Identify game strategy.

You will need:

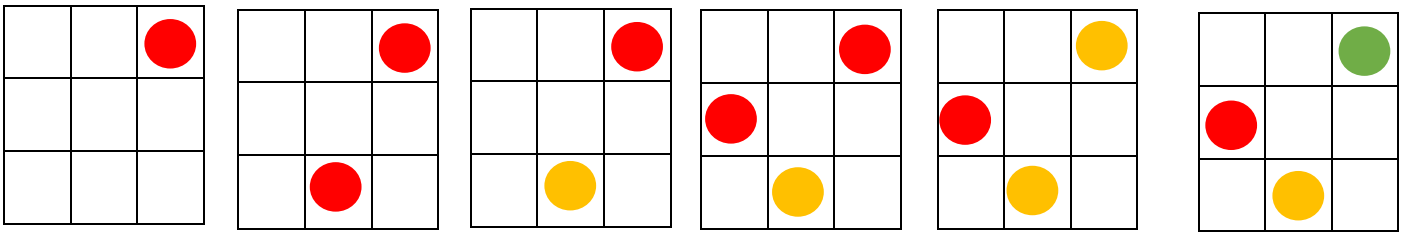
- A 3 by 3 game board (*see resources*)
- Counters (*see resources*)

Red – Amber – Green is a game for 2 players using a 3x3 grid as the playing board.

- At the start of the game, the board is empty.
- The players take turns to play. When it is your turn, you must either:
  1. Place a red counter in an empty square, *or*
  2. *Replace* a red counter already on the board with an orange one, *or*
  3. *Replace* an orange counter already on the board with a green one.

  Green counters cannot be replaced!

You **win** by completing a line (row, column, or diagonal) of *three counters all the same colour*. It doesn't matter who placed the first counter(s) in the line - it's the third counter of the line which determines the winner.



1 2 3 4 5 6

Here is an example of how a game could start:

1. Player 1 places a red counter at the top right-hand corner.
2. Player 2 places a red counter at the middle of the bottom line.
3. Player 1 changes a red for an orange counter.
4. Player 2 places another red counter.
5. Player 1 changes a red for an orange counter.
6. Player 2 changes an orange counter for a green counter.

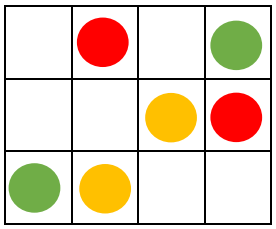
Player 1 now has three choices: placing another red counter, changing the red counter for an orange or changing the orange counter for a green.

What would be the player's best choice? Why?

Play the game several times, then think about these questions.

- How many red counters can be placed before you would lose if you didn't change one for orange?
- How may red counters and orange counters can be on the board before you would lose if you didn't change one for green?
- Is it better to go first or second?
- Is it better to change to green counters as soon as possible?
- The players in the example game avoided the centre square of the grid. Is that a good tactic? Why/why not?

Traffic Lights – Champions Version!



- Try playing the game on a **4 by 3 grid.**
- The aim is the same. You must complete a line (row, column, or diagonal) of **three** counters all the same colour.
- Will the same tactics work?

HAVE A GO AT THE CHALLENGE BELOW – GO ON, YOU CAN DO IT!

Traffic light challenge

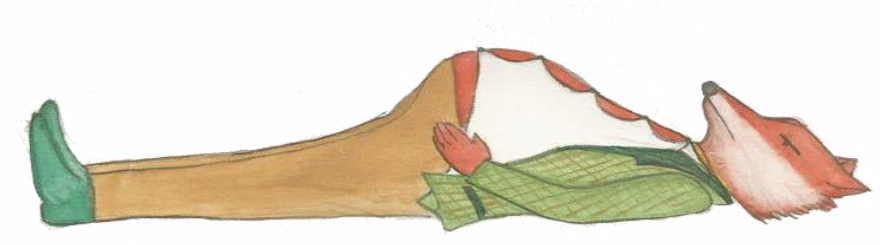
1. Take 3 counters, **one of each colour**. Place them in a line.
   Record this arrangement however you like, e.g.  or **G R O**

   Now rearrange the counters into a different order and record.
   How many different arrangements are there?
   A good strategy is to be **systematic** in your recording.

2. This time you may use 3 counters of any colour, so you could have 2 red and 1 green or 2 orange and 1 red or all 3 the same colour.
   How many different arrangements are possible now?

3. Predict how many possibilities if we make <u>4 in a row</u> from 3 choices of colour.

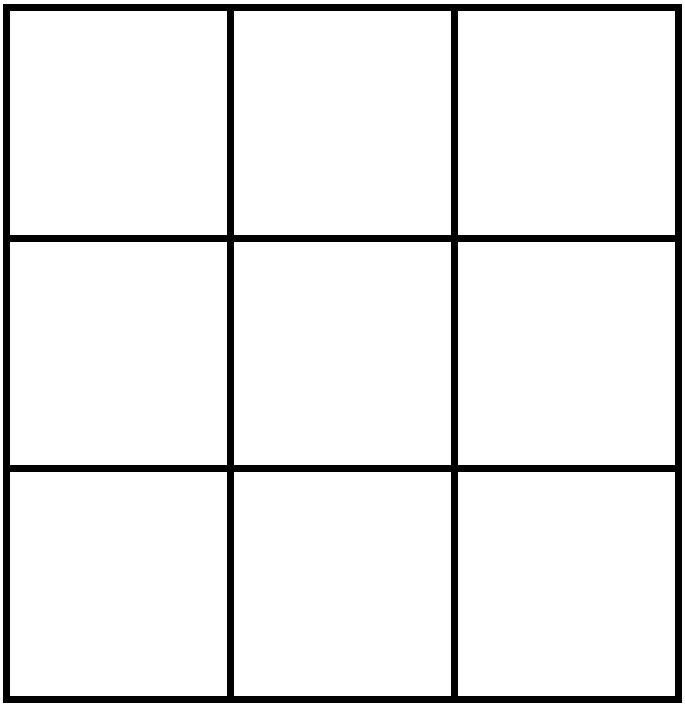
   A good strategy with a problem like this us to simplify it first…
   - What if you made a row of 4 from 1 choice of colour?
   - What if you made a row of 4 from 2 choices of colour?
   - Then 4 in a row from 3 choices of colour?

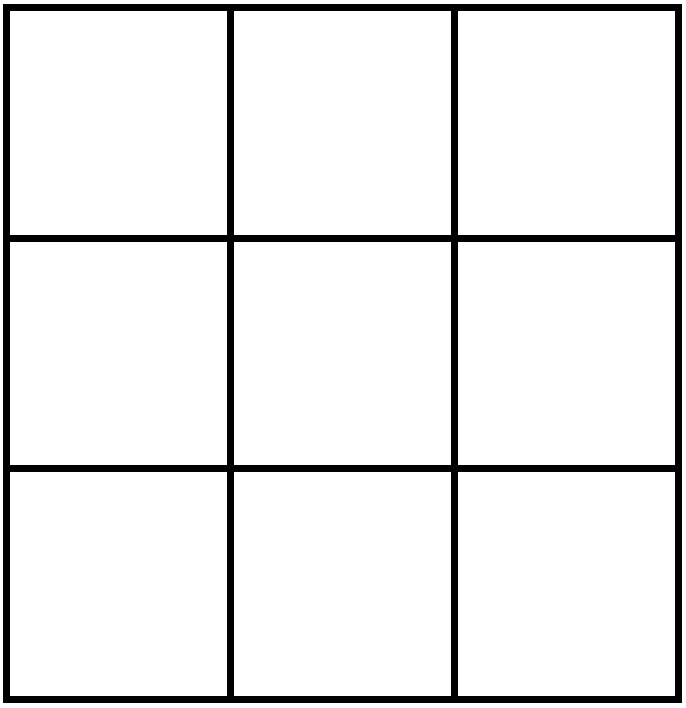


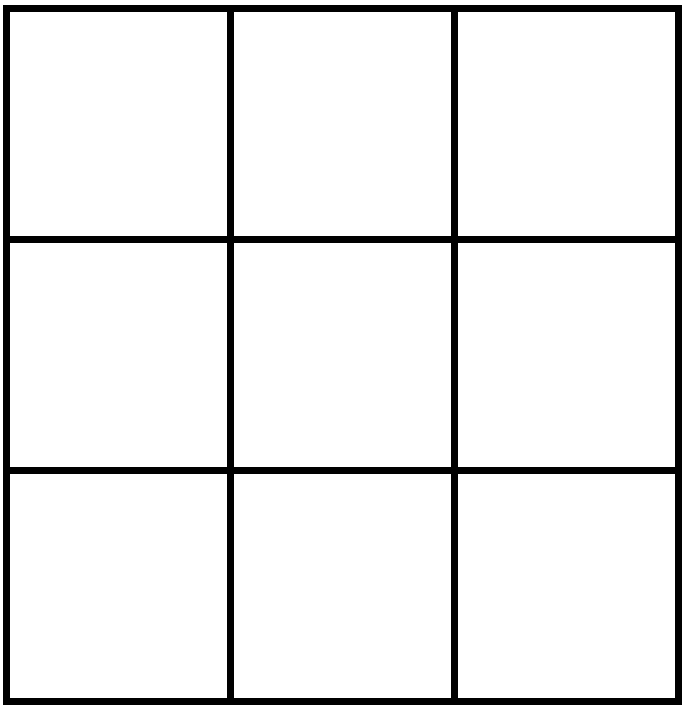
Answers

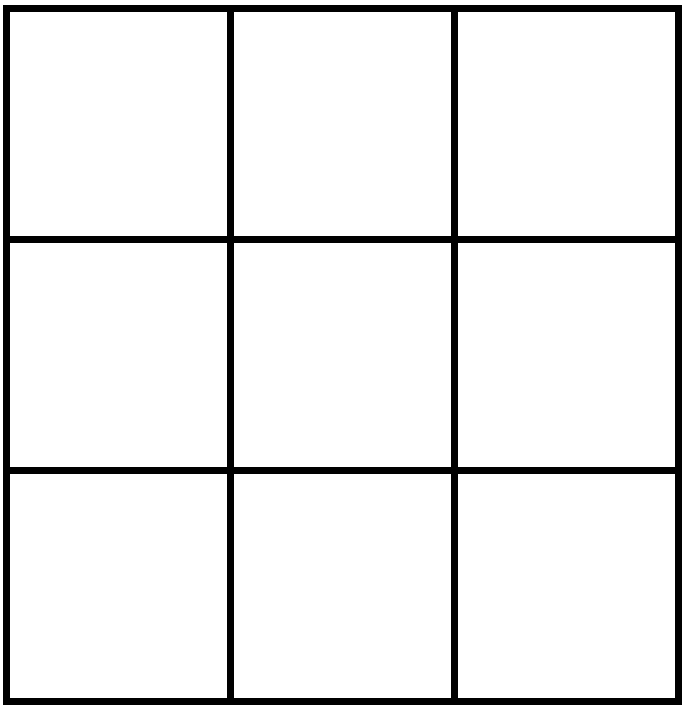
1. 6 possibilities (3 x 2 x 1). The first counter can be one of 3 colours, the second 2 and one choice for the third.
2. 27 possibilities (3 x 3 x 3). Here each of the counters can be one of three colours.
3. 81 possibilities (3 x 3 x 3 x 3). Each of the counters can be one of three colours.

Game Board 1
(3 by 3)

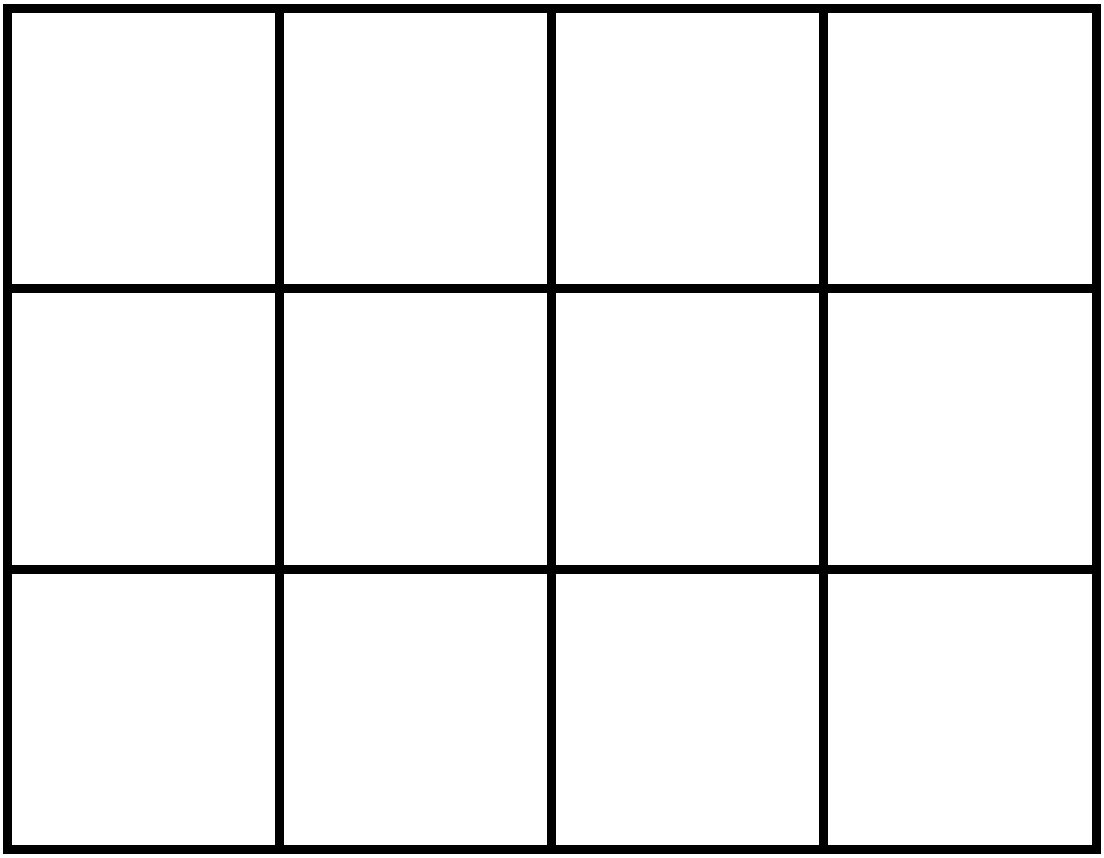


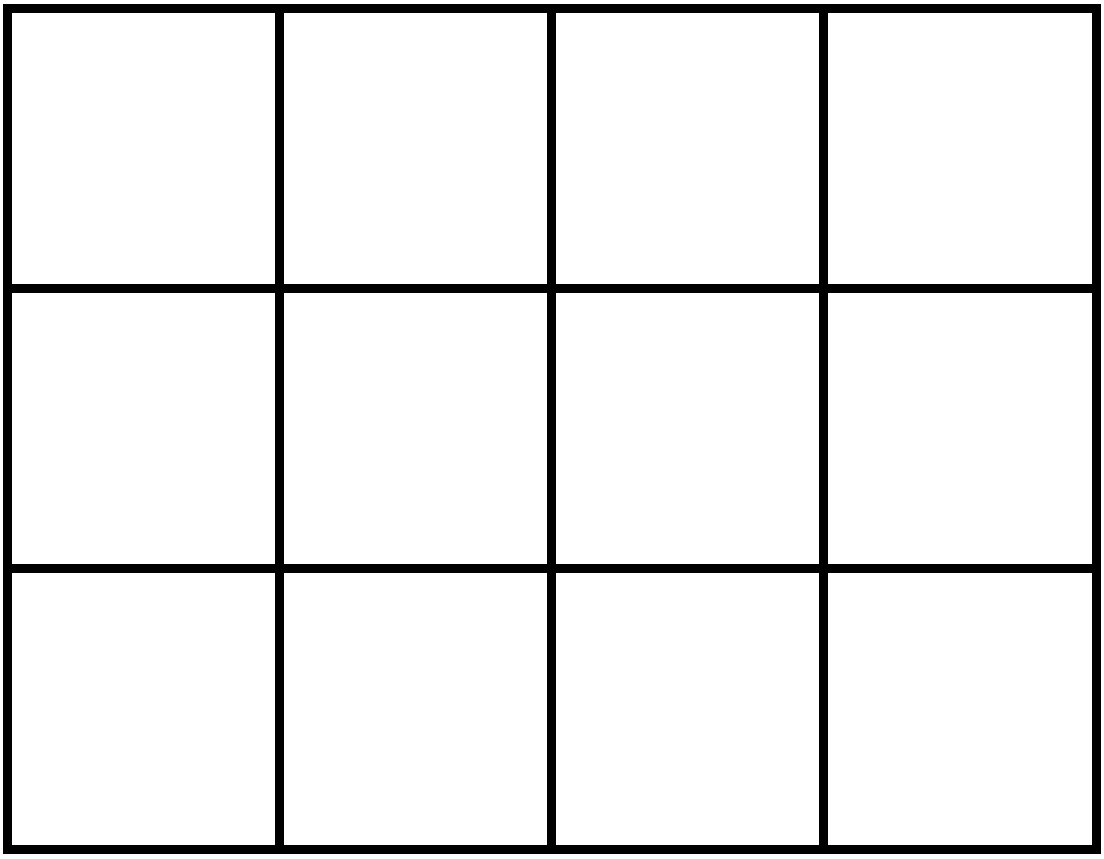






Game Board 1
(4 by 3)





Counters to cut out