

### Charlie's Delightful Machine

Stage: 3 and 4 Challenge Level:  $\star$   
You may wish to look at [Shifting Times Tables /6713](#) before trying this problem.

Charlie's Delightful Machine has four coloured lights. Each light is controlled by a rule. If you choose a number that satisfies the rule, the light will go on. Some numbers may turn on more than one light!

Start by exploring Level 1. Type in some numbers and see which lights you can switch on. To start again with a new set of rules, click the Level 1 button.

Can you develop a strategy to work out the rules controlling each light?

### Charlie's Delightful Machine

Enter some whole numbers in the box and so discover the rules which switch on each of the lights.

Pressing a level button generates a new rule

Once you have a strategy, challenge yourself to find some four-digit numbers that turn on each light.

Once you are confident that you can work out the rules for Level 1 lights, have a go at [A Little Light Thinking /7016](#), where you can explore how to turn on several lights at once.

You may also wish to explore the Level 2 and 3 lights (which use a different type of sequence) in the same way.

Level 1

Adding and subtracting 3 starting from 0 = Green.

Adding and subtracting 8 starting from 4 = Red and Blue

Adding and subtracting 7 starting from 6 = Yellow

$$\begin{aligned}
 0 &= G \\
 1 &= 0 \\
 2 &= 0 \\
 3 &= G \\
 4 &= R + B \\
 5 &= 0 \\
 6 &= G + Y \\
 7 &= 0 \\
 8 &= 0 \\
 9 &= G \\
 10 &= 0 \\
 11 &= 0 \\
 12 &= G + B + R \\
 13 &= Y \\
 14 &= 0 \\
 15 &= G \\
 16 &= 0 \\
 17 &= 0 \\
 18 &= G \\
 19 &= 0 \\
 20 &= Y + R + B \\
 21 &= G
 \end{aligned}$$

### Level 2

Yellow = All square numbers

Blue = Start on five and add 2 and increase what you add every time by 2.

Red = Start on 0 then add 2 then 4 then 6 etc.

Green = Start on 7 then add ten every time.

(VF)

An excellent start!

### Level 3

Yellow = Start on 0, add 4, add 5, add 6 etc.

Green = Multiples of 9.

Blue = Add 1 Start on 5 add 1, 3, 5, 7, 9, 11, 13 etc.

Red = Start on 0 add multiples of 4 going 4, 8, 12, 16, 20 etc.

A little light thinking.

Blue = Start on 7 add 10 every time.

Red = Start on 5 add 12 every time.

Yellow = Start on 2 add 10 every time.

Green = Start on 5 add 7 every time.

Q1. Impossible

Q2. Impossible

Q3. It's always a mixture.

Q4. Not always

Q5. On some of them.

Q6. Red and green both start on the same number

Q7. Blue and red have the same 2nd term.

Q8. Look in the rules and find a number to satisfy two rules.

Level 2

Blue = Start on 4 add 7 then 9 then 11 and so on.

Yellow = Start on 0 add 8 then 10 then 12 and so on.

Red = Start on 3 add 1 then 3 then 5 and so on.

Green = Start on 9 and add 11 every time.

Level 3

Red = Start on 9 add 18<sup>th</sup> and increase the number you're adding by 6 every time.

Blue = Start on 5 then add 2, 6, 10 and add 4 every time.

Green = Start on 9 and do the same as blue.

Yellow = Start on 6 add 7 every time.