

ISBN-10: 1-874428-70-0

ISBN-13: 978-1-874428-70-1

Sample topic from the Y9 Optymistic Guide to the National Curriculum

You have permission to print off this topic
and try it with your students.

This document contains the complete topic (p01-27) and answers (p28-30)

Teachers' notes, worksheets, Star Challenge answers, revision and assessment
for this topic can be downloaded and printed off in the
Y9 Optymistic Resource Sample document.

ENJOYMENT

The 'Maths is ...' Jugglers

Knowledge

Skills

Understanding



Optymistic

Patterns and Rules

Most students should start at the beginning of the topic. However, they should be encouraged to attempt Levels 7&8 material if they have the time.

More able students should omit the work at Level 4 and start the topic at the first section which is at Level 5.

Even able Y9 students will benefit from using the Level 5 material as a last review of these topics, before going on to the Higher Level Topics at GCSE (Levels 6-10) in Y10. All Y9 students should at least do the High Level Star Challenges at Level 5.

				§9 Multiplying out two brackets
			§8 Simultaneous equations	
		§7 Systematic equation solving		
		§6 Solving equations		
	§5 Shape patterns			
	§4 Algebra rules, OK ?			
	§3 Machines and rules			
	§2 Using letters for numbers			
§1 Rules in words				
Level 4	Level 5	Level 6	Level 7	Level 8

National Curriculum CONTENTS AND LEVELS

Worksheets are required for:

p17: *10H: Hexagon solution patterns

p21: *11H: Find the fours

p22: *12H- Equation crossnumber



THE OPTYMISTIC GUIDE

to Basics	pp 005 – 034	
Bar Charts and Beyond	pp 035 – 064	
Working with Numbers	pp 065 – 084	
Areas, Volumes and Formulae	pp 085 – 122	
Probability	pp 123 – 144	
Fractions, Decimals and Percentages	pp 145 – 168	
The Geometry of Angle and Shape	pp 169 – 206	
Patterns and Rules	SAMPLE TOPIC	pp 207 – 234
Coordinates and Graphs	pp 235 – 278	
Practical and Computational Measurement	pp 279 – 310	
Extending Algebraic Techniques (must go after Patterns & Rules)	pp 311 – 327	
ANSWERS	pp 328 – 352	

Teachers may change the order of the topics.
However, the topics in this text are in order of difficulty.

For each topic in Y9, we suggest that the date of the topic test is announced in advance. Students then do as much of the topic as they can before that date.

Most students should start at the beginning of the topic and work as far as they can through the topic. However, they should be encouraged to attempt Level 7 material if they have the time.

More able students could omit the work at Level 4 and start the topic at the first section at Level 5.

However, any student who wishes to do this should first seek their teacher's advice.

The material in each topic:

- takes 3-4 weeks to complete
- follows a logical development of mathematical ideas
- progresses up through the levels as students work through the topic
- is labelled with its levels

Each student:

- is given a set period of time to do what they can within the topic (and is given the test date)
- is told that the more they can master in each topic the better they will do in the NCTs in May
- is encouraged to take responsibility for what they do within the time allowed
- should mark their own work and seek help if there is anything that they do not understand or cannot get right.
- can earn stars by tackling the High Level Star Challenges in each topic
- does a revision sheet and assessment at the end of each topic

Each teacher:

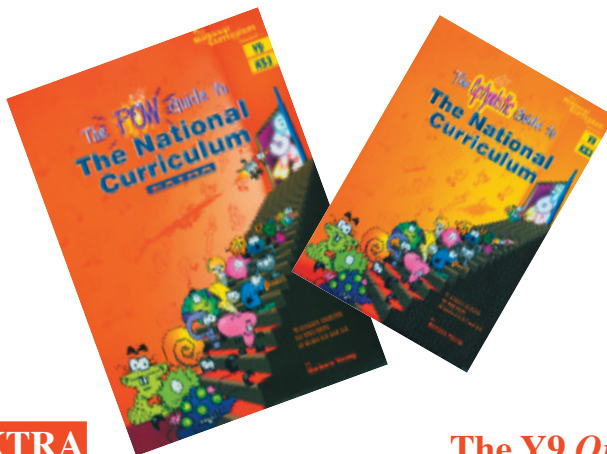
- can work through the topic in the order presented
- can reorder the material, and/or decide what is suitable for individual students using the CONTENTS and LEVELS chart which is at the front of each topic
- can incorporate material from elsewhere that has worked well for them
- **can class-teach some material but will also have time to give plenty of individual help to students**
- at the end of each topic will need about an hour to mark the assessment for each class

The two texts that give to Y9 students of all abilities:

- a totally different approach to mathematics
- motivation
- a well-deserved sense of achievement
- ENJOYMENT



Pow



Optymistic

The Y9 Pow Guide EXTRA

This A4 text delivers levels 3-6
through 9 topics

The Y9 Optymistic Guide

This A5 text delivers levels 4-8
through 11 topics

by Barbara Young

These texts were developed by Barbara in the classroom over several years, with the enthusiastic help of her students, and then trialled in a wide variety of schools.

All students, even those in the lower sets,
are extremely well motivated working with this material.

**Each topic progresses steadily up the levels
and is labelled clearly with the levels.**

- **For each topic, choose the best starting point(s) for your students.**
- **Tell them how long they will be allowed to spend on that topic.**
- **See how far they can progress up the levels in that time.**

Better students are not held back by slower classmates.

Teachers have time to spend with those who most need their help.

Watch well-motivated students fly !

Watch confidence soar !

**Order half price copies of Y9 Optymistic and Y9 Pow
using the Special Offer form
which can be downloaded
from the website
www.mathsisjugglers.co.uk**

The POW Guide **EXTRA**

An unusual approach to Mathematics for Low Attainers – that works !!

Students in our lower sets said

“We don’t want a course that only does the easy stuff (a ‘dumbo’ course).

We want to do the same work as everyone else.

So, will you please:

- make the instructions and explanations clearer
- introduce ideas more slowly and put in extra steps
- put in extra practice
- make the work interesting”

SO WE DID !



Our EXTRA texts for LOW ATTAINERS do not follow the route of so many other texts for these students.

Instead of giving them lots of easy material, we took the syllabus and delivered it in such a way that LOW ATTAINERS could understand and cope with the ideas and techniques.

We gave them what they had asked for !!

But we couldn’t have produced these texts had it not been for the active help of the students themselves. We started with the mainstream texts and students really enjoyed finding out what didn’t work for them - but, more importantly, WHY!! They quickly became expert at pinpointing where the material didn’t work for them and helping to find what would work for them.

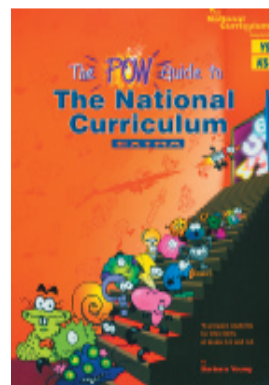
Devising ways that would work took a lot of working/trialling with LOW ATTAINERS, but we ended up with the EXTRA texts – which work exceptionally well, particularly with bottom sets, disaffected students and students at Pupil Referral Units.

This **EXTRA** course :

- has been specially developed for low attainers
- is a version of the Y9 mainstream course
- has lots of EXTRA practice on all techniques
- can be run alongside the mainstream course
- can stand on its own
- is suitable for the lower 50% of the ability range

Each student:

- takes responsibility for his/her own learning
- can decide how much practice (s)he needs to do for each technique
- can try Star Challenges when (s)he feels ready for them
- will be capable of taking the mainstream tests



ISBN-10: 1-874428-68-9

ISBN-13: 978-1-874428-68-8

The authors firmly believe that all students can tackle the material in the mainstream course.

However, some students need :

- more time to get to grips with the ideas and techniques involved
- lots of EXTRA practice
- one idea at a time introduced step-by-step
- to meet ideas and techniques over and over again

Most students in lower sets are underachieving.

This course aims to raise the level of achievement of these students.

How does the Star Challenge system work ?

The number of stars is a measure of the difficulty of the Challenge.

So, one star denotes a basic fairly easy challenge.

However, students should not be discouraged from attempting any Challenges.

For example, students may earn fewer stars from many two or three star challenges, with partially correct answers.

Students of lower ability can amaze you with what they can achieve, if they really want to tackle problems that you might think beyond them.

A true cautionary tale

Three very low ability students were working together. They had to. Mark was severely dyslexic - he could not read at all. Jason could read very well, but could make no sense of what he was reading. Matthew was very slow at everything. Between them, they could tackle problems.

Jason would read the question. Mark would explain what it was all about. Together the three of them would work out how to solve the problem.

One day they had done all the one star problems. They asked me if they could try the three star problem - The Chest of Drawers. It contained a mixture of fractions and decimals and both cm and mm. My first reaction was to tell them that it was too difficult for them - but I said they could try it, provided they accepted that they might not be able to do it.

About ten minutes later, they brought me the correct answer. I couldn't believe that they had solved such a complex problem. I changed the data (marked below in blue). They were back a few minutes later with the correct answer. Then I made a big mistake. I asked them to tell me how they had worked it out. I couldn't follow their explanation at all !!

From then on I never restricted the choice of Star Challenges of even the least able students.

Star Challenge

The chest of drawers

A chest of drawers 84 cm high has a 42.5 mm top and a 90 mm base. Four identical drawers fit in between, with 22.5 mm between each drawer.

Work out the height of each drawer in cm.

If the 22.5 mm gaps were reduced to 12.5 mm each, what would be the height of each drawer then?

84 cm

$4\frac{1}{4}$ cm

$2\frac{1}{4}$ cm

9 cm

What do schools do with the stars students earn for Star Challenges ?

One school:

- gives a house point for each star.
- has a commendation system and awards a commendation for so many stars. They also award stars for effort when the books are taken in each fortnight.
- gives a smiley face for 5 stars
- gives a Mars Bar for 10 stars
- gives a copy of one of a group of Chaos posters for 20 stars (very popular with low attainers)
-

It doesn't matter what you do. It is the sense of achievement that is most important.

However, a system that awards something for so many stars, then starts them collecting the next set of stars, means that students keep track of how many stars they have and how many more they need towards the next 'prize' – instead of (possibly invidious) comparisons of the total number of stars each student has.

Patterns and Rules

Teachers' Guide

Printing List	Pages in Book	Pack Page(s)
Star Ch 10H (Hexagon Solution Pattern)	224	44
Star Ch 11H (Find the fours)	228	45
Star Ch 12H (Equation crossnumber)	229	46

Students who will probably do NCTs at Tier 4-6 should start at Section 1. However they should be encouraged to attempt Level 7 material if they have the time.

Students who will probably do NCTs at Tiers 5-7 or 6-8 should start at [Section 2](#). These students will have the opportunity to tackle level 8 problems but will also be well grounded at Level 5.

Section 1: Rules in words

This section presents few problems. I was surprised that all the students in my bottom set could cope with two-stage rules.

Section 2: Using letters for numbers

Students who have worked on the Y8 books in this series have few problems with this material. However, if you have done little algebra with your students, then this section may need to be class taught.

Section 3: Machines and rules

Students have usually met number machines at junior school and have few problems here, provided they know that $2N$ means $2 \times N$ and $2(N+1)$ means add 1 then multiply by 2. Only very simple algebraic statements are used here.

Please stress that statements like $N \rightarrow N+1$ should be read in the form “a number becomes the number + 1” and that the arrow should be read as “becomes”.

Section 4: Algebra rules, OK?

The aim here is to get students familiar with using a wide variety of algebraic expressions – using a variety of puzzles. It also gives them practice working with negative numbers.

P3: From A to B exactly is excellent at giving practice with both algebraic expressions and negative numbers. There is an A4 version of this game at the end of this Teachers' Guide which you may photocopy. It is difficult to fit counters onto the A5 version

Star Challenge 6H is a must for able students. It explains algebraically how magic squares work.

Section 5: Shape patterns

Here students meet rules given algebraically (formulae). Even students with little algebra experience should have few problems here. They are not asked to devise the formulae – just choose which is the correct one from those given them.

Section 6: Solving equations

Before students are taught to solve equations systematically, it is essential that they understand what is meant by “the solution of an equation” or the instruction “solve the equation”.

A good introduction to this is to put a few simple equations on the board, using a variety of letters and ask them to tell you the value of each letter. Then explain that they have just solved each equation. Stress that solutions ought to be given in the form $a = \dots$.

Star Challenge 10H is very popular.

Section 7: Systematic equation solving

D1: Diagnostic testing should be used to determine where each student should start in this section – unless, of course, students have done no systematic equation solving. In this case they should start at **D2: Simple equations** and work from there.

Section 8: Simultaneous equations

D1: The elimination method, D2: When you can't just add or subtract and **D3: You'e on your own** should pose no problems to the more able students. However, they will be accessible to a wider range of abilities if class taught.

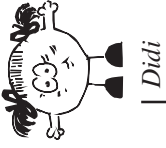
D4: The substitution method and **D5:Rearrange and substitute** are only for the the most able.

Section 9: Multiplying out brackets

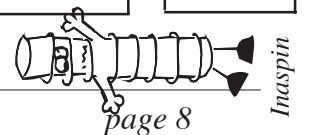
This is also initially accessible to students who would not normally tackle Level 8, but it gets difficult quickly as it is aimed at the most able students.

From A to B exactly

Section 4 – rules for this game are on page 217



$-c^2$	$x - 10$	$6 - n$	$7 + p$	$x - 8$	$1 - 2t$	$n - 3$	$x + 1$	HOME B	Move on 3 places	$m[m-3]$	$2p$
$x + 1$	$-3r$	$1 - 2y$	$4(n-2)$	$x - 2$	$f + 5$	$2(q+1)$	$s(s+1)$	$\frac{9m}{3}$	$7 - r$	$3t - 7$	$z - 2$
$2m + 1$	$\frac{a^2-16}{a+4}$	$t(6-t)$	$p - 7$	$6 + g$	Move back x places	$t - 8$	$3q$	$-3n$	$2y$	$7 + x$	$8 - s$
$k - 6$	$r + 2$	$y + 1$	$-m^2$	$\frac{x^2-9}{x-3}$	$2t + 4$	b^2-10	$n - 6$	$t + 1$	$q - 3$	$x(x-5)$	t^2-20
Move on y places	$k(k-1)$	$2s + 1$	$-2p$	$m(m+1)$	$x - 5$	n^2	$3t - 5$	m^2-20	$t(t+1)$	$\frac{4k}{2}$	$\frac{c^2-1}{c-1}$
$s - 10$	$2b$	$3 - k$	$3c$	$y + 1$	$x - 1$	$q + 7$	$2 - p$	$n - 5$	$2x + 1$	$1 - 2n$	$r + 3$
c^2	$2p + 1$	$m - 1$	$a + 4$	$b - 2$	$3n - 8$	$2d + 1$	$p - 7$	$4 + y$	Move back 3 places	$s - 3$	START A
$10 - z$	$6 - f$	x^2	$s - 1$	$e + 3$	$2r - 1$	$c - 2$	$4 - 2w$	$3n + 1$	$10 - x$	$2m$	$y + 4$



1H

All correct = 1 star

1. $25 \rightarrow 21 \rightarrow 17 \rightarrow 13 \rightarrow 9$
2. $1 \rightarrow 5 \rightarrow 25 \rightarrow 125 \rightarrow 625$
3. $6 \rightarrow 7 \rightarrow 9 \rightarrow 13 \rightarrow 21$
4. Multiply by 3
5. Double it and take away 1

2H

All correct = 1 star

- Task 3** $1 + 2n = n + n + n$ $2n + 1 = 1 + 2n$ $2 + n + 3 = n + 5$
Task 4 $2n = n + n$ $n + 2 = 2 + n$ $n + n + 1 = 2n + 1$
 $n + 3 = 3 + n$ $2(n + 1) = 2n + 2$ $3n + 1 = 2n + n + 1$

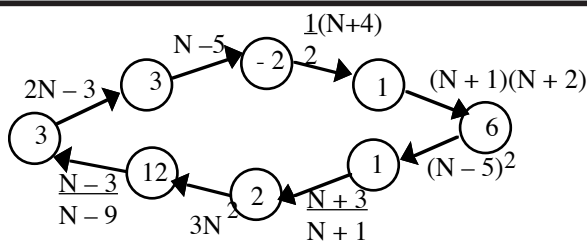
3H

All correct = 1 star

1. $S + T$ 2. $2S + T$ 3. $ST - 1$ 4. $3(S + T)$ or $3S + 3T$ 5. $\frac{T}{S} + 1$ 6. $S^2 + T$

4H

All correct = 1 star



5H 5H

All 3 correct = 2 stars
2 correct = 1 star

Wall 1

			73			
		48	25			
	27	21	4			
13	14	7	-3			
6	7	7	0	-3		
4	2	5	2	-2	-1	6

Wall 2

			29			
		22	-7			
	19	-3	4			
15	-4	-1	-5			
10	-5	-1	0	5		
-4	1	2	2	-3		

Wall 3

			173			
		211	-19			
	133	39	-29			
51	41	-1	-14			
13	19	11	-6	-4		
3	5	7	2	-4	0	

6H 6H

12-13 correct = 2 stars 10-11 correct = 1 star

1.

5	6	10
12	7	2
4	8	9

9	16
---	----

6	15
10	4
14	11

6	13	5
7	8	9
11	3	10

 Magic sum = 24
2. Magic sum = 3 x middle number 3. $m - 4$ 4. $m + 2$
5.

m	$m+1$	$m-1$
$m-1$	m	$m+1$
$m+1$	$m-1$	m

 6.

$m-2$	$m+1$	$m+1$
$m+3$	m	$m-3$
$m-1$	$m-1$	$m+2$

 7.

$m-1$	$m-2$	$m+3$
$m+4$	m	$m-4$
$m-3$	$m+2$	$m+1$
8.

$m-4$	$m+7$	$m-3$
$m+1$	m	$m-1$
$m+3$	$m-7$	$m+4$

 9.

m	$m-2$	$m-1$
$m-2$	$m-1$	m
$m-1$	m	$m-2$

 10.

$m+1$	$m+1$	$m+4$
$m+5$	$m+2$	$m-1$
m	$m+3$	$m+3$
11.

$m-p$	m	$m+p$
$m+2p$	m	$m-2p$
$m-p$	m	$m+p$

 12.

$m+2n$	$m-3n$	$m+n$
$m-n$	m	$m+n$
$m-n$	$m+3n$	$m-2n$

 13.

$m+q$	$m+p-q$	$m-p$
$m-p-q$	m	$m+p+q$
$m+p$	$m-p+q$	$m-q$

3 totally correct = 2 stars
2 totally correct = 1 star

7H

For each of the two number patterns, students are asked to:

- copy the first three shapes and write the number of dots underneath
- draw shape 4 and its number of dots
- predict the number of dots in shape 5. Explain why they think it is that number.
- draw shape 5 to test the prediction
- write down the sixth and seventh numbers in the sequence

T	Pentagonal numbers	1	5	9	13	17	21	25
U	hexagonal numbers	1	6	15	28	45	66	91
W	next three numbers are	40	65	96				

8H 8H

14-15 marks = 2 stars
12-13 marks = 1 star

1.

2	3	5	7	(3 marks)	2. 3	2	5	1	(3 marks)
5	8	12	9		6	10	5	3	
13	20	21	14		60	50	15	18	
33	41	35	27		3000	750	270	1080	
74	76	62	60						
3. (a) $c = a + 2b$

136	137	98	89	107
410	333	276	303	379

 (3 marks)
4. 34 37 47 49 33 (2 marks)
5. (a) B+B = W, W + W = W, B + W = B (2 marks) (b) B B B W B (2 marks)

9H

All correct = 1 star

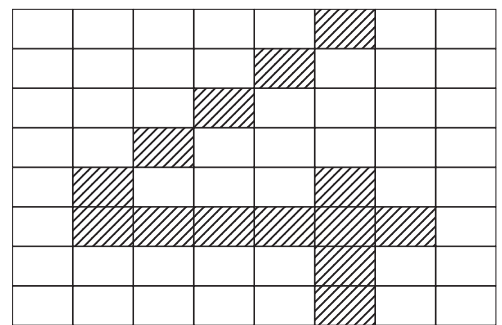
- 6 and 6 reversed placed back to back 7 and 7 reversed placed back to back
S S (first letters of six and seven)
3 5 (numbers of letters in the words for six and seven)
VI VII (Roman numerals for six and seven)

10H

All correct = 1 star

11H

All correct = 1 star



Patterns and Rules

Star Challenge Answers



41-42 squares correct = 2 stars
38-40 squares correct = 1 star

¹ 1	² 2	0		³ 1	3		⁴ 1
	1		⁵ 1	4		⁶ 3	0
⁷ 2		⁸ 2	2		⁹ 1	2	4
¹⁰ 1	5		¹¹ 1	¹² 3	1		
0		¹³ 7		2		¹⁴ 2	¹⁵ 3
	¹⁶ 6	2	¹⁷ 5		¹⁸ 3		1
¹⁹ 1	4		²⁰ 1	3		²¹ 5	
7		²² 9			²³ 1	0	0

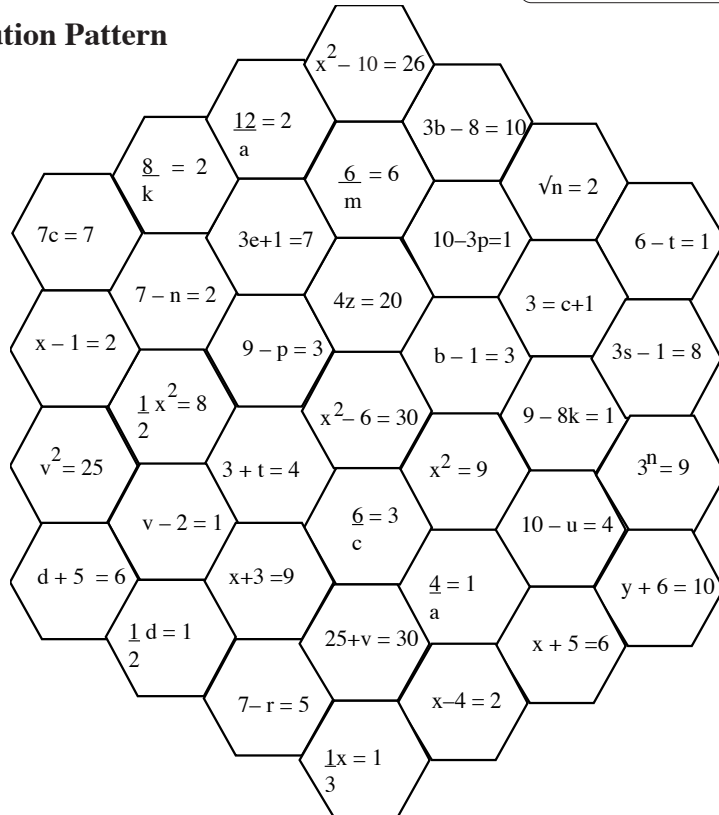


- $3p^2 + 7p + 2$
- $2a^2 + 5a - 25$
- $12u^2 - 4uv - v^2$
- $-2n^2 - 9n + 33$
- $x^2 - 1$
- $6t^2 + 5t - 6$
- $x^2 - 2xy + y^2$
- $n^2 + 18n + 81$
- $16p^2 + 40p + 25$
- $x^2 - 10x + 25$
- $3m^2 + m - 2$
- $15e^2 + 2e - 1$
- $x^2 - 10x + 25$
- $r^2 + 14r + 49$
- $4v^2 - 4vt + t^2$

Hexagon Solution Pattern

Solution – colour key

Solution	Colour
1	Red
2	Blue
3	Green
4	Orange
5	Yellow
6	Purple



Solve each equation.

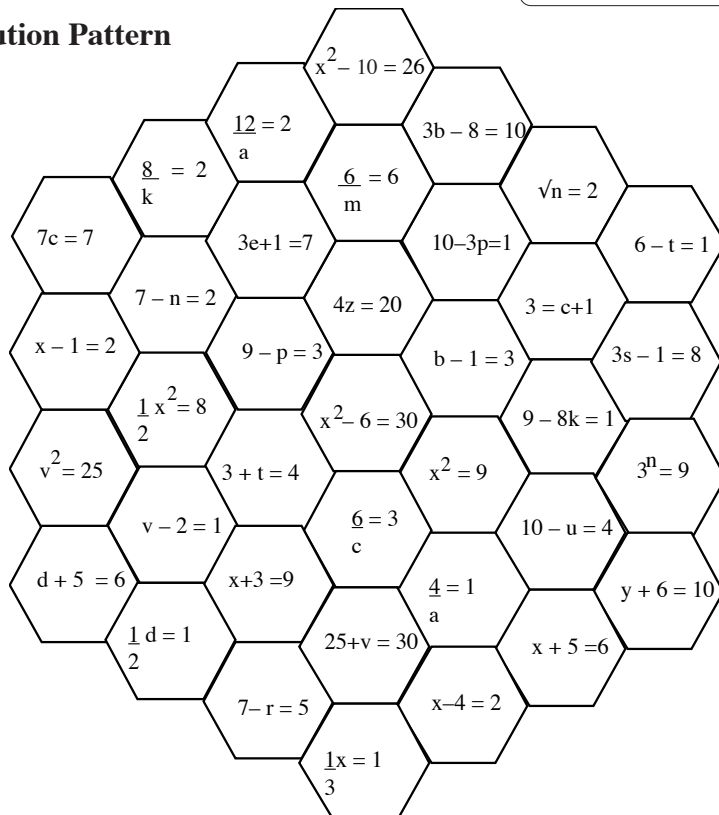
Colour each rectangle with the solution colour.

WORKSHEET MASTER FOR “PATTERNS AND RULES”

Hexagon Solution Pattern

Solution – colour key

Solution	Colour
1	Red
2	Blue
3	Green
4	Orange
5	Yellow
6	Purple



Solve each equation.

Colour each rectangle with the solution colour.

Star Challenge

All correct = 1 star

$z-2 = \frac{1}{2}z+1$	$12-2x=2$	$3r-4=2$	$\frac{x+3}{3}=3$	$7c-4=3$	$\sqrt{n}=2$	$x^2-5=20$	$\frac{y}{2}=1$
$m-2=1$	$2(3e+1)=14$	$\frac{6}{m+1}=3$	$3(6-t)=3$	$\frac{n+6}{2}=5$	$x^2-x=30$	$3+c=2c+1$	$\frac{d+5}{2}=3$
$(n+1)^2=4$	$15-2p=3$	$7-2r=3$	$\frac{4}{a}+4=5$	$\frac{1(x-4)}{2}=1$	$x^2-7=2$	$\frac{6}{c}=2$	$p-3=4$
$v^2=25$	$\frac{1x+2}{3}=3$	$3b-3=9$	$\frac{x+5}{2}=3$	$\frac{1(3s-1)}{2}=4$	$4z-5=15$	$2n-1=1$	$5c+2=14$
$\frac{q+4}{2}=5$	$\frac{1x^2}{2}=8$	$3^n=9$	$\frac{45-40k}{5}=5$	$\frac{1(10+u)}{2}=2$	$2m-1=7$	$\frac{1d+2}{2}=3$	$a+4=9$
$10-3p=1$	$\frac{12}{a}-1=2$	$17-3m=5$	$\frac{8}{k-2}=4$	$n^2=4n$	$12-q=8$	$\frac{48}{t}=12$	$3(t+1)=9$
$5p-6=4$	$3+5t=4(t+1)$	$5y+10=5$	$\frac{25+v}{5}=6$	$3b-8=10$	$\frac{11+a}{3}=5$	$\frac{10}{x-1}=5$	$3v-1=2v$
$\frac{24}{t+1}=3$	$17-3m=2$	$7-h=1$	$2p+1=3p$	$\frac{15}{w}=5$	$3p-5=7$	$12-5p=2$	$5(t-5)=5$

Fourteen of these equations have a solution equal to 4.

Find which equations they are.

Shade in the squares for these equations. • *Your teacher has the answer to this.*

WORKSHEET MASTER FOR "PATTERNS AND RULES"

Star Challenge

All correct = 1 star

$z-2 = \frac{1}{2}z+1$	$12-2x=2$	$3r-4=2$	$\frac{x+3}{3}=3$	$7c-4=3$	$\sqrt{n}=2$	$x^2-5=20$	$\frac{y}{2}=1$
$m-2=1$	$2(3e+1)=14$	$\frac{6}{m+1}=3$	$3(6-t)=3$	$\frac{n+6}{2}=5$	$x^2-x=30$	$3+c=2c+1$	$\frac{d+5}{2}=3$
$(n+1)^2=4$	$15-2p=3$	$7-2r=3$	$\frac{4}{a}+4=5$	$\frac{1(x-4)}{2}=1$	$x^2-7=2$	$\frac{6}{c}=2$	$p-3=4$
$v^2=25$	$\frac{1x+2}{3}=3$	$3b-3=9$	$\frac{x+5}{2}=3$	$\frac{1(3s-1)}{2}=4$	$4z-5=15$	$2n-1=1$	$5c+2=14$
$\frac{q+4}{2}=5$	$\frac{1x^2}{2}=8$	$3^n=9$	$\frac{45-40k}{5}=5$	$\frac{1(10+u)}{2}=2$	$2m-1=7$	$\frac{1d+2}{2}=3$	$a+4=9$
$10-3p=1$	$\frac{12}{a}-1=2$	$17-3m=5$	$\frac{8}{k-2}=4$	$n^2=4n$	$12-q=8$	$\frac{48}{t}=12$	$3(t+1)=9$
$5p-6=4$	$3+5t=4(t+1)$	$5y+10=5$	$\frac{25+v}{5}=6$	$3b-8=10$	$\frac{11+a}{3}=5$	$\frac{10}{x-1}=5$	$3v-1=2v$
$\frac{24}{t+1}=3$	$17-3m=2$	$7-h=1$	$2p+1=3p$	$\frac{15}{w}=5$	$3p-5=7$	$12-5p=2$	$5(t-5)=5$

Fourteen of these equations have a solution equal to 4.

Find which equations they are.

Shade in the squares for these equations. • *Your teacher has the answer to this.*

High Level Equation Crossnumber

Across

1. $\frac{x}{5} - 20 = 5$
3. $2(n - 3) = 20$
5. $\frac{1}{3}a + 2 = 9$
6. $2(y - 11) = y + 9$
8. $\frac{x}{5} = 4$
9. $2(250 - t) = 38$
10. $\frac{1}{3}v + 2 = 11$
11. $3n - 102 = 2(n + 6)$
14. $3p - 16 = 2p - 4$
16. $\frac{1}{10}(m - 45) = 20$
18. $2(5x - 3) = 3(2x + 6)$
19. $\frac{n+3}{3} = 7$
20. $\frac{1}{4}(v - 6) = 5$
22. $2(v + 3) = v + 13$
23. $\frac{x}{25} = 9$

1	2			3			4
			5			6	
7		8			9		
10			11	12			
		13				14	15
	16		17		18		
19			20			21	
		22			23		

Down

2. $3(m + 2) = 75$
3. $\frac{1}{2}(p + 5) = 8$
4. $\frac{3e + 9}{3} = 114$
5. $\frac{1}{3}t - 7 = 60$
6. $2m - 6 = 3(m - 13)$
7. $\frac{1}{4}x - 10 = 20$
9. $50 - 2x = 2$
12. $4h - 4 = 40$
13. $\frac{1}{2}e - 2 = 5$
15. $\frac{n + 2}{5} = 5$
16. $\frac{1}{4}u + 3 = 10$
17. $3(60 - v) = v - 28$
19. $2p + 3 = p + 19$
21. $\frac{1}{2}m - 15 = 1$

Take a double spread in your book.

Stick this worksheet on the left hand page.

Show all working out on the right hand page.

- Check your answers.

WORKSHEET MASTER FOR "PATTERNS AND RULES"

Patterns and Rules

REVISION

Name: Write the answers on this sheet.

LEVEL 4

1. Complete these chains and rules:

- (a) 7 → → → → →
 (b) 3 → → → → →
 (c) 5 → 10 → 20 → 40 → 80 →

Chain

Rule

Take away 2

Double and take away 1

2. Find the rule, in words, for each table:


Number of packets	Number of sweets
1	12
2	24
3	36

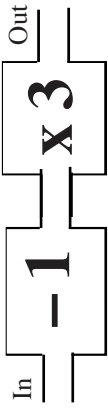
Rule :

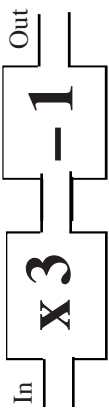
Number of Δ s	no. of matches
Δ	3
$\Delta\Delta$	6
$\Delta\Delta\Delta$	9

Rule :

3. Complete the table for each machine:

- (a) 

In	2	3	5
Out			
- (b) 

In	3	4	1
Middle			
Out			
- (c) 

In	3	4	0
Middle			
Out			

LEVEL 5

4. There are three pairs of matching expressions here. Find them.


$n + n$	$n + n + 3$	$2n$	$2n + 3$	$n + n - 1$	$2n - 1$
---------	-------------	------	----------	-------------	----------

.....&.....&.....&.....&.....&.....

5. Write down the rule for each machine in terms of n :

(a)  Rule :




(b)  Rule :

6.  Rule :

One of these rules describes this machine. Put a loop round the correct rule.

$b = (a - 3) \times 5$ $b = 3a - 5$ $b = 5a - 3$

7.

Number of triangles (T)	Number of matches (M)
	3
	5
	7

Which formula describes the data in this table ?
Put a loop round the correct formula.

$M = 2T + 1$ $M = 3T - 1$ $M = 3T$
 $T = 2M + 1$ $T = 3M - 1$ $T = 3M$

Section 5

LEVEL 6



Shape 1 Shape 2 Shape 3 Shape 4

(a) Draw shape 4.

(b) Complete the table :

Shape number	1	2	3	4	5	6
Matchsticks	3	7				

(c) Explain how you find the number of matchsticks for the next shape in the pattern, without drawing the shape.....

Section 7

9. Solve each equation. Show all your working.

(a) $2p + 5 = 17$

(b) $3(2n - 1) = 21$

(c) $8f - 26 = 3(3 + f)$

Section 9

LEVEL 8

11. Multiply out:

(a) $(a + 3)(2a - 1)$

(b) $(2x - y)^2$

ANSWERS

- (a) $7 \rightarrow 5 \rightarrow 3 \rightarrow 1 \rightarrow -1$
 (b) $3 \rightarrow 5 \rightarrow 9 \rightarrow 17 \rightarrow 33$
 (c) halve the number or divide by 2

- (a) number of sweets = 12 x number of packets
 (b) number of matches = 3 x number of Δ s

3. (a) Out	4	6	10
(b) Middle	2	3	0
Out	6	9	0
(c) Middle	9	12	0
Out	8	11	-1

- $n + n + 2n$ $n + n + 3 + 2n + 3$ $n + n + 1 + 2n + 1$
- (a) Rule : $(n - 2) \times 3$ or $3 \times (n - 2)$ (b) $3n - 2$

6. $b = 5a - 3$

7. $M = 2T + 1$



- (a) Matchsticks 3 7 11 15 19 23

(c) add 4 to the previous number

- (a) $2p + 5 = 17$ (b) $3(2n - 1) = 21$ (c) $8f - 26 = 3(3 + f)$
 $2p = 12$ $6n - 3 = 21$ $8f - 26 = 9 + 3f$
 $p = 6$ $6n = 24$ $5f = 315$
 $n = 4$ $f = 7$

- (a) $m = 3, n = 1/2$ (b) $a = 7, b = 5$

- (a) $2a^2 + 5a - 3$ (b) $4x^2 + y^2 - 4xy$

Section 8

LEVEL 7

10. Solve these pairs of simultaneous equations. Show your working.

(a) Use the elimination method:
 $5m + 2n = 16$
 $7m - 4n = 19$

(b) Use the substitution method:
 $3b + 2a = 29$
 $a = 2b - 3$

Patterns and Rules

Intermediate (Levels 4-6)

Higher (Levels 4-8)

%

%

ASSESSMENT

Name: Write the answers on this sheet.

LEVEL 4

1. Complete each chain:

Chain

- (a) $3 \rightarrow \dots \rightarrow \dots \rightarrow \dots \rightarrow \dots \rightarrow \dots$
 (b) $32 \rightarrow \dots \rightarrow \dots \rightarrow \dots \rightarrow \dots \rightarrow \dots$
 (c) $2 \rightarrow \dots \rightarrow \dots \rightarrow \dots \rightarrow \dots \rightarrow \dots$

2. Find the rule for each chain:

- (a) $4 \rightarrow 8 \rightarrow 16 \rightarrow 32 \rightarrow 64$
 (b) $25 \rightarrow 22 \rightarrow 19 \rightarrow 16 \rightarrow 13$
 (c) $3 \rightarrow 5 \rightarrow 7 \rightarrow 9 \rightarrow 11$

3. Find the rule in words for this table:

number of lines in square	number of Δ s
	2
	4
	8

Rule

.....

4. Complete these tables and number machines:

Rule in words

Add 3

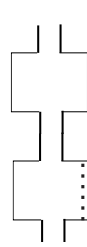
Number machine

In	1	3	5	6
Out				

Double & add 3



Multiply by 3 and take away 1



Rule

Add 5

Divide by 2

Multiply by 2 and take away 1

.....

3 marks

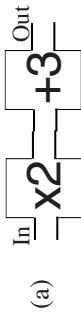
6 marks

6 marks

LEVEL 5

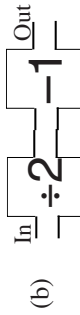
5. Write down the rule for each machine in terms of n :

4 marks



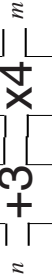
Rule

.....



Rule

.....



2 marks

One of these rules describes this machine. Put a loop around the correct rule.

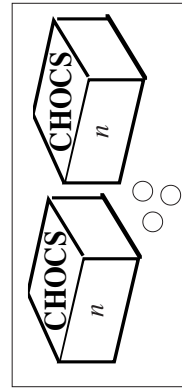
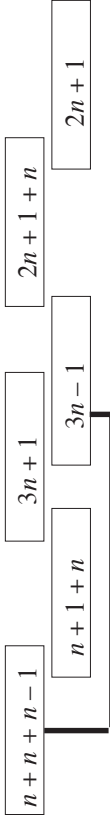
- $m = (n + 3) \times 4$ $m = 4n + 3$ $m = 3n + 4$

7. There are three pairs of matching expressions here.

Link each pair with a line. One has been done for you.

Link the other two pairs.

4 marks



8. Two of these expressions are correct for the total number of chocolates.

4 marks

- $2n + 3$ $n + 3$ $3 + n + n$
 $n^2 + 3$ $3n + 2$

Put loops around the two correct expressions.

9. Which formula describes the data in this table?

Shape number (N)	Number of squares (S)
1	4
2	7
3	10

$N = 3S + 1$

$S = 3N + 1$





$S = 2N$

$N = 2S$

2 marks

Put a loop around the correct formula.

LEVEL 6

10.     Shape 4
- (a) Draw shape 4. 1 mark

(b) Complete the table :

Shape number	1	2	3	4	5	6
Distance round shape	4	6				

4 marks

- (c) Explain how you work out the distance round the shape for the next shape in the pattern, without drawing the shape. 2 marks
-
-

11. Solve each equation. Show all your working.

(a) $5n + 1 = 26$	(c) $2(3m + 7) = 24 + 4m$
(b) $5(2a - 3) = 75$	

9 marks : 1 for each correct answer and 2 for each correct set of working

Mark for levels 4-6 (Intermediate Mark) / 58

LEVEL 7

12. Solve these pairs of simultaneous equations. Show all working.

(a) Use the elimination method.
 $3a + 5b = 31$
 $3a - 2b = 17$

(b) Use the substitution method.
 $5q + 2p = 29$
 $p = 2q + 1$

- (c) Use any method.
 $m + n = 19$
 $3m - 2n = 17$

12 marks : 2 for each pair of correct answers and 2 for each correct set of working

LEVEL 8

13. Multiply out:

- (a) $(2n + 3)(3n + 5) = \dots\dots\dots$
- (b) $(3a - 1)(2 + 3a) = \dots\dots\dots$
- (c) $(4t + 3s)^2 = \dots\dots\dots$

9 marks

Mark for levels 4-8 (Higher Mark) / 79

Patterns and Rules

ASSESSMENT ANSWERS

Intermediate (Levels 4-6) %
Higher (Levels 4-8) %

Write the answers on this sheet.

LEVEL 4

1. Complete each chain:

Chain

- (a) $3 \rightarrow \dots 8 \rightarrow \dots 13 \rightarrow \dots 18 \rightarrow \dots 23$
 (b) $32 \rightarrow \dots 16 \rightarrow \dots 8 \rightarrow \dots 4 \rightarrow \dots 2$
 (c) $2 \rightarrow \dots 3 \rightarrow \dots 5 \rightarrow \dots 9 \rightarrow \dots 17$

2. Find the rule for each chain:

- (a) $4 \rightarrow 8 \rightarrow 16 \rightarrow 32 \rightarrow 64$
 (b) $25 \rightarrow 22 \rightarrow 19 \rightarrow 16 \rightarrow 13$
 (c) $3 \rightarrow 5 \rightarrow 7 \rightarrow 9 \rightarrow 11$

3. Find the rule in words for this table:

number of lines in square	number of Δ s	Rule
<input checked="" type="checkbox"/>	2	...number of Δ s
<input checked="" type="checkbox"/>	4	...= 2 x number of lines
<input checked="" type="checkbox"/>	8

4. Complete these tables and number machines:

Rule in words

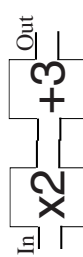
Add 3



2 marks

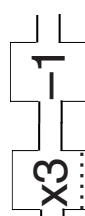
Number machine

Double & add 3



4 marks

Multiply by 3 and take away 1



5 marks

6 marks

Rule

- Add 5
Divide by 2
Multiply by 2 and take away 1

6 marks

- ...Multiply by 2...
 ...Take away 3...
 ...Add 2....

3 marks

- ...number of Δ s
 ...= 2 x number of lines

Table

In	1	3	5	6
Out	4	6	8	9

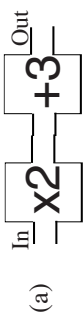
In	1	2	3	5
Middle	2	4	6	10
Out	5	7	9	13

In	2	3	4	10
Middle	6	9	12	30
Out	5	8	11	29

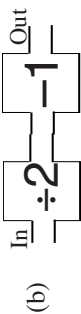
LEVEL 5

5. Write down the rule for each machine in terms of n :

4 marks



Rule ... $2n + 3$



Rule ... $\frac{1}{2}n - 1$



2 marks

One of these rules describes this machine. Put a loop round the correct rule.

$m = (n + 3) \times 4$

$m = 4n + 3$

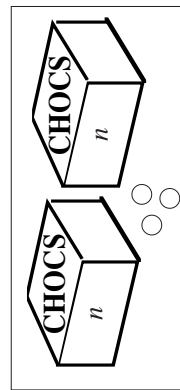
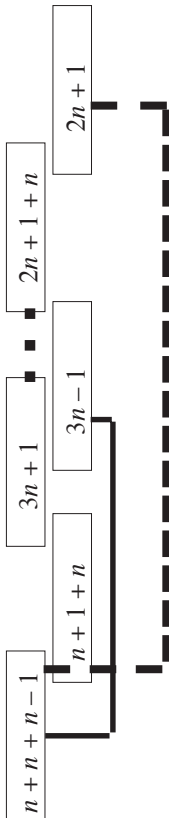
$m = 3n + 4$

7. There are three pairs of matching expressions here.

Link each pair with a line. One has been done for you.

Link the other two pairs.

4 marks



8. Two of these expressions are correct for the total number of chocolates.

4 marks

$2n + 3$

$n + 3$

$3 + n + n$

$n^2 + 3$

$3n + 2$

Put loops around the two correct expressions.

9. Which formula describes the data in this table?

Shape number (N)	Number of squares (S)
1	4
2	7
3	10

2 marks





$N = 3S + 1$

$S = 2N$

$S = 3N + 1$

$N = 2S$

LEVEL 6

10.  Shape 1  Shape 2  Shape 3  Shape 4

(a) Draw shape 4. 1 mark

(b) Complete the table: 4 marks

Shape number	1	2	3	4	5	6
Distance round shape	4	6	8	10	12	14

(c) Explain how you work out the distance round the shape for the next shape in the pattern, without drawing the shape. 2 marks

.....**...add 2 to the previous number...**.....

.....

11. Solve each equation. Show all your working.

(a) $5n + 1 = 26$
 $5n = 25$
 $n = 5$

(b) $5(2a - 3) = 75$
 $10a + 15 = 75$
 $10a = 60$
 $a = 6$

(c) $2(3m + 7) = 24 + 4m$
 $6m + 14 = 24 + 4m$
 $2m + 14 = 24$
 $2m = 10$
 $m = 5$

9 marks : 1 for each correct answer and 2 for each correct set of working

Mark for levels 4-6 (Intermediate Mark) / 58

LEVEL 7

12. Solve these pairs of simultaneous equations. Show all working.

(a) Use the elimination method.
 $3a + 5b = 31$
 $3a - 2b = 17$

$a = 7 \quad b = 21$

(b) Use the substitution method.
 $5q + 2p = 29$
 $p = 2q + 1$

$p = 7 \quad q = 3$

(c) Use any method.
 $m + n = 19$
 $3m - 2n = 17$

$m = 11 \quad n = 8$

12 marks : 2 for each pair of correct answers and 2 for each correct set of working

LEVEL 8

13. Multiply out: 9 marks

(a) $(2n + 3)(3n + 5) = \dots\dots 6n^2 + 19n + 15 \dots\dots$

(b) $(3a - 1)(2 + 3a) = \dots\dots 9a^2 + 3a - 2 \dots\dots$

(c) $(4t + 3s)^2 = \dots\dots 16t^2 + 9s^2 + 24st \dots\dots$

Mark for levels 4-8 (Higher Mark) / 79

Y9 Patterns and Rules

Date Name

I can do the following:

LEVEL 4

- Q1 use rules to make chains of numbers
- Q2 find rules for chains of numbers
- Q3 find rules in words
- Q4 work with number machines

LEVEL 5

- Q5 write rules for number machines in terms of n
- Q6 recognise rules given in algebraic form
- Q7-8 match algebraic expressions
- Q9 choose the correct formula for a data table

LEVEL 6

- Q10 look for and explain patterns in shapes and tables
- Q11 solve simple equations systematically

LEVEL 7

- Q12 solve pairs of simultaneous equations

LEVEL 8

- Q13 multiply out pairs of brackets

I would like more practice on

Pupil's comment (optional).....

Teacher's comment (optional)

Assessment

Parent's comment (optional)

Signature of teacherSignature of parent.....

Y9 Patterns and Rules

Date Name

I can do the following:

LEVEL 4

- Q1 use rules to make chains of numbers
- Q2 find rules for chains of numbers
- Q3 find rules in words
- Q4 work with number machines

LEVEL 5

- Q5 write rules for number machines in terms of n
- Q6 recognise rules given in algebraic form
- Q7-8 match algebraic expressions
- Q9 choose the correct formula for a data table

LEVEL 6

- Q10 look for and explain patterns in shapes and tables
- Q11 solve simple equations systematically

LEVEL 7

- Q12 solve pairs of simultaneous equations

LEVEL 8

- Q13 multiply out pairs of brackets

I would like more practice on

Pupil's comment (optional).....

Teacher's comment (optional)

Assessment

Parent's comment (optional)

Signature of teacherSignature of parent.....