Crystal Maze
Maths Event

KS3—Curriculum based maths workshop

Crystal Maze Maths Event

KS3 – Curriculum based maths workshop

Synopsis

The Crystal Maze Maths Event is a curriculum based maths workshop for year 9 students. It is designed to be run in a normal classroom lesson and can be used as a revision workshop. The event touches on the four different sections of the curriculum recommended for year 9 students: Number; Algebra; Shape, Space and Measures; and Handling Data. There are 5 different workstations to the event: Number countdown; Algebra Snakes and Ladders; Desert Island Rescue; Correlation Challenge; and Crystal Maze. Overall, the Crystal Maze Maths Event provides a hands-on, fun revision session tailored to the Y9 maths curriculum, which is outside that of normal classroom techniques.

Crystal Maze—Maths Event

KS3—Curriculum based maths workshop

Teacher Guide

Introduction

The Crystal Maze—Maths Special is an interactive event designed around the KS3 maths curriculum. There are 4 individual stations in which the students are asked to complete a group task. Once that task is completed the students will move onto the next station.

The 4 stations are:

1. Number Countdown: Much like the format of the TV show, students are asked to work in a group to make the sum of a random number given to them. Working in groups, and with the aid of a calculator, the students get the chance to practise their number skills.
2. Algebra Snakes and Ladders: The traditional board game with a twist. The students roll the dice to determine which space they land on. However, once on that space they have to work out the sum of an equation to determine whether they stay on that space, or move either forwards or backwards.
3. Desert Island Rescue: The group are introduced to a scenario in which they have crashed on a desert island. To get rescued they have to navigate themselves, using a series of co-ordinates, angles and bearings, to the opposite end of the island, making sure they dodge the islands hazardous areas.
4. Correlation Challenge: Students measure the height and arm span of their group and record the data. They are then asked to complete a series of tables and graphs. Finally, they are given a question sheet which they have to answer using the graphs and tables they have just produced.

After completing the interactive event, the students have to fill in a question sheet which, once again, is linked to the KS3 curriculum. They can do this in their groups or individually, whichever you prefer. This should give some helpful revision and reflection on the events they have just undertaken.

On completion of the 4 stations, students should stay in their groups to build a geodesic dome or kaleidocycle. This activity is hands on, allowing the students to understand how shapes can be used to construct a structure.

> Build Crystal Maze/Kaleidocycle: Students are given a set of instructions to follow, which will result in them building a geodesic dome or moving kaleidocycle. The dome uses triangles to form a structure built using pentagons and hexagons. After completion the group must answer a series of questions.

The overall aim of the event is to give the students a chance to work in interactive groups and further practise all areas of the curriculum in a fun surrounding. All of the information and worksheets needed to run this event can be found in this booklet.

Curriculum fit

All of the five stations are designed to cover aspects of the KS3 curriculum. Below is an outline of the aspects of the curriculum the stations cover.

Number countdown:

Areas of the curriculum covered:

- Working with numbers
- Fractions
- Percentages
- Equivalents and using a calculator

Algebra Snakes and Ladders:

Areas of the curriculum covered:

- Solving Linear equations (Simple and with Brackets)
- Using equations to solve problems
- Common number patterns

Desert Island Rescue:

Areas of curriculum covered:

- Loci and coordinates
- Angles
- Bearing and scale diagrams

Correlation Challenge:

Areas of curriculum covered:

- Averages
- Scatter diagrams
- Collecting data
- Representing information

Build Crystal Maze/Kaleidocycle:

Areas of curriculum covered:

- Shapes
- Area and perimeter of 2D shapes
- Volume of 3D shapes

Activity timeline

The table below states a suggested timetable for the whole event.

Note: The first 4 workstations should all be started at the same time. The one group with no station to work on should read and discuss the instructions to Build Crystal Maze/Kaleidocycle and cut out templates ready to use.

Time Required	Task	Teachers instructions	Resources required
5 minutes	Introduction	Split the class into groups then hand out the introduction sheet. Explain the concept of the event.	Crystal Maze Maths Event Introduction sheet
50 minutes (10 minutes at each workstation)	Individual workstations	Ensure that the students rotate and complete all the workstations	All the worksheets for the individual stations. All the resources and templates listed on pages 12-32
5 minutes	Round up and introduce to building the Crystal Maze task	Handout the resources or template if making the paper one.	Templates found in the templates section.
20 minutes	Build Crystal Maze/Kaleidocycle	Supervise the class, ensuring the understand the instructions	The building crystal maze instruction sheets
10 minutes	Round up the session	Allow the students to examine each other's domes.	None

Worksheet outline

The table below indicates how the worksheets are tailored to encourage learning outcomes specific to the curriculum, guided by http://curriculum.qca.org.uk/

For an explanation of the codes, see *References* at the back of the booklet or visit the website cited above.

Worksheet	Learning outcomes
Number Countdown	1.1 a,b,c; 1.2 a,b,c; 1.3 a,b,c 2.1 a,b,c,d 2.2 a,b,c,g,h,I,j,l,m,o,p 2.3 f,g 2.4 a,b,c
Algebra Snakes and Ladders	1.1 a,b,c; 1.2 a,b,c; 1.3 a,b,c 2.1 a,b,c,d 2.2 a,b,c,g,h,I,j,l,m,n,o,p 2.4 a,b,c 3.1 a,b,c,d,e,f,g,h
Desert Island Rescue	1.1 a,b,c; 1.2 a,b,c; 1.3 a,b,c 1.4 a,b,c 2.1 a,b,c,d 2.2 a,b,c,g,h,I,j,k,l,m,n,o,p 2.3 a,b,f,g 2.4 a,b,c,d,e 3.2 a,b,c,d,e,f,g,h
Correlation Challenge	1.1 a,b,c; 1.2 a,b,c; 1.3 a,b,c 1.4 a,b,c 2.1 a,b,c,d 2.2 a,b,c,d,e,f,g,h,I,j,k,l,m,n,o,p 2.3 a,b,c,d,e,f,g 2.4 a,b,c 3.3 a,b,c,d
Build Crystal Maze/Kaleidocycle	1.1 a,b,c; 1.2 a,b,c; 1.3 a,b,c 1.4 a,b,c 2.2 a,b,c,d,g,h,I,p 2.4 a,b,c,d,e 3.2 a,b,e,f,g,h

Resources

To run all of the workshops please ensure that you have all of the resources listed below.

Workstation	Worksheet required	Templates required	Extra resources required
Number Countdown	Yes	Number Cards Question sheets	Calculator Pencils/Pens A4 paper
Algebra Snakes and Ladders	Yes	Board Game Question sheets	Counters Dice Pencils/Pens A4 paper
Desert Island Rescue	Yes	Desert Island Question sheets	Pencils/Pens Compass Protractor Ruler
Correlation Challenge	Yes	None Question sheets	Pencils/Pens Tape Measure Graph Paper Ruler
Crystal Maze/Kaleidocycle	Yes	Paper cut outs Question sheets	Sticky Tape/ glue Scissors

Templates and Answer sheets

Number Countdown Templates and Answer sheet

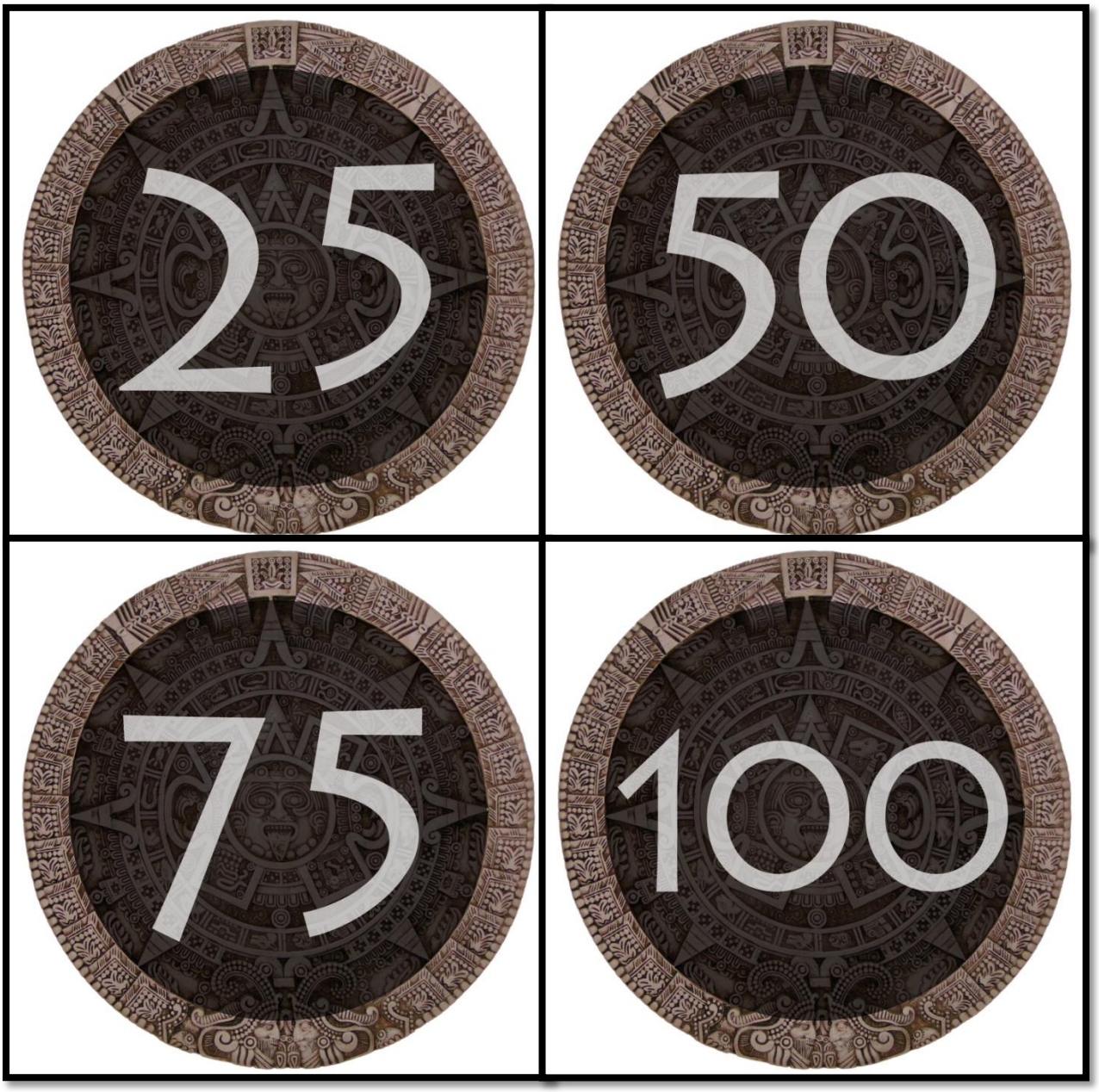
For this workstation photocopy the following:

- X1 Large number templates.

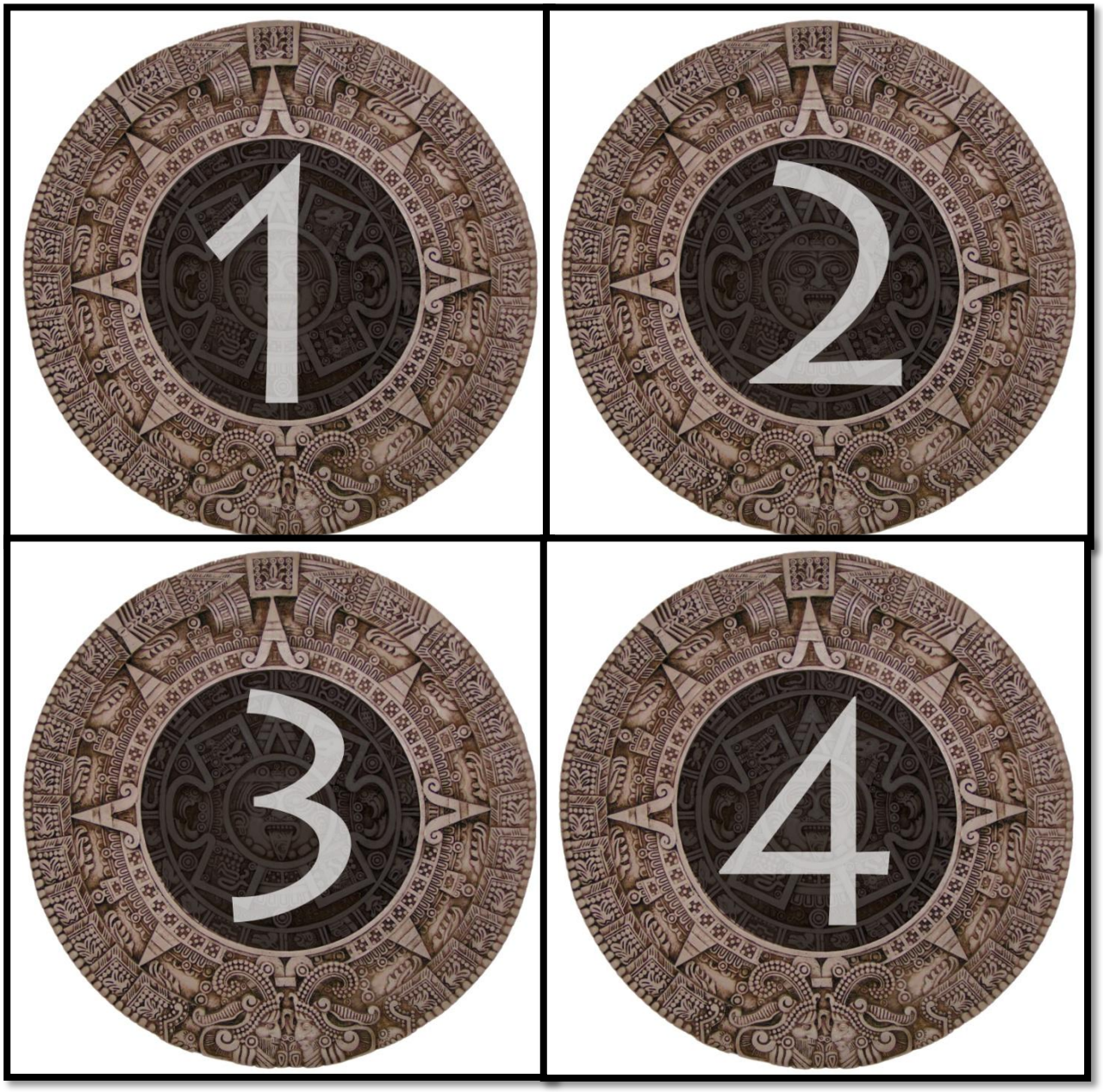
- X3 Small number templates .
    - 2 copies make up the small number groups the students can choose from
    - 1 copy should be used to make the digitised number the students have to make

- Enough answer sheets for each round played.

Large number templates



Small number templates




5
6
7
8
9
10

Group Number: _____

Number Countdown Answer sheet

Use this sheet to record all the steps of your working out on.

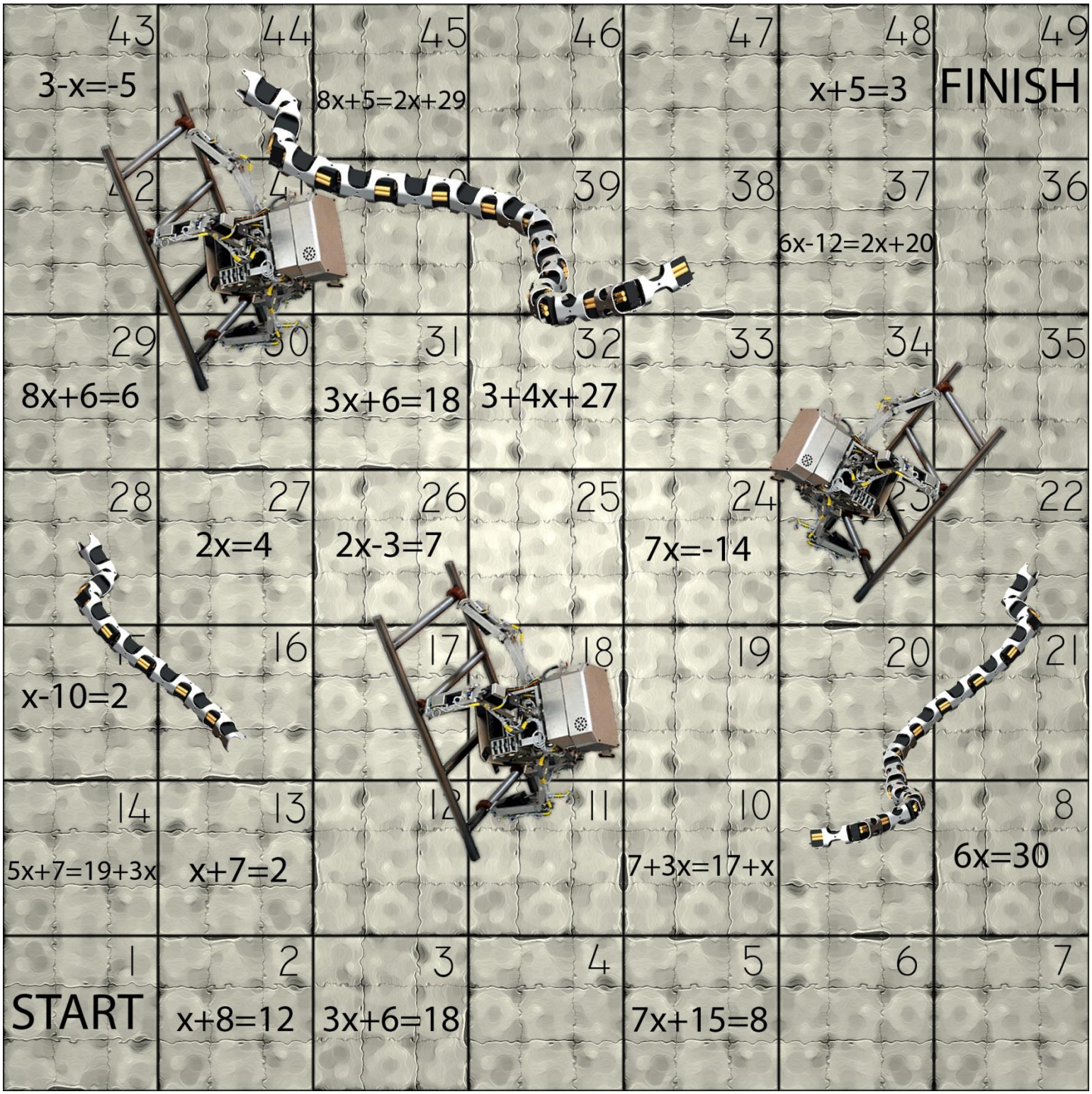
Once complete, hand it to your teacher.

Round
Target Number (As picked randomly by your teacher)
Working out
Final Number

Algebra Snakes and Ladders Template and Answer Sheet

For this workstation photocopy the following:

- 1 Algebra Snakes and Ladders Board, found on the next page. *(For best results, blow up to A3).*
- Enough answer sheets for one per person


43
3-x=-5
44
45
8x+5=2x+29
46
47
48
x+5=3
49
FINISH
42
39
38
37
6x-12=2x+20
36
29
8x+6=6
30
31
3x+6=18
32
3+4x+27
33
34
35
28
27
2x=4
26
2x-3=7
25
24
7x=-14
23
22
16
x-10=2
17
18
19
20
21
14
5x+7=19+3x
13
x+7=2
12
11
10
7+3x=17+x
8
6x=30
1
START
2
x+8=12
3
3x+6=18
4
5
7x+15=8
6
7

Algebra Snakes and Ladders Answer sheet

Group number:_____

Name:_____

After every move, fill in out the table below:

Roll	Spaces moved	Space landed on	Equation and workings out	Equation answer	Extra spaces moves
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					

Desert Island Rescue Template and Answer Sheet

For this workstation photocopy the following:

- 1 Desert Island Rescue Template, found on the opposite page. *(For best results, blow up to A3).*
- Enough answer sheets for one per group.

Please note:

Every effort has been made to ensure that the scale is 1:100,000 at A3 (i.e. 1cm = 1km). However, due to variations in printer settings, this may no longer be 100% accurate. As a result, marking discretion is advised.


The Tower of Refuge
Dead Marshes
Warlock Wood
Wraith Valley
Lake Eerie
N
NW
NE
W
E
SW
SE
S
Mount Doom
Lake Terror
you are here

Desert Island Rescue Answer Sheet

Group Number: _____

Use the table below, record your moves to safety!

Note: You do not have to use 15 steps.

Step	Action	Move from (co-ordinates)	Move to (Co-ordinates
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

Correlation Challenge

For this workstation photocopy the following:

- Enough answer sheets for one per group.

No template is required.

Correlation Challenge Answer sheet

Group Number: _____

Fill in the tables below as you progress through the task.

Handling data Section

Height and arm span table:

Name	Height (cm)	Arm span (cm)

- Using the information in the table, draw a scatter diagram on the graph paper provided.
- Plot the line of best fit
- What type of correlation does the graph show, if any?

Move onto the averages section of the challenge.

Averages section

Using the height and arm span information you measured in the first part of the task, work out the mean, mode and medium of the measurements you have taken.

Just in case you have forgotten how to work out averages, here's a quick reminder…

Averages of discrete data:

There are 3 types of averages: mean, medium and mode.

- Mean—sometimes known as the 'average'.

$$\text{Mean} = \frac{\text{Sum of a set of values}}{\text{The number of values used}}$$

- Median—the middle value when the numbers are put in order of size.
- Mode—that value that occurs most often
- Range—tells you how much the information is spread.

Range = Highest value - Lowest value

Now you understand averages, work out the mean, mode, medium and range of all the information you have gathered in the tables on the next page.

Mean, mode and medium of your data

Group Number: _____

Mean
Height (cm) **Answer**
Arm span (cm) **Answer**

Median
Height (cm) **Answer**
Arm span (cm) **Answer**

Mode
Height (cm) **Answer**
Arm span (cm) **Answer**

Range
Height (cm) **Answer**
Arm span (cm) **Answer**

Concluding your report

Group Number: _____

Finally, your report is almost done. To complete the report for the scientists of 2104 answer the questions below

Using your mean average for height and arm span, state how many group members are below the average, and how many are over the average

Height

Above the mean average:

Below the mean average:

Arm span

Above the mean average:

Below the mean average

Using your median average for height and arm span, state how many group members are below the average, and how many are over the average

Height

Above the median average:

Below the median average:

Arm span

Above the median average:

Below the median average:

Using your mode average for height and arm span, state how many group members are below the average, and how many are over the average

Height

Above the mode average

Below the mode average

Arm span

Above the mode average

Below the mode average

Crystal Maze/Kaleidocycle Template and Answer Sheet*

For this workstation photocopy the following:

- One template per group, or student. Depending on how you decide to run the session.
(For best results, blow up the Crystal Maze template to A3 size. The kaleidocycle template works fine at A4 size).
- Instructions for how to build the Crystal Maze/Kaleidocycle (One per group).
- The answer sheet is on the same page as the instruction sheet.

If you would like to expand the building a crystal maze session, more information can be found at:

http://sci-toys.com/scitoys/scitoys/mathematics/paper_ring.html [accessed 28 July 2007]

Templates for both the Crystal Maze and Kaleidocycle can be found on the page immediately after the instructions for the given structure.

**The crystal maze and kaleidocycle templates and explanation sheets were sourced from:*
http://sci-toys.com/scitoys/scitoys/mathematics/paper_ring.html

Instructions for the Crystal Maze:

Making the Crystal Maze Dome is simple!

If you choose to use paper, you can print out a template on a printer, and then simply cut it out, fold it, and tape the edges together to get a dome.

Follow the three simple steps below:

- Cut out your template.
- Fold over all the lines on the template.
- Stick the edges together.

When you have completed your Dome, answer the questions below.

Look closely at the hexagons in the dome. What kind of triangles make up the hexagons in the dome: right angle, equilateral, isosceles or scalene?

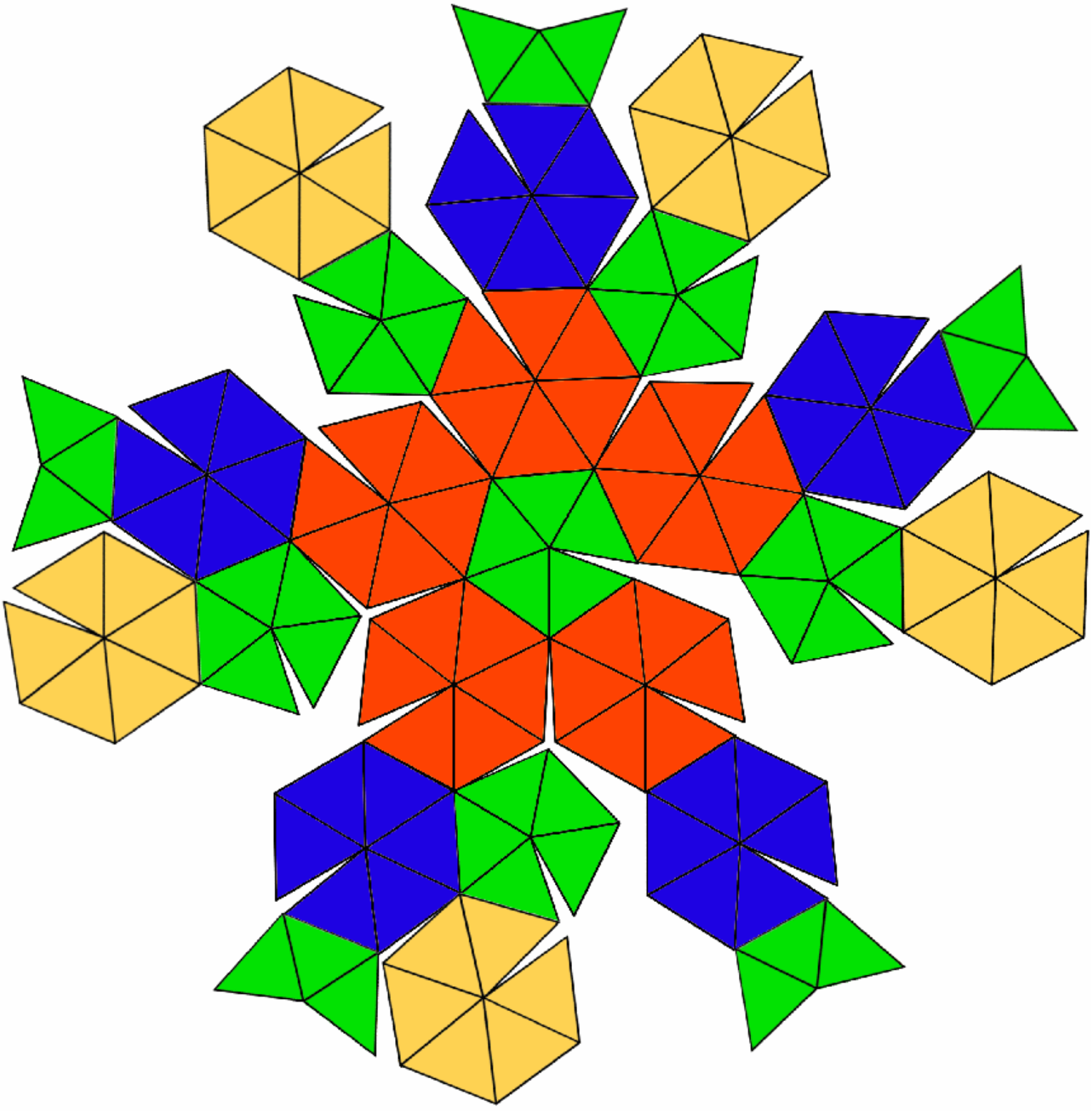
List the symmetrical properties of this type of triangle
1. **2.**

Look closely at the pentagons in the dome. Answer the three questions below

How many equal sides do they have?

True or False. They have a rotational symmetry of order 6? If false, how what is a pentagons order of rotational symmetry?

How many lines of symmetry do they have?



Instructions for the Kaleidocycle:

Look closely at your templates. The pattern on the right has extra information and lines on it. Attempt this model first, or use it as a guide. The one on the left will look better as there is no extra printing on it. Make sure this template is used for your final model.

To build your Kaleidocycle, follow the instructions below:

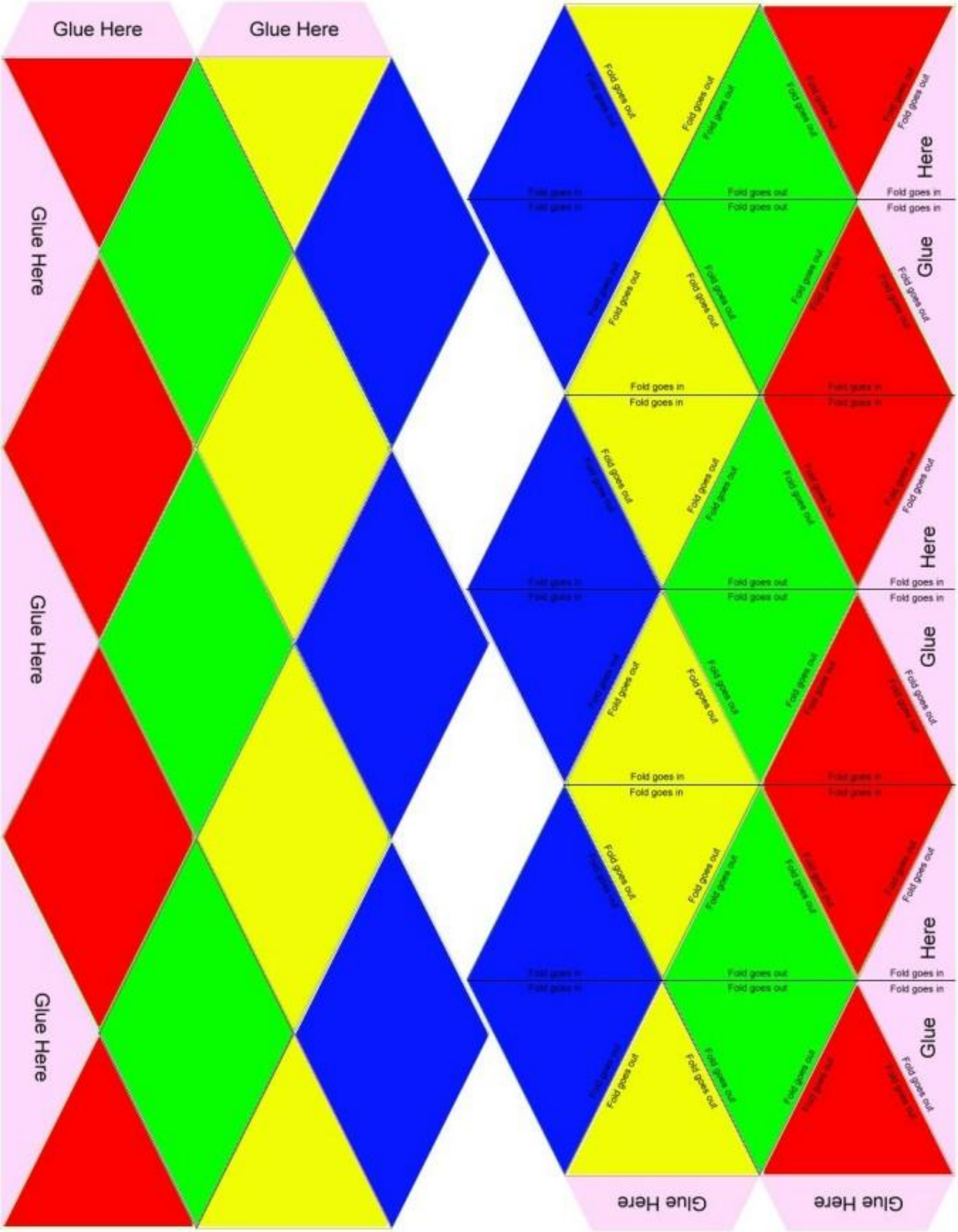
- Cut out your template.
- Fold carefully along the lines that separate the colours and along the lines that connect the points of the diamonds.
- Spread glue or sticky tape on the first triangle that says, “Glue here.”
- Fold the paper so that the blue diamond fits onto the part of the paper you have just covered with glue.
- Repeat this step with the other two blue diamonds. Your model should begin to look almost snake like when all stuck together.
- Spread glue on the two end tabs and insert them carefully together with the other end of the snake.
- Finally, pinch the end you have just glued closed so that the tabs are firmly glued to the paper, forming a ring.
- Before you start turning the ring inside out, ensure that all the glue has dried.
- Congratulations… You have completed your Kaleidocycle.

Now you have completed your Kaleidocycle, answer the questions below:

What 3D shape is the Kaleidocycle made up of: square-based pyramid or triangular-based pyramids?

How many faces does each individual pyramid have?

How many edges does each individual pyramid have?


Glue Here
Glue Here
Glue Here
Glue Here
Glue Here
Glue Here
Glue Here
Glue
Here
Glue
Here
Glue
Here
Glue
Fold goes out
Fold goes in

Student Guide

Introduction

Welcome to the Crystal Maze Maths Event!

The aim of this workshop is to allow you to try and solve different maths problems working in groups, outside your usual classroom learning. There are five different stations, all of which you will get a chance to complete.

The five events are:

1. Number Countdown
2. Algebra Snakes and Ladders
3. Desert Island Rescue
4. Correlation Challenge
5. Build Crystal Maze/Kaleidocycle

The stations are designed to try and help you practise the maths skills you have been taught throughout the year.

Once you have completed the event, you must fill in the question sheets that are handed out to you. These questions will act as helpful revision.

Go to your first station and read the worksheet to find out what it involves.

Enjoy!

Number Countdown Worksheet

Ever wanted to appear in the TV show Countdown?

Well, now's your chance!

Using the same format taken from the number rounds of the TV show your group gets the chance to take part in the Countdown Numbers game for real!

The numbers game is about using standard mathematical operations (+, -, *, /) with 6 given numbers to create a randomly given 3 digit number.

Numbers are divided into two groups:

- Large numbers: 25, 50, 75, 100
- Small numbers: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 (there are 2 of each small numbers possible to get)

Before the game starts, your group will ask for certain selection of cards (e.g. 1 large and 5 small) and Carol (your teacher) will display them and then provide you with a 3 digit target number.

Your group will then get an answer sheet to do workings out on and a calculator. You have 2 minutes to find an answer.

Right, now it's down to you, thinking caps on…

Can you beat the Countdown clock?

Good luck!

Example of game:

Cards selected: 1 large, 5 small

Numbers drawn: 2, 6, 7, 10, 10, 50

Target number: 362

Timer starts

Note: There can be more than one answer!

Possible answers:

50 * 7 = 350
6 * 2 = 12
350 + 12 = <u>362</u>

Or

50 * 7 = 350
350 + 10 + 2 = <u>362</u>

Algebra Snakes and Ladders Worksheet

Yes, it's the traditional favourite board game…

With a twist!

Before you start the game, make sure that everyone has their own counter and place them on the *start* space on the board.

Decide who goes first and begin…

Game play:

Take it in turns to roll the dice, and move the number of spaces you roll.

- If you land on a ladder, climb it, if you land on a snake, slide down it, like you would on the traditional version.

However, here's the twist...

- If you land on a space with an equation, you have to work out the equation, which in turn determines whether you move forwards, backwards, or stay put on your current space.

For example:

- You roll a 5 from the start position.
- You land on the space with the equation:5(2x-2) = 10

Work out the equation:

5(2x-2) = 10
10x-10 = 10
10x = 10 + 10
10x = 20
X = 20/10
X = 2

- As the answer is +2, move a further 2 spaces on the board.

The winner is the player who reaches the finish space first.

Rules:

- Each player takes one roll each in turn.
- If you land on an equation space you must complete the equation before the next person rolls the dice.
- If you land at the bottom of a ladder you climb the ladder.
- If you land at the top of a snake you must fall down it.
- To win you must roll the exact number that results in you landing on the *finish* space.

Desert Island Rescue Worksheet

You have crash landed in the foothills of a remote island!

Little is known about this place; before now it had not been thought to exist outside the realms of myth and folklore. You and your fellow passengers warily climb the nearest hill to try and make sense of these strange new surroundings. Hidden behind a rocky outcrop, you peer over the brow of the hill only to see the neighbouring valley obscured by low-lying fog. You do not know which way to turn or what dangers lie ahead. Suddenly, when you think that all hope is lost, one of the larger rocks gives way underfoot to reveal a map beneath it. As luck would have it, you have stumbled across a detailed map of the island, with instructions of how to get to 'The Tower of Refuge' the only location on the map that is not accompanied by an ominous place name!

From the point 'x' that indicates your current position use the supplied bearings, in degrees, and distances, in kilometres, to plot a route to the Tower. The quicker you can do this, the sooner you have a chance of being rescued.

Using the equipment provided, draw your route to safety on the map of the island you have been given. Remember to work as a team and discuss the possible routes you can take.

Before you start, check that you have the following equipment:

- Map
- Pencil
- Ruler
- 360^0 Protractor

Guidance Notes:

All bearings are counted clockwise from North, which means they will always be less than 360^0, otherwise you would turn through a full circle on the spot and end up back facing north again.
Distances are to be measured out in the direction of the accompanying bearing. That is to say, once you have turned on the spot, through the bearing angle, you should start walking in the direction you are facing.

Good luck!

Correlation Challenge Worksheet

You have been time warped to the year 2104.

Scientists are fascinated by your appearance and want to record a number of stats about your body.

Your task is to assist them to do this.

Before you start the task, ensure you have the following:

- Tape Measures
- Answer sheet
- Graph Paper
- Pencil
- Ruler

Once you do, let's begin.

The data they want to record and gather is each group member's height and arm span.

Follow the instructions below:

- Measure each group member's height and record it in the table provided.
- Measure each group member's arm span and record it in the table provided.
- Plot each person's height and arm span on a scatter diagram.
- Plot a line of best fit.
- Comment whether there is positive, negative or zero correlation.
- Calculate the mean, medium and mode average of both the height and arm span, as well as calculating the range of both sets of data.
- Finalise your report for the scientists of the future!

Good luck!

Build Crystal Maze or Kaleidocycle!

Now the time has come to build your very own Crystal Maze, Kaleidocycle or, if you have time, both!

And what's more, it couldn't be easier to do.

This is a fun activity that highlights how 2D shapes can be combined to create 3D shapes. Many famous buildings, such as the Eden Project, use similar technique. The kaleidocycle creates a moving sculpture which can fascinate for hours!

Before you start the activity check you have the following:

- Crystal Maze or Kaleidocycle template
- Scissors
- Glue or sticky tape

Follow the simple steps below:

- Cut out your template.
- Fold over all the lines on the template.
- Stick the edges together.
- Admire your Crystal Maze or moving Kaleidocycle.

Good luck!

Reference

KS3 Maths Curriculum

http://curriculum.qca.org.uk/key-stages-3-and-4/subjects/mathematics/keystage3/index.aspx
[Correct as of 11 June 2009]

1. Key concepts

There are a number of key concepts that underpin the study of mathematics. Pupils need to understand these concepts in order to deepen and broaden their knowledge, skills and understanding.

1.1 Competence

A. Applying suitable mathematics accurately within the classroom and beyond.

B. Communicating mathematics effectively.

C. Selecting appropriate mathematical tools and methods, including ICT.

1.2 Creativity

A. Combining understanding, experiences, imagination and reasoningto construct new knowledge.

B. Using existing mathematical knowledge to create solutions to unfamiliar problems.

C. Posing questions and developing convincing arguments.

1.3 Applications and implications of mathematics

A. Knowing that mathematics is a rigorous, coherent discipline.

B. Understanding that mathematics is used as a tool in a wide range of contexts.

C. Recognising the rich historical and cultural roots of mathematics.

D. Engaging in mathematics as an interesting and worthwhile activity.

1.4 Critical understanding

A. Knowing that mathematics is essentially abstract and can be used to

model, interpret or represent situations.

B. Recognising the limitations and scope of a model or representation.

2. Key processes

These are the essential skills and processes in mathematics that pupils need to learn to make progress.

2.1 Representing

Pupils should be able to:

A. identify the mathematical aspects of a situation or problem

B. choose between representations

C. simplify the situation or problem in order to represent it mathematically, using appropriate variables, symbols, diagrams and modelsselect mathematical information, methods and tools to use.

2.2 Analysing

Use mathematical reasoning

Pupils should be able to:

A. make connections within mathematics

B. use knowledge of related problems

C. visualise and work with dynamic images

D. identify and classify patterns

E. make and begin to justify conjectures and generalisations, considering special cases and counter-examples

F. explore the effects of varying values and look for invariance and covariance

G. take account of feedback and learn from mistakes

H. work logically towards results and solutions, recognising the impact of constraints and assumptions

I. appreciate that there are a number of different techniques that can be used to analyse a situation

J. reason inductively and deduce.

Use appropriate mathematical procedures
Pupils should be able to:

K. make accurate mathematical diagrams, graphs and constructions on paper and on screen

L. calculate accurately, selecting mental methods or calculating devices as appropriate

M. manipulate numbers, algebraic expressions and equations and apply routine algorithms

N. use accurate notation, including correct syntax when using ICT

O. record methods, solutions and conclusions

P. estimate, approximate and check working.

2.3 Interpreting and evaluating

Pupils should be able to:

A. form convincing arguments based on findings and make general statements

B. consider the assumptions made and the appropriateness and accuracy of results and conclusions

C. be aware of the strength of empirical evidence and appreciate the difference between evidence and proof

D. look at data to find patterns and exceptions

E. relate findings to the original context, identifying whether they support or refute conjectures

F. engage with someone else's mathematical reasoning in the context of a problem or particular situation

G. consider the effectiveness of alternative strategies.

2.4 Communicating and reflecting

Pupils should be able to:

A. communicate findings effectively

B. engage in mathematical discussion of results

C. consider the elegance and efficiency of alternative solutions

D. look for equivalence in relation to both the different approaches to the problem and different problems with similar structures

E. make connections between the current situation and outcomes, and situations and outcomes they have already encountered.

3. Range and content

This section outlines the breadth of the subject on which teachers should draw when teaching the key concepts and key processes.

The study of mathematics should enable pupils to apply their knowledge, skills and understanding to relevant real-world situations.

The study of mathematics should include:

3.1 Number and algebra

A. rational numbers, their properties and their different representations

B. rules of arithmetic applied to calculations and manipulations with rational numbers

C. applications of ratio and proportion

D. accuracy and rounding

E. algebra as generalised arithmetic

F. inear equations, formulae, expressions and identities

G. analytical, graphical and numerical methods for solving equations

H. polynomial graphs, sequences and functions

3.2 Geometry and measures

A. properties of 2D and 3D shapes

B. constructions, loci and bearings

C. Pythagoras' theorem

D. transformations

E. similarity, including the use of scale

F. points, lines and shapes in 2D coordinate systems

G. units, compound measures and conversions

H. perimeters, areas, surface areas and volumes

3.3 Statistics

A. the handling data cycle

B. presentation and analysis of grouped and ungrouped data, including time series and lines of best fit

C. measures of central tendency and spread

D. experimental and theoretical probabilities, including those based on equally likely outcomes