

BREAK OUT



STEM resources

STEM – Science, Technology, Engineering and Maths – this subject matter forms the basis of a wide array of knowledge that is inter-connected to work based careers. Many schools cover these areas through the school curriculum in an academic way but STEM based subjects don't have to be boring.

In Scouting we offer young people a unique learning space where everything can be explored. Learning by doing, working in teams, sharing ideas and being creative, solving problems – these are some of the ways that Scouting uses to gain and impart knowledge.

Throughout our programme we already introduce many STEM type activities to young people – of course we do not 'tag' them in this fashion and they are presented to young people as challenges, games and explorations in the fun learning spaces of our meetings and activities.

This collection of resources highlights the many activities and ideas that can be incorporated into our programmes, so that young people can see STEM as fun and awaken their interest in these subject areas.

In today's world, many employers seek a wide knowledge of the STEM related areas. With the increased focus on science, technology and information transfer and interaction those new to a work environment are expected to have a solid base of knowledge of these areas. Another requirement of the work place and an increasing request from employers are young people who have additional life skills. These skills include what are called 21st century skills – ability to work in teams, take leadership and responsibility, be creative and innovative, be able to solve problems all key skills provided by Scouting.

By combining STEM related areas with what we do best in Scouting – develop young people - we have a package of activities and ideas that can provide young people with a solid base from which to develop their life long career path.

This resource has been funded by the Science Foundation of Ireland because they recognise the value of the Scout programme and how it provides learning spaces for young people that are unique and based on play and fun. Science can be perceived as 'boring' by many young people but we



hope in this resource to provide a series of novel activities that will show science in a new fun way.

The resources have been created around a series of themes. By using themes it allows us to explore the wide area of STEM through many different scenarios. The resource only provides the ideas, it does not present a programme structure or how it might be developed as a programme cycle. This we will leave to the young people in your Section as they develop programme cycles and adventures in your programme. So, many possibilities are possible from simple insertions in meetings, to themed camps and activities, wide games or incident trails.

The ideas presented are only a sample of the millions of possibilities that can be used. The internet is widely distributed with many ideas related to STEM. This resource presents and links to the best ones that can be undertaken by Scouts in all Sections.

Using the resource

The resource is driven by the poster (cover of this handbook) – a full size series of posters will be provided to each Group for display. On the poster is a series of QR codes that when scanned by a QR code app on a mobile phone that will bring the user to an online

interface. That interface will lead to this PDF resource, Video links, Pinterest pins and other websites. Each of the links is related to the theme that is been presented. There are a number of different resources and they can be found collectively via the resource area www.scouting360.ie

The mobile phone – in a young person's pocket- is a powerful interaction tool and computer and can quickly present the ideas to young people to explore. Ideas are presented in an easy to understand way and then it is time for some hands-on experience and learning by doing as each idea is tried out at meetings and activities.

It is suggested that Scouts (in all Sections) are exposed to the resources so that they can discover the ideas and then create programme cycles and adventures at which they can be included. The themes can be used as presented or mixed and matched to create new themes/adventures/trails etc.

Included in the resources is an innovation and creativity exercise. The idea of this exercise is to allow young people to create and invent. All inventions are created by a process of knowledge (science), inventing the new item or process (engineering), refining and developing (maths can be used) and finally producing a new invention (a tool – a piece of technology). The creation process is STEM applied and how it is done is in teams (small team system in sections), gathering knowledge, working creatively as a team, engineering their idea and solving problems and creating new solutions. We do this every time we challenge young people at meetings and on activities and incident trails. So again, Scouting is good at this.

It is therefore suggested that each programme cycle will include one 'invention' session where Scouts can take the knowledge they have explored in the themed meeting or programme cycle and use this knowledge to invent something new and exciting. Ideally this session would be undertaken in week three or four of a programme cycle when some knowledge has been gained in a themed area.

Plan, do, review, is of course a cornerstone of our programme method and the review process should include a reflection on what has been learned or changing attitudes to STEM type activities.

Storylining

As Baden Powell once said – 'Scouting is a game for young people and a job for adults' and within this context story- lining is extremely important in holding together the programmes and activities we run. A series of incidents can be held together with an inventive storyline, for example, related to escaping from a prison camp or tasks to be completed in a treasure hunt. Likewise at our meetings we will run games and challenges and these should also be story-lined (or within a symbolic framework – Lands of Adventure in the Cub Scout Section).



In the context of the STEM resources they have been related to themes which in themselves suggest possible storylines and scenarios. Action hero's for example focuses on action hero films and situations, James Bond, Bourne, Indiana Jones, MacGyver and many such films and TV series provide the backdrop and the situations that an action hero must escape from, find clues, improvise or be inventive.

Therefore cracking a code or survival situations can be cloaked in mystery, suspense and excitement with the introduction of a creative storyline – 'defuse the bomb in 30 seconds or the world blows up' can make exciting the creation of an electrical circuit. Cracking a code is just a simple way of telling the team what is the next location they need to travel to.

By using story-lining and scenarios we allow young people to use their imagination and develop creative solutions to a challenge in context. Artificial time pressure is introduced – build this tower before the flood raises, or do this challenge before the door time lock engages. Time pressure enables leadership and organisation skills to be developed.

Real life scenarios such as accident setups are also useful for some situations and again relate to the subject matter under exploration.

In some incidences a storyline can run over a whole weekend or period of time. This involves a bit more work in organising the elements of the programme but often it adds to and enhances the overall experience – a Viking theme, Space camp or Desert island survival.

Wide games are another feature of story-lining to be considered. In general terms they are quest driven scenarios – a mission must be completed. So in the context of a wide game Patrols (small team system) are each competing to reach an objective – a treasure hunt for example – and must complete various challenges and situations to progress towards their objective.



In all sections within a Group the programme is presented through a 'Programme Cycle'. This programme cycle can have any timeline but it contains three crucial features – Plan, Do, Review.

Each programme cycle is built around an adventure or series of adventures leading to a key highlight. Normally, a programme cycle will last around 4 weeks (but can be shorter or longer)

The 'adventure' is the main highlight of the Programme cycle – the weekend camp, for example, and the meetings or associated activities are the 'learning spaces' to enable the successful completion of the adventure. So, for example, the Scouts will need to be able to build an oven on the camp - so that they can bake a cake. The weekly meeting or a special day activity might be created for the Scouts to learn how to do this so it can be completed with success on the weekend camp.

Within this process all of the Scouts will be involved in the creation of the adventure, the weekly meetings and activities. The team system will be used at all times and all the interactions associated with this process will be focused on the programme cycle and the planned adventure.

The Plan, Do, Review method is used....so the adventure is planned, it takes place and finally the programme cycle is reviewed and learning is determined.

The process

The first step in the creation of a Programme Cycle This is where the ideas for adventures are created and selected. This resource will highlight some ideas based around the theme but additional ideas can be added and created as young people wish in the programme creation stage.

Doing and discovering

This STEM based resource is designed to enable young people to discover science, technology, engineering and maths all around them and as part of their daily lives.

They are not subjects primarily associated with school, and that as Scouts we can have a lot of fun using, exploring and discovering knowledge based on fun, play and group interactions.

Each idea therefore has a 'science idea' that Scouts need to discover as they undertake each activity. In the review process it is hoped that Scouts express in their own way the things they have learned and the knowledge and new understandings they have gained.

Reviewing

The object of the review session is to understand what has happened, what we learned along the way and to 'mark up' and acknowledge how every Scout has progressed.

Reviewing is critical to the learning process. Until a Scout takes time to internalise and access what they have

learned through an experience it serves no real value - bar entertainment.

As Scouting is in the business of assisting young people in their development the review process is a vital component of the Scout programme. There are many ways of conducting the review – it can be done as the activity progresses or at the end of each day or in a sit down discussion at the end of the programme cycle.



Break out

The 'Break Out' resource presents a series of practical maths problems and puzzles. Nineteen problems are presented via 'Pinterest' pins and weblinks. This resource also contains all of the seventeen problems.

The problems can be presented and explored via the poster resource directly with a mobile device. However, for best experience and learning it is suggested that a series of bases or locations are established to enable team based problem solving and a fun activity.

'Break Out' is designed around 'Get out of the building' or Escape type games that exist as computer games and apps. Physical play arenas are now to be found in some areas of the country. The idea is that there is a maze of 'rooms' and to move from one room to another the team must solve the problem presented within a time frame.

Each of the problems are similar in terms of 'difficulty' so a team can start in any location and move around a series of 'rooms'.

Possible setup – a series of tables in a big hall, a collection of rooms, or a series of outdoor bases/ locations. Each problem has a time limit (this can be determined by age range and knowledge base of participants). When the locations are established a team will go to one of the locations to start – on the blow of a whistle or signal the teams start. The teams move to the next location at the next signal – and so the teams engage with each problem.



The solution of each problem could provide a key to get out of the room, perhaps a letter, a piece of a map that are combined over the game to provide the final location and escape route.

Each location needs to be manned and games need to be reset and adjudicated upon before a team leaves the location.

If possible have physical items present rather than providing the problem and some paper and pencils.

Teams should be observed for teamwork and participation rather than a single Scout solving the problem.

This activity is just the basic idea of an activity – other elements can be provided and additional problems/obstacles etc. added to make it a 'brilliant activity'. The main focus should be on 'making maths fun' and commonplace rather than its attachment to a school environment.

The Boiled Egg Problem



You need to boil an egg for exactly 9 minutes, or else the visiting King will complain and you will lose your job as head chef.

But you only have 2 hourglasses, one measures 7 minutes and the other measures 4 minutes.

How can you correctly measure 9 minutes using these devices.

Countdown Numbers



Select a target number with three digits at random

Try to get as close to the target using a choice of six numbers - randomly selected from the pile

You don't have to use all the numbers

You can't use the same number more than once

Only plus, minus and divide are allowed

There are four big numbers
25, 50, 75 and 100

There are twenty small numbers .
Two of each 1,2,...,9,10

Make 1000

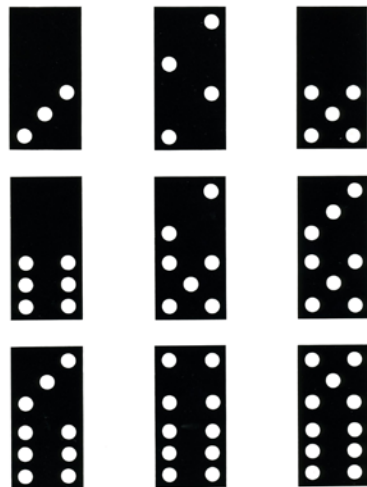


Using only the number 8 exactly eight times make 1000 using only plus, minus and divide

Dominoes Puzzle



Place dominoes on the table in this order.
Now try to rearrange the dominoes so that
the sum of the dots on every
vertical, horizontal and diagonal row
totals twenty - one



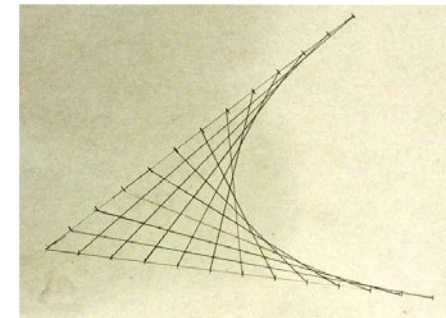
Newspaper Fraction Dancing



If you can master the easy ones try doing

$1/5$, $1/7$, $1/32$

Create a parabolic curve

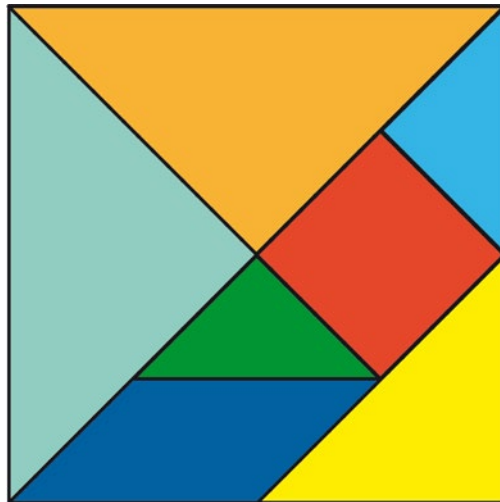


Using the material provided create a
parabolic curve and ropeweave.

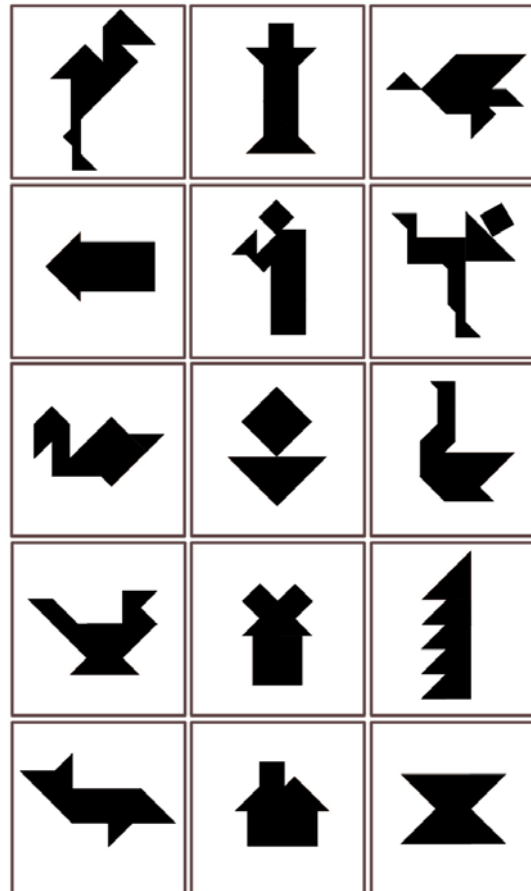
Materials:- cardboard, pins thread.

The Tangram

The tangram is a seven piece puzzle. It can easily be made by cutting up a square piece of card



Using all the pieces create the following shapes



2 Litres of Water



The Problem

You need to measure two litres of water but you only have a 4 litre and 5 litre bowl

The River Cross



The Problem

During a country walk, a man and three children encounter a stream. As he is the only one wearing suitable boots he decides to carry the children over one at a time.

Bearing in mind that Ann argues when left alone with either Andrew or Mark. How does he manage to carry them across the stream without an argument breaking out.

Troubled Waters



Five engineers are exploring a possible route for a railway through the jungle regions of Brazil. They find themselves on the bank of a river with five cannibals on the other side.

They agree to help each other but both parties are cautious.

The only method of crossing is a canoe and only one engineer and one cannibal can paddle.

The boat can hold three men.

The engineers do not trust the cannibals, and are unwilling to be outnumbered either in the boat or on either shore for the time it takes the boat to cross.

What is more, the cannibals feel exactly the same way about the engineers!

Is it possible for both groups to cross safely?

Packing Boxes Puzzle



You have 10 smaller boxes that need to be packed on to larger crates for transport.

Each crate can carry a maximum of 25 kg - but you only have three crates and the total weight of all the smaller boxes is 75kg.

The box weights are:- 15kg, 13kg, 11kg, 10kg, 9kg, 8kg, 4kg, 2kg, 2kg, 1kg.

Hanoi Rings



The objective of the puzzle is to move the entire stack starting on the left hand side to rod on the right hand side, obeying the following simple rules:

Only one disk can be moved at a time.
Each move consists of taking the upper disk from one of the stacks and placing it on top of another stack i.e. a disk can only be moved if it is the uppermost disk on a stack.

No disk may be placed on top of a smaller disk.

What is the mallest number of moves possible to move the disks from one stack to create another stack.

Frog Hop Puzzle

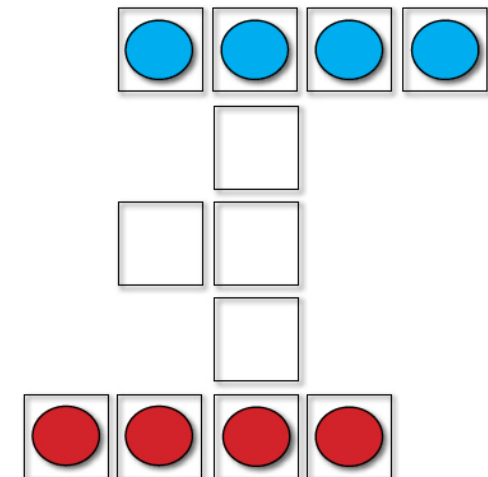


Move all three green frogs to the rocks on the left and move all three brown frogs to the rocks on the right.

Frogs cannot move backwards and can only hop over one frog at a time.

Shutting Puzzle No. 1

Create a board with plastic counters or coins as shown



The aim of the game is to shift the top blue counters with the bottom red counters using the smallest number of moves. You can slide a counter one at a time with no jumping of another counter or sharing/stacking of counters on a square

Unconnected

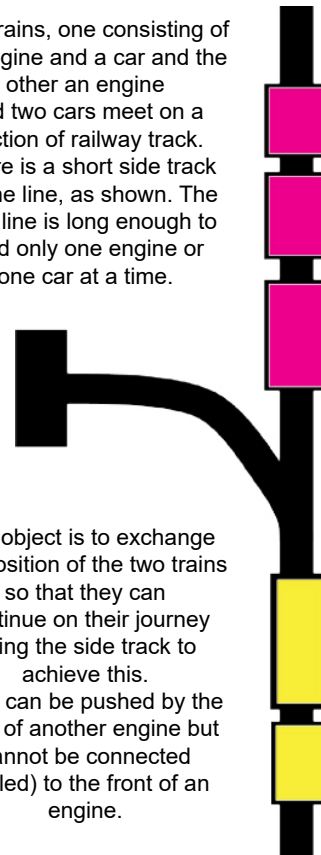
Using each number, 1 through 10, place them in the circles so that no consecutive numbers are connected by a line.

For example, 4 cannot be connected by a line (in any Direction) to 3 or 5



Shutting Puzzle No. 2

Two trains, one consisting of an engine and a car and the other an engine and two cars meet on a section of railway track. There is a short side track on the line, as shown. The side line is long enough to hold only one engine or one car at a time.

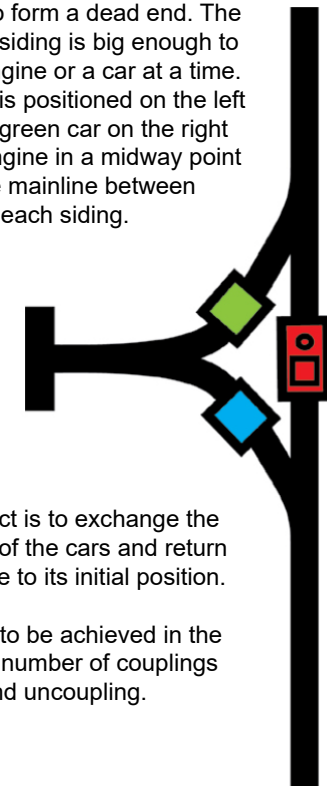


The object is to exchange the position of the two trains so that they can continue on their journey using the side track to achieve this.

A car can be pushed by the front of another engine but cannot be connected (pulled) to the front of an engine.

Shutting Puzzle No. 3

Two siding join the the main track of a railway line. They meet together to form a dead end. The dead end siding is big enough to hold an engine or a car at a time. A blue car is positioned on the left siding, a green car on the right siding and the engine in a midway point on the mainline between each siding.



The object is to exchange the positions of the cars and return the engine to its initial position.

This has to be achieved in the smallest number of couplings and uncoupling.

