<table>
<tr><td>Year group: 8
HD 1

Title:
Dodgy Dice</td><td colspan="3">Unit overview:
To design an experiment to test the ‘fairness’ of a die.
Pupils will also need to construct the net of a cube.</td><td>Length:
4 x 1 hour lessons</td></tr>
<tr><td>Prior learning

Be familiar with the language of probability and that a probability can be written as a fraction</td><td>Objectives
<u>MPA</u>
• identify the mathematical features of a context or problem; try out and compare mathematical representations; select appropriate procedures and tools . Evaluate the efficiency of alternative strategies and approaches then refine own findings and approaches on the basis of discussions with others

<u>Probability</u>
• interpret the results of an experiment using the language of probability; appreciate that random processes are unpredictable
• use diagrams and tables to record in a systematic way all possible mutually exclusive outcomes for single events
• compare estimated experimental probabilities with theoretical probabilities, recognising that:
– if an experiment is repeated the outcome may, and usually will, be different
– increasing the number of times an experiment is repeated generally leads to better estimates of probability

<u>Constructions and loci</u>
• use ruler and protractor to construct simple nets of 3-D shapes</td><td>Unit outcomes for pupils

• To be able to design an experiment to solve the problem posed.
• To construct the net of a cube and make a simple 6-sided die.
• To record the outcomes of the experiment in a systematic way, that will allow the pupil to solve the problem.
• To appreciate that the more times an experiment is repeated the more reliable the outcome
• To communicate the findings of an experiment, providing a convincing argument.</td><td>Key mathematical terms and notation

Fair
Biased
Equally likely outcomes
Trial
Frequency
Use of P(6) = 1/6</td><td>Other links
(Other links e.g. cross curricular or whole-school initiatives)

History of dice.</td></tr>
</table>

Phase 1

Overview of this phase	How will the pupils learn? e.g. tasks/activities, starters, plenaries …	How will the learning emerge? e.g. key questions, assessment points …	How will this be adjusted? e.g. support/extension …	Notes e.g. practical resources, ICT, homework …
A reminder of some of the vocabulary associated with probability (1x 1 hour lesson)	Use Probing Questions (level 5) from the Progression maps to assess understanding of probability. Students to play the game – Heads you win.... to appreciate the need to consider equally likely outcomes when conducting an experiment and to understand the concepts of fairness and bias.	Pupils should be able to mark on a number line the probability of a particular event exactly e.g. P(4) on a fair six-sided dice. On a fair dice what is the probability of rolling: 1. 5? 2. an odd number? 3. zero? 4. a number greater than 2? 5. a prime number? 6. a number lying between 0 and 7? Mark these probabilities on a probability scale. Is the game fair? If we do more trials will the person who is 'two heads' ever win?	Support : provide a recording sheet where pupils colour in blocks – so that the visual image supports their understanding Extension : Who will win if we spin 3 coins?	Each group of 3 pupils needs 2 coins.

Phase 2

Overview of this phase	How will the pupils learn? e.g. tasks/activities, starters, plenaries …	How will the learning emerge? e.g. key questions, assessment points …	How will this be adjusted? e.g. support/extension …	Notes e.g. practical resources, ICT, homework …
Planning how to solve the problem and carrying out the experiment	Starter : Use the Probing Questions power points (level 5) to assess pupils understanding of simple probability. Responses should indicate whether some further work may be necessary before embarking on the task. Introduce the activity 'Dodgy Dice'. Pupils should work in small groups – ideally pairs. In pairs pupils begin to design their experiment. They should discuss: • how they will make their dice. They will need to consider how the faces will be numbered. (i.e. opposite faces summing to 7) • how they will record their outcomes? Take feedback from pairs/groups. In the first lesson the focus could be on constructing an accurate net for a cube. Activity – pupils to draw sets of 6 squares, joined edge to edge, finding as many arrangements as possible and then identify those that could be folded up to make the net of a cube. Pupils to construct cubes on cards accurately using a ruler and protractor. Pupils conduct the experiment, recording their findings. Pupils may need to repeat he experiment a few times after they have changed their 'dodgy dice'	**Key questions**: • How would you check if a dice is fair? What do you think 'fair' means? • How are the faces on a die numbered? What do you notice? • Which of these nets will fold up to make a cube? • What will be important to record when conducting your experiment? Pupils could test another pairs' dice and compare findings. *Probing question from the Progression Maps (PM)* You toss a coin 100 times and count the number of times you get a head. A robot is programmed to toss a coin 1000 times. Who is most likely to be closer to getting equal numbers of heads and tails? Why?	**Support** : provide templates for the net of a cube and tables to complete for the experiment. Students may need to throw a normal manufactured 'fair' dice initially and record outcomes. *What if pupils find this a barrier? (from PM)* Carry out an experiment, e.g. coloured counters taken from a bag. Do the experiment twice to demonstrate the difference in the results but take out a counter as many as fifty times in each experiment to demonstrate similarities. Use the results to give experimental probabilities. Indicate these on a 0 to 1 line. **Extension:** • to consider the fraction or percentage for each outcome that would make it a Dodgy Die, but not too dodgy. • how would you make an octahedral die 'dodgy'? • consider if it is important how a dice is labelled e.g. does it make a difference if 6 is not opposite 1?	Card, scissors, glue. Small pieces of blu-tac for each pair/group. A few 'proper' dice (to notice labelling of faces).

Phase 3

Overview of this phase	How will the pupils learn? e.g. tasks/activities, starters, plenaries …	How will the learning emerge? e.g. key questions, assessment points …	How will this be adjusted? e.g. support/extension …	Notes e.g. practical resources, ICT, homework …
Writing the report and reviewing the process	Starter and/or Plenary Use the programme 'Dice and bar chart' to question pupils on what they have discovered. Students write up a report of their experiment	Questions about the EXCEL simulation: Are any of these dice (A, B or C) dodgy? If so, how are the faces labelled? How many trials do we need to be sure of the result? Peer assessment could be used initially.	Support SMILE game to re-inforce the idea of repeated trials leading to better estimates of probability.	SMILE game