

New Turf

Purpose:

The purpose of this activity is to engage students in solving a probability problem using both theoretical and experimental (modelling) methods.

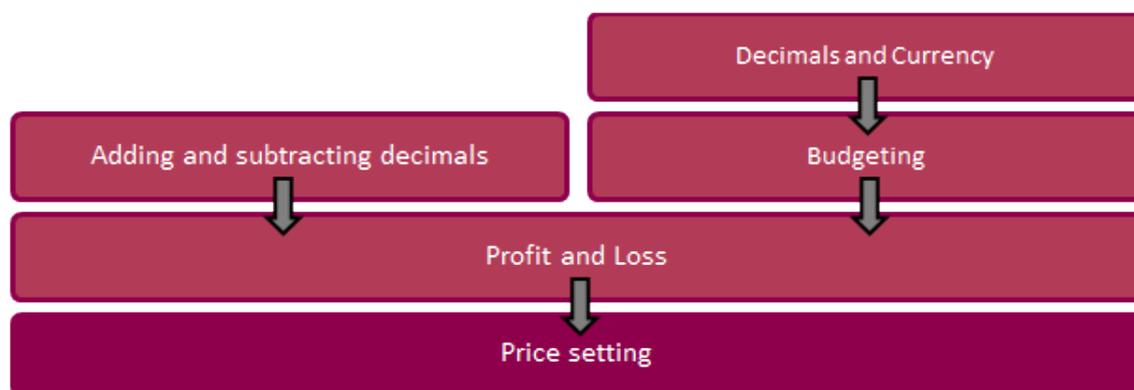
Achievement Objectives:

S4-3: Investigate situations that involve elements of chance by comparing experimental distributions with expectations from models of the possible outcomes, acknowledging variation and independence.

S4-4: Use simple fractions and percentages to describe probabilities.

Description of mathematics:

The background knowledge and skills that need to be established before and/or during this activity are outlined in the diagram below:



Decimals and fractions

Write 0.125 as a fraction.

Proportion and probability

If I have five white socks and one green sock, what is the probability that when I randomly select a sock, it is green?

Calculation expected values

If the probability of forgetting to pack my lunch is $\frac{1}{5}$, how many times can I expect to forget my lunch in a school term (50 days)?

Running a probability simulation

To model forgetting my lunch (probability = $\frac{1}{5}$), I use one blue counter to represent forgetting and four red counters to represent remembering to pack my lunch. Randomly select a counter, record the colour and replace the counter. Repeat this 50 times to find how many times I can expect to forget my lunch in a term.

Using random numbers to run a probability simulation

To model forgetting my lunch (probability = $\frac{1}{5}$), I use random numbers (given on a sheet or using a calculator) to represent forgetting (2, 3) and to represent remembering (0, 1, 4, 5, 6, 7, 8, 9) to pack my lunch. Record the results of the first 50 random numbers to find how many times I can expect to forget my lunch in a term.

Comparing probabilities/expected values found by theory and experiment/simulation

The probability of my forgetting to pack my lunch is $\frac{1}{5}$. Calculate the number of times I can expect to forget my lunch in a term (50 days). Set up and run a simulation using random numbers to model this problem. Compare the theoretical and experimental values you have found for the expected number of times I will forget my lunch in a term.

This activity may be carried out with step by step guidance, or by allowing the student to follow their own method of solution. The approach should be chosen in sympathy with students' skills and depth of understanding.

Activity:

At the local hockey grounds, there are four fields, with one of the four being brand new artificial turf. The allocation of fields to play on for the draw in a ten round competition is random.

How many games would a team expect to play on the new turf?

Use random numbers to set up a simulation of this problem.
Comment on the results of your simulation.



The conceptual approach

The student is able to run a probability simulation, and to calculate using a theoretical probability, to find an expected value and to compare the results of the two methods.

Prompts from the teacher could be:

1. Calculate the (theoretical) expected number of games that will the team will play on the turf.
2. Using the random numbers provide, set up a simulation to model this situation.
 - o Choose suitable digits to represent games on the new turf and games on the old.
 - o Decide how many trials you will run.
 - o Find the (experimental) expected number of games that the team will play on the new turf.
3. Compare the values you calculated.

T: Tell me about this "01-25".

S: I have to have 25% of the phone numbers meaning new turf, so since percentage is 100, I used the last two digits, coz there's 100 of them 1 to 99, and 00. I made 1-25 of them new turf.

01 - 25 = new turf

$$1. \quad 25\% = \frac{1}{4} = 0.25$$

$$\times 10 \text{ games}$$

$$= 2.5$$

so expect 2 or 3

T: I see you've said 2 or 3 games.

S: Yeah, coz 2.5 is half way between the two and you won't just get half a game and I didn't want to round.

$$2. \quad 25 \div 10 = 2.5$$

so expect 3 games.

3. Both methods give about the same answer.

T: You've stopped after this number.

S: Yeah, coz that's 100 numbers and I'm looking at ten games so 100 is ten lots of ten games which is easier to divide.

Numbers from telephone book used to obtain random numbers. Note that only the last four digits are random.

455 0999
488 7818
488 1108
488 1499
470 4437
409 3321
455 8907
454 2986
409 5827
453 5336
488 0695
465 8016
489 8906
454 4970
481 1279
454 2258
454 5200
488 3051
455 4301
401 1751
467 2119
473 8888
455 0045
465 7777
473 9950
455 5247
470 1449
467 2528
488 7802
472 7500
OK Simon
155 0448
454 6176
455 5473
455 7389
455 8171
488 8994
455 8522
489 5289
30
454 5683
455 7768
476 1862
453 6754
488 5547
77 1110
489 5058
77
454 2441
465 3705
489 7088
476 1609
470 1575
470 4282
456 1975
456 0050
488 5045
489 776
474 9943
488 7065
476 6577
455 8834
455 7608
454 5278
477 9417
489 6307
477 0057
455 6752
456 0032
454 1436
474 5954
455 0168
451 0300
455 7852
481 1882
467 1725
472 8084
454 143
453 8861
477 779
484 7136
454 4254
489 5239
481 1103
489 2150
453 8883
478 8088
456 2635
455 441
454 6015
488 5311
467 5945
454 6011
454 4119
472 7452
489 8081
489 5146
453 0444
489 1817
455 6726
467 7370
473 6187
475 9579
489 1528
455 7529
457 7888
478 0480
489 6964
471 8078
471 8343
489 6964
478 0009
478 0009
489 1964
454 8256
467 1732
456 3229
455 3005
471 7095
453 5683
488 5405
456 2379
455 7304
477 1459
455 7810
455 7304
476 1700
455 7840
471 0520
454 5449
455 1176
471 0520
454 9818
489 2511
488 3117
472 7467
487 7215
467 8994
486 3054
486 4074
478 7722
454 4588
481 1465
487 7677
454 3349
481 1465
465 7247
489 6788
489 1017
455 1967
478 1570
454 4929
473 8229
477 4657
489 5450
488 3781
473 8567
455 6625
488 8128
456 4804
472 7419
454 1721
454 3823
455 1923
481 0856
476 1195
488 8804
476 3183
476 1195
476 1195
489 2555
453 1209