

Perfect Fundraiser - Teachers' Notes

Curriculum Links:

This problem requires students to work with doubling and halving in a multiplicative way and understand the how this process works proportionally on a set of numbers. It would be appropriate for students working at Level 5 of the curriculum.

Background:

The problem involves understanding how many times a set can be halved in order to reach a target number by eliminating elements of the set through Yes and No questions.

The key to the solution is that 2 to the tenth power is 1,024 (over 1,000). With each of the 10 questions you knock out half the remaining numbers, and after ten questions only the "thought" number is left. You start by eliminating half the numbers and ask "Is the number greater than 500?"

If yes add half as much (+250) and ask again. If no subtract half as much (- 250) and ask again. Repeat 8 more times.

The following is an example of how to reach the target number 860.

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| 1. "Is your number greater than 500?" "Yes." | Add 250. |
| 1. "Greater than 750?" "Yes." | Add 125. |
| 2. "Greater than 875?" "No." | Subtract 62. (not 62.) |
| 3. "Greater than 813?" "Yes." | Add 31. |
| 4. "Greater than 844?" "Yes." | Add 16 (not 15.5). |
| 5. "Greater than 860?" "No." | Subtract 8. |
| 6. "Greater than 852?" "Yes." | Add 4. |
| 7. "Greater than 856?" "Yes." | Add 2. |
| 8. "Greater than 858?" "Yes." | Add 1. |
| 9. "Greater than 859?" "Yes." | BINGO! |

The number is 860.

Suggestions:

Following this investigation, students may be interested in pursuing exploration in one of these areas:

- The Learning Object Squirt at the higher levels supports exploration of complex proportional relationships
<http://www.nzmaths.co.nz/node/1572>
- An in-depth exploration of number and algebra is provided with the support material that goes with each chapter of the novel The Number Devil
<http://www.nzmaths.co.nz/resource/number-devil-mathematical-adventure>