Problem

100 Challenges (Suggested for groups of 2 to 4 students)

For this game, form teams (pairs or small groups); each team needs one die (or number cube) and a score sheet (below).

To play, first roll the die five times and place the resulting five numbers in the five boxes at the top of the score sheet. The goal is to use these five numbers to form as many of the numbers from 1 to 100 as you can, using adding, subtracting, multiplying, dividing, and combining digits. (e.g., a 5 and a 2 could combine to form 52 or 25). Each number you form must use one or more of these five operations. None of the five digits rolled can be used more than once in forming a single number (unless you rolled two of that digit). For example, if you rolled 1, 2, 2, 5, 6, some of the numbers you could form are 1 $(2 - 1)$, 2 (2×1), 3 $(5 - 2)$, 4 $(6 - 2)$, 5 (5×1), 6 (6×1), 7 $(5 + 2)$, 8 $(5 + 2 + 1)$, 12, 21, 25, 52, 65, 22, 60 (12×5), 28 $(56 \div 2)$, $61(5 \times 6 \times 2 + 1)$, etc. As you form the numbers, write how you did it in the space beside that number on the chart. The team that forms the most numbers in a specified time wins the game. (A suitable time could be 20 or 30 minutes.)

SCORE SHEET FOR 100 CHALLENGES

☐   ☐   ☐   ☐   ☐

$= 1$	$= 2$	$= 3$	$= 4$	$= 5$
$= 6$	$= 7$	$= 8$	$= 9$	$= 10$
$= 11$	$= 12$	$= 13$	$= 14$	$= 15$
$= 16$	$= 17$	$= 18$	$= 19$	$= 20$
$= 21$	$= 22$	$= 23$	$= 24$	$= 25$
$= 26$	$= 27$	$= 28$	$= 29$	$= 30$
$= 31$	$= 32$	$= 33$	$= 34$	$= 35$
$= 36$	$= 37$	$= 38$	$= 39$	$= 40$
$= 41$	$= 42$	$= 43$	$= 44$	$= 45$
$= 46$	$= 47$	$= 48$	$= 49$	$= 50$
$= 51$	$= 52$	$= 53$	$= 54$	$= 55$
$= 56$	$= 57$	$= 58$	$= 59$	$= 60$
$= 61$	$= 62$	$= 63$	$= 64$	$= 65$
$= 66$	$= 67$	$= 68$	$= 69$	$= 70$
$= 71$	$= 72$	$= 73$	$= 74$	$= 75$
$= 76$	$= 77$	$= 78$	$= 79$	$= 80$
$= 81$	$= 82$	$= 83$	$= 84$	$= 85$
$= 86$	$= 87$	$= 88$	$= 89$	$= 90$
$= 91$	$= 92$	$= 93$	$= 94$	$= 95$
$= 96$	$= 97$	$= 98$	$= 99$	$= 100$

Hints

Suggestions:

1. Use one (reasonable) starter set of 5 numbers for the whole class. (See the Solutions for one possible starter set.)

2. Work with finding ways to form the numbers 1-20 first, and then seek more possibilities with the students.

3. Offer bonus points for more than one way to get a number.

(See solution below for possible ways to play the game.)

Solution

Two ways to play the game:

1. Set a time limit for the game, suited to your class and the available time. The game could also be used to occupy some students while you are busy with others. Have the teams check each others' work to make sure the operations used are correct.

2. Alternately, play the game as a class. Select a (promising) set of five numbers, and have the whole class work on this. Post the solutions on the bulletin board and have students add to it as they find solutions. Encourage them to check each other's solutions.

Below is a score sheet sample to suggest some possible answers. There are many others.

Note: If you noticed the students slowing down in finding solutions, you may wish to introduce other 'operations'. For example, if you permit a decimal point, then you could write $76 = 56 + (2 \div .1)$, or $85 = 6 \div .1 + 25$ or $16 \div .2 + 5$. Another possibility is to allow squaring (if your starter set contains a 2), so $76 = 5^2 \times (6 \div 2) + 1$ or $(6^2 - 1) \times 2 + 5$.

SAMPLE SCORE SHEET FOR 100 CHALLENGES
$\boxed{1}$ $\boxed{2}$ $\boxed{2}$ $\boxed{5}$ $\boxed{6}$

$2 - 1 = 1$	$2 \times 1 = 2$	$5 - 2 = 3$	$6 - 2 = 4$	$5 \times 1 = 5$
$6 \times 1 = 6$	$5 + 2 = 7$	$5 + 2 + 1 = 8$	$5 + 2 + 2 = 9$	$5 \times 2 = 10$
$(5 \times 2) + 1 = 11$	$(5 \times 2) + 2 = 12$	$(5 \times 2) + 2 + 1 = 13$	$(5 + 2) \times 2 = 14$	$5 \times (2 + 1) = 15$
$6 + 5 + 2 + 2 + 1 = 16$	$15 + 2 = 17$	$6 \times (2 + 1) = 18$	$15 + 2 + 2 = 19$	$16 + 2 \times 2 = 20$
$21 = 21$	$22 = 22$	$22 + 1 = 23$	$25 - 1 = 24$	$25 = 25$
$25 + 1 = 26$	$25 + 2 = 27$	$25 + 2 + 1 = 28$	$(6 \times 5) - 1 = 29$	$6 \times 5 = 30$
$5 \times 6 + 1 = 31$	$5 \times 6 + 2 = 32$	$5 \times 6 + 2 + 1 = 33$	$5 \times 6 + 2 + 2 = 34$	$5 \times 6 + 2 + 2 + 1 = 35$
$6 \times (2 + 1) = 36$	$6 \times (5 + 1) + 2 \div 2 = 37$	$6 \times (5 + 1) + 2 = 38$	$5 \times (6 + 2) - 1 = 39$	$6 \times (5 + 1) + 2 + 2 = 40$
$6 \times (5 + 2) - 1 = 41$	$21 \times 2 = 42$	$6 \times (5 + 2) + 1 = 43$	$6 \times (5 \times 2) + 2 = 44$	$51 - 6 = 45$
$(5 - 1) \times 6 \times 2 - 2 = 46$	$52 - 6 + 1 = 47$	$6 \times (5 + 2 + 1) = 48$	$25 \times 2 - 1 = 49$	$25 \times 2 = 50$
$25 \times 2 + 1 = 51$	$52 \times 1 = 52$	$56 - 2 - 1 = 53$	$56 - 2 = 54$	$56 - 1 = 55$
$56 \times 1 = 56$	$56 + 1 = 57$	$56 + 2 = 58$	$56 + 2 + 1 = 59$	$56 + 2 + 2 = 60$
$56 + 2 + 2 + 1 = 61$	$65 - 2 - 1 = 62$	$65 - 2 = 63$	$65 - 1 = 64$	$65 \times 1 = 65$
$65 + 1 = 66$	$65 + 2 = 67$	$65 + 2 + 1 = 68$	$65 + 2 + 2 = 69$	$65 + 2 + 2 + 1 = 70$
$2 \times (2 + 1) + 65 = 71$	$2 \times 5 + 62 = 72$	$2 \times 5 + 62 + 1 = 73$	$12 \times 6 + 2 = 74$	$6 \times 2 \times 2 + 51 = 75$
$(16 \times 5) - (2 \times 2) = 76$	$56 + 21 = 77$	$56 + 22 = 78$	$56 + 21 + 2 = 79$	$2 \times 12 + 56 = 80$
$(5 \times 2) \times (6 + 2) + 1 = 81$	$16 \times 5 + 2 = 82$	$26 \times (1 + 2) + 5 = 83$	$12 \times (5 + 2) = 84$	$[16 + (2 \div 2)] \times 5 = 85$
$65 + 21 = 86$	$65 + 22 = 87$	$65 + 21 + 2 = 88$	$2 \times 12 + 65 = 89$	$15 \times 6 = 90$
$15 \times 6 + (2 \div 2) = 91$	$122 - (5 \times 6) = 92$	$(26 + 5) \times (2 + 1) = 93$	$(15 \times 6) + 2 + 2 = 94$	$(21 - 2) \times 5 = 95$
$(5 - 1) \times 6 \times 2 \times 2 = 96$	$52 \times 2 - 6 - 1 = 97$	$52 \times 2 - 6 = 98$	$52 \times 2 - 6 + 1 = 99$	$(6 - 1) \times 5 \times 2 \times 2 = 100$