

## The Game of 24

### Materials:

Playing cards. (Incomplete decks are fine.)

### Procedure:

Have pairs or groups of students play together, sitting at a single desk surface.

Deal out 4 cards in the center of the circle face up.

Students must use each card exactly once, combining their face values using addition, subtraction, multiplication, and division to get a result equal to 24.

For example, we can make 24 with the cards 2, 6, 7, and 8 as follows:  $[(8+7) \times 2] - 6$ .

An ace always counts as 1. You can count Jacks, Queens, and Kings as 11, 12, and 13, respectively. For a simpler game, remove the picture cards, or count each as a 6 (a useful number in getting to 24).

### Hints:

It is possible to get 24 about 90% of the time.

If no one sees a solution, let the group choose to replace one card with a card from the deck.

If students need a hint, give them the last step. For example, tell them that the last step is "times 3." This leaves them room to get their own solution, in this case assembling either the 8 or the 3 with the given cards and the allowable operations.

For a competitive situation, award the 'used' cards to the first student who can make 24, and count cards at the end. If a card has been added (because the group deemed the original problem impossible), that card also goes to the winner. If two students answer at the same time, they can split the cards.

For a slightly more formal context, have students write down the arithmetic expression (including parentheses) that shows how to get 24.

### Classroom context:

Students find this game intriguing, and often ask for it. It is a good 'filler' for lessons that don't quite fill the class time. Or, this game can be used to break the tension that might arise from another, more difficult session.

The best way to play this game is in groups of 4-6 students.

A difficulty arises if one or two students are much better than the others, and continually win. One way to handle this is to create an 'advanced' group: if the advanced students play against each other they will gain more for themselves, and will not discourage the others. Another way to handle this situation, depending on personality, is to put the advanced student in charge of deciding whether it is possible to get 24, or of giving students the 'last operation' hint.