Warm-up Activities for Grade 7s

Mark Rushby

Sweet Valley Primary School, Bergvliet, Cape Town

deputy@sweetvalleyprimary.co.za

As teachers, we are usually keen to get into the day's Mathematics lesson for a particular class right from the outset, often forgetting that pupils have typically just been engaged with a different subject and as such may need a little time to make the mental transition to the Mathematics classroom. A warm-up activity at the start of a Mathematics lesson is often a good way to help pupils make this transition. What follows are a number of activities that I have found work well with Grade 7 pupils.

FOUR 4S

Once the Grade 7s have been exposed to square roots and exponents, the well known "four 4s" challenge makes an excellent warm-up activity. The "four 4s" problem requires pupils to find mathematical expressions for as many whole numbers as possible using four 4s each time along with any of the symbols $+$, $-$, $\times$, $\div$, $\sqrt{\ }$, ! and brackets. Fours may be 'joined', for example to make 44, and the symbols may be used as many times as you like. Although most Grade 7s will be unfamiliar with factorial notation, it is a simple matter to explain how the factorial symbol operates [$n! = n \times (n-1) \times (n-2) \times \ldots \times 3 \times 2 \times 1$]. While some variations of the "four 4s" problem allow the use of the decimal point, I generally ignore this option.

Examples of expressions for the first four whole numbers are shown below, although there are certainly many other possibilities:

$$1 = \frac{4}{4} \times \frac{4}{4} \qquad 2 = \frac{4}{4} + \frac{4}{4} \qquad 3 = \frac{4+4+4}{4} \qquad 4 = 4^{\sqrt{4}} \div \sqrt{4} \div \sqrt{4}$$

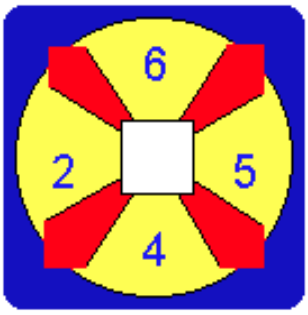
One way to use the "four 4s" problem as a warm-up activity is to challenge pupils to find as many different expressions as possible for a given whole number. By way of example, 2 can be expressed in the following different ways:

$$\frac{4}{4} + \frac{4}{4} \qquad \frac{4^{\sqrt{4}}}{4+4} \qquad 4 \times (4-4) + \sqrt{4} \qquad \frac{4!}{4} - \sqrt{4 \times 4}$$

I have used the "four 4s" problem every year for many years, and pupils have found the activity both accessible and enjoyable. This is a great warm-up activity for mixed ability classes.

MAKE 24

Having spent some time on the "four 4s" problem it is an easy transition to "make 24" using four given numbers, with the same rules as for the "four 4s" problem. It is easy enough to find examples of "make 24" cards on the internet, such as that shown alongside. Some pupils get very good at this activity and come up with some quite spectacular solutions. The following solutions for the card alongside were all generated by Grade 7 pupils in a warm-up activity:



$$2^5 - 6 - \sqrt{4} \qquad 6! \div 5 \div (4+2) \qquad [5-(6-2) \div 4]!$$

$$5! \div (6+4) \times 2 \qquad 6! \div 5! \times 2 \times \sqrt{4} \qquad \sqrt{6! - 5! - (\sqrt{4}+2)!}$$

After about 10 minutes into the problem I invite pupils to write their solutions on the board in order to generate a class discussion around the various proposed solutions.

Rather than using prepared cards, one can simply present pupils with four random digits and challenge them to come up with ways of arriving at an answer of 24. While we obviously haven't exhausted all the possibilities, no combination of digits has yet stumped any of my classes. I thought that finding expressions for the odd numbers from 1 to 29 using the four digits 2, 4, 6 and 8 might prove difficult, but the pupils rose to the challenge without any problem.

In their final examination of 2012 I put in the following problem:

> Using the digits 2, 4, 7 and 9, and any of the operations $+$, $-$, $\times$, $\div$, $\sqrt{\ }$, $!$ and brackets, find five different expressions each equal to 1. In each case, each of the digits may be used only once. The digits may be joined to form larger numbers, e.g. 47.

I thought that this would be a good challenge for the Grade 7s, but I clearly underestimated them! Not only did a fair number of pupils provide five correct solutions, but the variety and ingenuity of some of the solutions was quite amazing. I list below all the different correct solutions that were generated as an illustration of how accessible, with practice, this sort of problem is to all Grade 7 pupils.

$24 \div \sqrt{9} - 7$	$9 - (7-4)! - 2$	$(4+7-9) \div 2$	$\frac{9-7}{4-2}$
$\frac{9-4+2}{7}$	$\frac{9-7+2}{4}$	$\frac{7+4}{9+2}$	$\frac{9}{7-4} - 2$
$\frac{2^4-9}{7}$	$7 \times 2 - 9 - 4$	$\frac{4^2}{9+7}$	$29 - 4 \times 7$
$2 - \frac{\sqrt{7+9}}{4}$	$\frac{7^2}{49}$	$2 \times 9 + 7 - 4!$	$\sqrt{9}! \times 2 - (4+7)$
$\frac{\sqrt{9}+7}{2} - 4$	$\frac{7-\sqrt{9}-\sqrt{4}}{2}$	$\frac{7+4-2}{9}$	$\frac{4^2-7}{9}$
$2 - \frac{7}{4+\sqrt{9}}$	$4 - \frac{27}{9}$	$(7-4)! - \sqrt{9} - 2$	$\frac{7-2}{\sqrt{4}+\sqrt{9}}$
$\frac{4!-\sqrt{9}}{7} - 2$	$7 - \sqrt{9 \times 2 \times \sqrt{4}}$		

CONCLUDING COMMENTS

At the start of the year, many pupils are likely to write something like $7 + 4 = 11$, $9 + 2 = 11$, $11 \div 11 = 1$ rather than $1 = (7 + 4) \div (9 + 2)$. The activities discussed in this article have the added benefit of allowing the order of operations and the use of brackets to be continuously reinforced, thus encouraging pupils to write expressions succinctly and correctly.

It has been my experience that pupils respond really positively to the types of open-ended problems described here, and in addition to serving as good warm-up activities I have found they contribute substantially to pupils' enjoyment of the subject.