

CONQUERING FRACTIONS, IN GRADE 8 AND 9, WITH THE HELP OF A CASIO SCIENTIFIC CALCULATOR

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1. Introduction

It is important to note that research is showing that

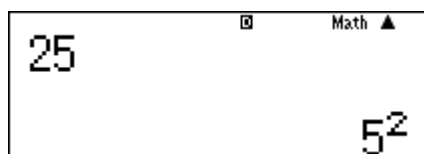
- learners of the age 13 – 15 years are struggling with Mathematics across the world,
- using a calculator does not have a negative influence on learners Mathematics proficiency.

The scientific calculator should be seen as a tool to support our teaching of fractions.

2. Prime Factors

Dividing numbers in prime factors is a very important skill we need to understand fractions.





Activity 1

Find the prime factors of:

- 256
- 36
- 9
- 32 400
- 2 835
- 105

Activity 2

Use the “factor” facility on your calculator and write 32 400 as the product of 5 different pairs of products.

Activity 3

Use the “factor” facility on your calculator and find common factors of the following:

- i. 12; 32 and 48
- ii. 36 and 54
- iii. 35; 63 and 84
- iv. 24; 36 and 48
- v. 25; 35 and 45
- vi. 36; 54 and 90

Activity 4

Use the “factor” facility on your calculator and find the highest common factor of the following:

- i. 12; 32 and 48
- ii. 36 and 54
- iii. 35; 63 and 84
- iv. 24; 36 and 48
- v. 25; 35 and 45
- vi. 36; 54 and 90

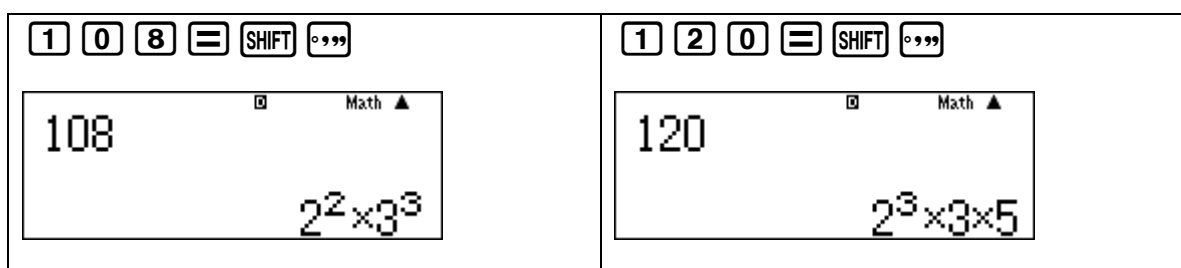
Activity 5

Use the “factor” facility on your calculator and find the lowest common multiple of

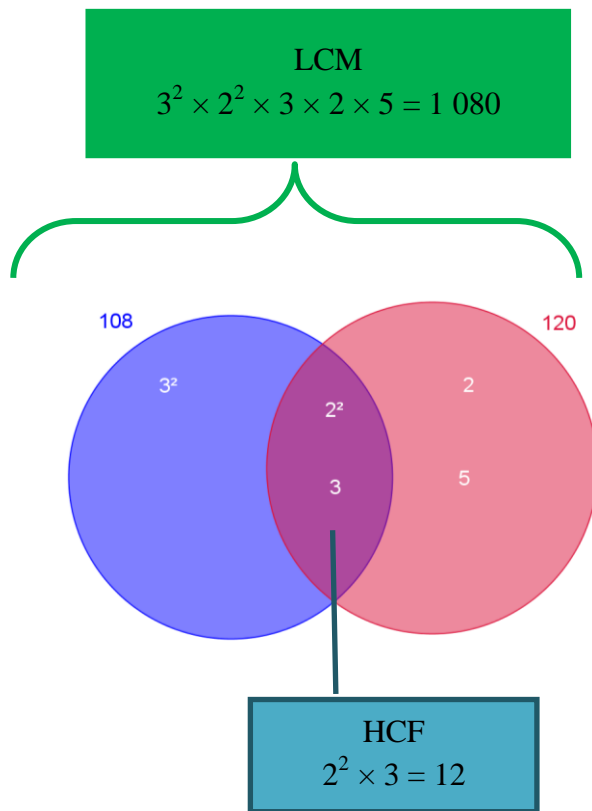
- i. 12; 32 and 48
- ii. 36 and 54
- iii. 35; 63 and 84
- iv. 24; 36 and 48
- v. 25; 35 and 45
- vi. 36; 54 and 90

An interesting look at HCF and LCM

Consider the numbers 108 and 120.



Organising the factors with the use of a Venn diagram will result into this:

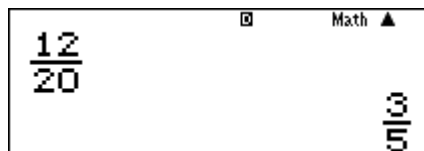


3. Simplification of fractions

When we simplify a fraction we divide (please note – we do not cancel) with a common factor. Using the calculator will do this for us, but we can still assist the learners to understand the process.

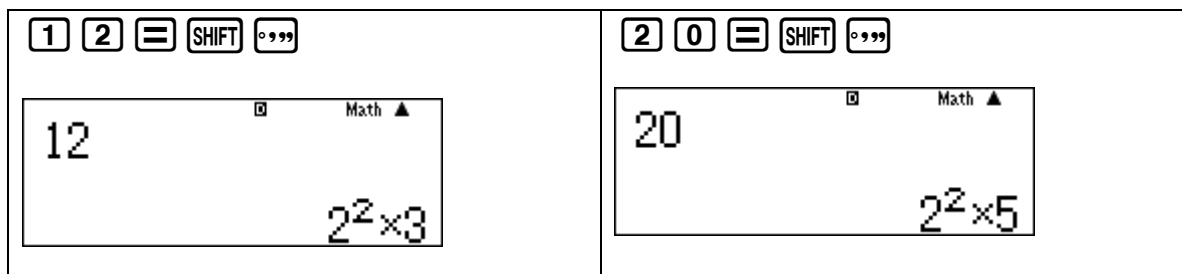
Simplify $\frac{12}{20}$

1 2 2 0



So how can we assist the understanding of what happened?

- Write each of the numbers as the product of prime factors.
- Find the largest common factor.
- Divide out.



$$\frac{12}{20} = \frac{2 \times 2 \times 3}{2 \times 2 \times 5} = \frac{4 \times 3}{4 \times 5} = \frac{4}{4} \times \frac{3}{5} = 1 \times \frac{3}{5} = \frac{3}{5}$$

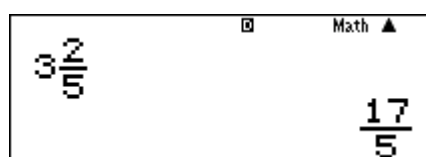
Activity 6

Use your calculator to simplify the following fractions. Then use the factor facility to explain how the calculator got the answer.

- $\frac{6}{8}$
- $\frac{12}{32}$
- $\frac{24}{32}$
- $\frac{36}{60}$
- $\frac{45}{60}$
- $\frac{45}{75}$

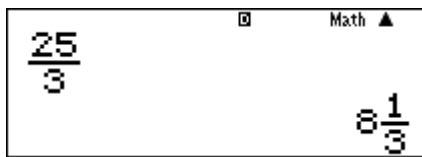
4. Writing mixed numbers as improper fractions and vice versa.

As we all know this is a regular question in the Grade 8 and 9 question papers.



And the other way around

2 **5** **□** **3** **=** **SHIFT** **□**



Activity 7

Write the following as improper fractions:

- i. $8\frac{1}{3}$
- ii. $3\frac{3}{8}$
- iii. $1\frac{5}{6}$
- iv. $1\frac{19}{32}$

Write the following as mixed numbers:

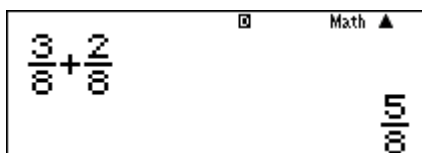
- v. $\frac{13}{5}$
- vi. $\frac{22}{6}$
- vii. $\frac{50}{3}$

5. Adding and subtraction of fractions

When fractions have the same denominator the fractions can be added and subtracted easily and then simplified.

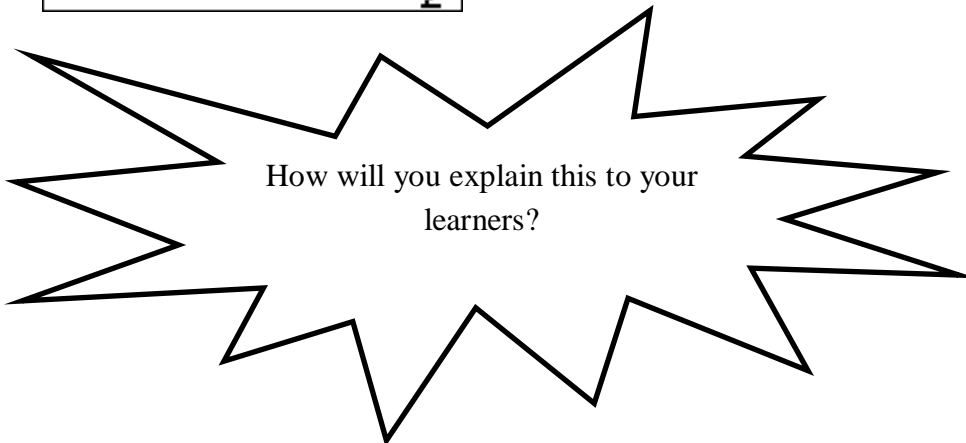
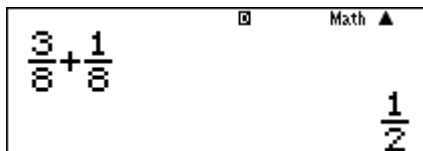
When we have $\frac{3}{8} + \frac{2}{8}$ the answer will be $\frac{5}{8}$.

3 **□** **8** **▶** **+** **2** **□** **8** **▶** **=**



Where the question is $\frac{3}{8} + \frac{1}{8}$ the calculator will not answer $\frac{4}{8}$, but will provide the simplified answer immediately.

3 $\frac{\square}{\square}$ 8 \rightarrow + 1 $\frac{\square}{\square}$ 8 =

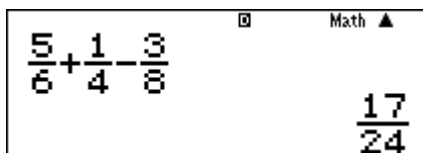


We know, however, that most of the time the questions in Grade 8 and 9 are more difficult. We need to embrace the calculator, but support the learners' thinking by asking them to explain what they think the calculator did.

Let us consider the question

$$\frac{5}{6} + \frac{1}{4} - \frac{3}{8}$$

5 $\frac{\square}{\square}$ 6 \rightarrow + 1 $\frac{\square}{\square}$ 4 \rightarrow - 3 $\frac{\square}{\square}$ 8 =



If we look at the answer we see that the answer has a denominator of 24. We ask ourselves if 24 is a common denominator of the three fractions – and in this case it is. We now have to write each of the fractions with denominator 24 and then find out how the calculator got the answer. (If learners are not sure about the LCM let them use the calculator to find it).

$$\begin{aligned} & \frac{5}{6} + \frac{1}{4} - \frac{3}{8} \\ &= \frac{5}{6} \times \frac{4}{4} + \frac{1}{4} \times \frac{6}{6} - \frac{3}{8} \times \frac{3}{3} \\ &= \frac{20}{24} + \frac{6}{24} - \frac{9}{24} \\ &= \frac{17}{24} \end{aligned}$$

Let us consider $\frac{2}{3} + \frac{5}{6} - \frac{1}{8}$. The calculator provides us with the answer $\frac{11}{8}$. The question we ask ourselves is “Is 8 a common multiple of 3, 6 and 8?” and the answer of course is no! So what happened?

We determine the lowest common denominator of 3, 6 and 8 and find out that it is 24. We change the answer $\frac{11}{8} \times \frac{3}{3} = \frac{33}{24}$. Now the learner can work on the question and change the fractions to all have the common denominator of 24. They can use the calculator to check if the fraction they get is indeed the equivalent fraction.

$$\begin{aligned} & \frac{2}{3} + \frac{5}{6} - \frac{1}{8} \\ &= \frac{2}{3} \times \frac{8}{8} + \frac{5}{6} \times \frac{4}{4} - \frac{1}{8} \times \frac{3}{3} \\ &= \frac{16}{24} + \frac{20}{24} - \frac{3}{24} \\ &= \frac{33}{24} \end{aligned}$$

Activity 8

Use your calculator to find the answer of the following. Then

- Check if the denominator of the answer is the LCM of all the denominators
- Explain how the calculator got the answer

i. $\frac{1}{3} + \frac{1}{4}$

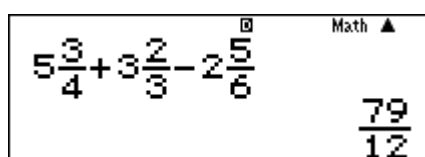
ii. $\frac{1}{6} + \frac{2}{5}$

iii. $\frac{3}{16} + \frac{5}{32}$

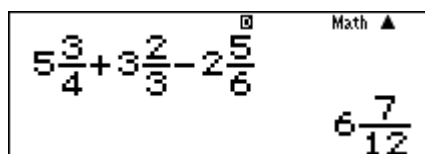
iv. $\frac{13}{16} + \frac{1}{4} - \frac{3}{8}$

We also need to simplify problems using mixed numbers. Again we are going to use the calculator to find the answer and then the learners will have to explain what the calculator did.

$$5\frac{3}{4} + 3\frac{2}{3} - 2\frac{5}{6}$$



The answer is given as an improper fraction and by convention we provide the answer as a mixed fraction.



Now that we have the answer we need to explain what the calculator did.

12 is the LCM of 4, 3 and 6.

$$\begin{aligned} &5\frac{3}{4} + 3\frac{2}{3} - 2\frac{5}{6} \\ &= \frac{23}{4} + \frac{11}{3} - \frac{17}{6} \\ &= \frac{23}{4} \times \frac{3}{3} + \frac{11}{3} \times \frac{4}{4} - \frac{17}{6} \times \frac{2}{2} \\ &= \frac{69}{12} + \frac{44}{12} - \frac{34}{12} \\ &= \frac{79}{12} \end{aligned}$$

Activity 9

Use your calculator to find the answer of the following. Then explain how the calculator got the answer.

- i. $2\frac{2}{3} + 3\frac{1}{4} + 4\frac{1}{6}$
- ii. $5\frac{1}{16} + 3\frac{3}{8} + 8\frac{1}{4}$
- iii. $1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4}$
- iv. $6\frac{1}{4} - 3\frac{1}{3} - \frac{5}{6}$

6. Use of brackets

Activity 10

Use your calculator to find the answer of the following. Then explain how the calculator got the answer.

- i. $1 - \left(\frac{1}{2} - \frac{1}{3}\right)$
- ii. $8\frac{1}{2} - \left(5\frac{1}{3} - 2\frac{3}{4}\right)$
- iii. $\left(\frac{11}{12} - \frac{3}{8}\right) + \frac{3}{4} - \left(\frac{7}{12} - \frac{1}{3}\right)$

7. Multiplication of fractions

When we multiply the algorithm $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$ applies. The calculator applies the algorithm and then (of course) simplifies the answer.

Activity 11

Use your calculator to find the answer of the following. Then explain how the calculator got the answer.

- i. $\frac{2}{3} \times \frac{3}{4}$
- ii. $\frac{3}{8} \times \frac{4}{9}$
- iii. $\frac{3}{4} \times \frac{7}{13}$

When the question includes a mixed number, we need to change the mixed number to an improper fraction (very easy with the calculator) so that:

$$\begin{aligned}
& 33\frac{1}{3} \times 3\frac{3}{10} \\
&= \frac{100}{3} \times \frac{33}{10} \\
&= 110
\end{aligned}$$

Activity 12

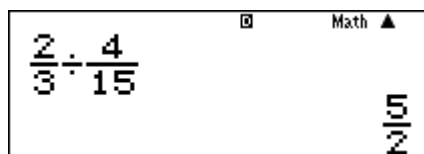
Use your calculator to find the answer of the following. Then explain how the calculator got the answer.

- i. $2\frac{1}{2} \times 3\frac{1}{3}$
- ii. $4\frac{2}{15} \times 37\frac{1}{2}$
- iii. $2\frac{3}{4} \times 8\frac{2}{3}$
- iv. $2\frac{2}{15} \times \frac{9}{64}$

8. Division of fractions

We all know the (infamous) “tip and times” when we are dividing fractions. I would like us to just investigate this for a moment. We yet again work with the LCM of the two denominators (or the lowest common denominator) and the identity element of multiplication (1).

Let us consider $\frac{2}{3} \div \frac{4}{15}$



$$\begin{aligned} \frac{2}{3} \div \frac{4}{15} \\ &= \frac{\frac{2}{3}}{\frac{4}{15}} \\ &= \frac{\frac{2}{3}}{\frac{4}{15}} \times \frac{15}{15} \\ &= \frac{\frac{2}{3} \times 15}{\frac{4}{15} \times 15} \\ &= \frac{10}{4} \\ &= \frac{5}{2} \end{aligned}$$

$$\begin{aligned} \frac{a}{b} \div \frac{c}{d} \\ &= \frac{\frac{a}{b}}{\frac{c}{d}} \\ &= \frac{\frac{a}{b}}{\frac{c}{d}} \times \frac{bd}{bd} \\ &= \frac{\frac{a}{b} \times bd}{\frac{c}{d} \times bd} \\ &= \frac{ad}{cb} \\ &= \frac{a}{b} \times \frac{d}{c} \end{aligned}$$

As with multiplication, mixed numbers are changed to improper fractions

Activity 13

Use your calculator to find the answer of the following. Then explain how the calculator got the answer.

- i. $\frac{1}{3} \div \frac{1}{2}$
- ii. $3 \div \frac{1}{2}$
- iii. $\frac{5}{8} \div \frac{3}{4}$
- iv. $\frac{\frac{1}{2} + \frac{1}{3}}{\frac{1}{3} + \frac{1}{6}}$

Remember – there are two (separate) issues

Teaching for understanding (classwork)

Teaching for results (exams and ANAs)