Problem Solving in Mathematics

Number

Egyptian Fractions

Rewarding Learning

Teacher Notes

Introduction

Pupils can work on this problem individually or with others.

- They can discuss how to add unit fractions to find the required weights.
- They can compare strategies and approaches.

This problem deals with a pupil's ability to add and subtract unit fractions in the context of weight, using multiples, factors and equivalence.

Additional resources
You can find an interactive website for Egyptian fractions at www.mathcats.com

What I know (think)

The pupils should know from the given problem:

- In ancient Egypt, fractions were written as the addition of unit fractions.
- They didn't use the same unit fraction more than once in an addition.
- Asim is a grocer and sells his goods by weight, using deben weights.
- A deben is a unit of weight used by ancient Egyptians.
- Asim has six individual weights.
- A customer has requested seven items.
- They need to work out how to use the weights to measure out each item.

What I need to know (identify)

Pupils need to identify:

- how to use the six weights provided to measure the weight of each of the seven items;
- how to add the unit fraction weights to obtain the fraction weights for the items; and
- whether there is more than one way of using the unit fraction weights, or if there is only one way to find the fraction weight for the items given the weights available.

Egyptian Fractions (Continued)

What I need to do (employ)

For each of the seven fraction weights for the items, pupils could employ strategies such as the following:

$\frac{5}{8}$

- This is the sum of $\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$
- **But** $\frac{1}{8}$ can only be used once
- Take $\frac{1}{8}$ away leaves $\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$ which is $\frac{4}{8}$
- $\frac{4}{8}$ as a unit fraction is $\frac{1}{2}$ – dividing top and bottom by 4
- Therefore, $\frac{5}{8} = \frac{1}{2} + \frac{1}{8}$

$\frac{2}{3}$

- This is the sum of $\frac{1}{3} + \frac{1}{3}$
- **But** $\frac{1}{3}$ can only be used once and Asim has no $\frac{1}{3}$ weight – so $\frac{1}{3}$ can't be used
- $\frac{2}{3}$ is also equivalent to $\frac{4}{6}$ – multiplying top and bottom by two
- $\frac{4}{6}$ is the sum of $\frac{3}{6}$ and $\frac{1}{6}$
- $\frac{3}{6}$ as a unit fraction is $\frac{1}{2}$
- Therefore, $\frac{2}{3} = \frac{1}{2} + \frac{1}{6}$

$\frac{17}{20}$

- Use the factors of the dominator to identify the numerators in the addition
- 20, 10, 5, 2 and 1 are all factors of 20
- 10 + 5 + 2 = 17
- $\frac{10}{20} + \frac{5}{20} + \frac{2}{20} = \frac{17}{20}$
- The equivalent fractions of the addition are $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{10}$
- Therefore, $\frac{17}{20} = \frac{1}{2} + \frac{1}{4} + \frac{1}{10}$

Pupils can use any strategy they think best:

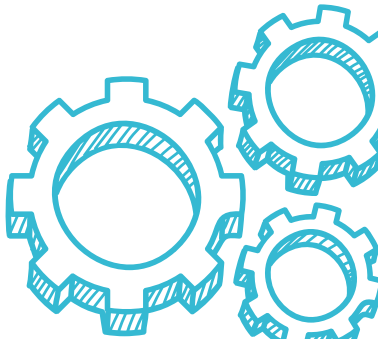
- Some pupils may even be able to work out the unit fractions mentally.
- Some may use pen and paper, but will quickly identify equivalent fractions in their working out process.

Egyptian Fractions (Continued)

What I did (review)

Pupils will use self-assessment, peer assessment or teacher feedback to decide whether they have approached the problem as intended.

- How did they approach the problem and what strategy did they use?
- Could they identify equivalent fractions easily or did they have to work them out?
- Did they check to see if Asim had all the weights in their sums?
- Did they find dominators with a prime number different from those with a composite number?
- Do they think there is a better strategy or did they use the most effective strategy?



Egyptian Fractions (Continued)

Curriculum Objectives

This problem should enable pupils to demonstrate their knowledge, understanding and skills through:

Developing pupils as Contributors to Society	**Explore issues related to Cultural Understanding** • Pupils explore how ancient Egyptians wrote fractions and write given fractions using the Egyptian method.

Thinking Skills and Personal Capabilities

This problem can provide an opportunity for pupils to demonstrate a variety of the following Thinking Skills and Personal Capabilities:

Managing Information	• Plan and set goals and break a task into sub-tasks
Thinking, Problem-Solving and Decision Making	• Sequence, order, classify and make comparisons • Generate possible solutions, try out alternative approaches and evaluate outcomes
Being Creative	• Experiment with ideas and questions • Learn from and value other people's ideas • Challenge the routine method
Working with Others	• Listen actively and share opinions • Suggest ways of improving their approach to working collaboratively
Self-Management	• Seek advice when necessary • Compare their own approach with others' and in different contexts

Cross-Curricular Skills

This problem should enable pupils to demonstrate a variety of the following Cross-Curriculum Skills:

Using Mathematics