

Express GST

Purpose:

The purpose of this task is to engage students in expressing a percentage as a fraction and to be able to apply this as a multiplier.

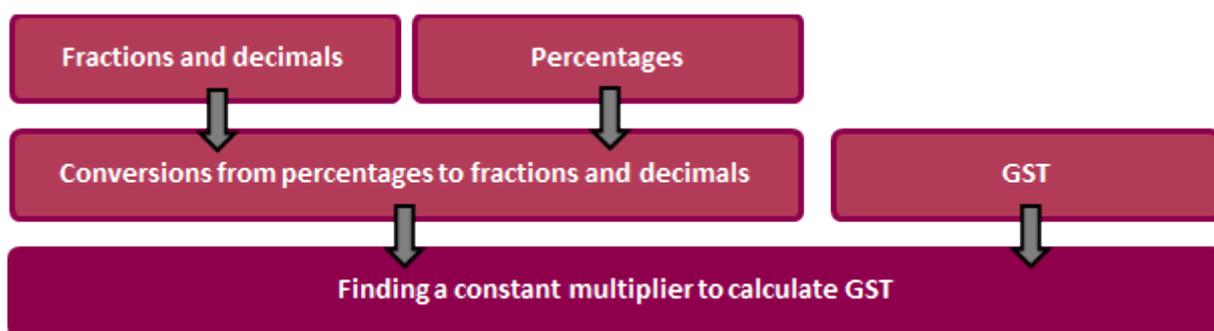
Achievement Objectives:

NA5-5: Know commonly used fraction, decimal, and percentage conversions.

NA5-3: Understand operations on fractions, decimals, percentages, and integers.

Description of mathematics:

This background knowledge and skills that need to be established before and/or during this task are outlined in the diagram below:



This task may be explored using a variety of different numerical explorations. The approach should be chosen in sympathy with their skills and depth of understanding of operations on fractions, decimals and percentages.

Activity:

Task: An old maths worksheet had a 'quick calculation trick' for working out the GST to add to the price of a product. The quick calculation said to multiply the GST exclusive price by $11/10$.

Was this quick calculation for when GST was, 10%, 12.5% or 15%?

What would the fractions be for quick calculations for each GST value; 10%, 12.5% or 15%?



The procedural approach

The student is able to express a GST inclusive price as a product of the exclusive price and a decimal.

Prompts from the teacher could be:

1. To find which GST corresponds with $11/10$, try working out the GST on a particular price, such as \$20 and see which agrees with multiplying \$20 by $11/10$.
2. The multiplier could be a decimal instead of a fraction.
3. To find a multiplier for each the remaining GST values, look at working back through the steps you took in part (1).

a) Price \$20 with GST 10% = 0.1
 $20 + 0.1 \times 20 = 22$
GST 12% = 0.125
 $20 + 0.125 \times 20 = 22.50$
GST 15% = 0.15
 $20 + 0.15 \times 20 = 23$

$\$20 \times \frac{11}{10} = \frac{220}{10} = 22$ so $\frac{11}{10}$ is for 10%.

b) $\frac{11}{10}$ as a decimal: 1.1x
adding 10% GST to \$20 $20 + 0.1 \times 20 = 1.1 \times 20 = 22$
 12.5% GST $\rightarrow 1.125x$ $20 + 0.125 \times 20 = 1.125 \times 20 = 22.50$
 15% GST $\rightarrow 1.15x$ $20 + 0.15 \times 20 = 1.15 \times 20 = 23$

T: These arrows show your thinking. Can you tell me about them?

S: I looked at how I worked out \$22 from the whole \$20 and 0.1 of it and thought it's the same as one and point one, or 1.1 times the \$20.

The conceptual approach

The student is able to express a GST inclusive price as a product of the exclusive price and an improper fraction.

A prompt from the teacher could be:

- Think of GST as a fraction, to be added to the whole price.

a) Gst at $\frac{11}{10} \times \text{Price}$: $\frac{11}{10} = \frac{110}{100} = 110\%$
 $= 100\% + 10\%$
So $\frac{11}{10}$ is the multiplier for 10% Gst

b) $10\% \rightarrow \frac{11}{10} \times \text{price}$

$12.5\% \rightarrow 100\% + 12.5\% = 112.5\%$
 $= \frac{112.5}{100} = \frac{1125}{1000} \begin{array}{l} \div 5 \\ \div 5 \end{array}$
 $= \frac{225}{200} \begin{array}{l} \div 5 \\ \div 5 \end{array}$
 $= \frac{45}{40} \begin{array}{l} \div 5 \\ \div 5 \end{array}$
 $= \frac{9}{8}$

T: Tell me about this arrow.

S: I mean take that GST percentage and add it to the whole amount and what you get is ... what's after the arrow.

So $12.5\% \rightarrow \frac{9}{8} \times \text{price}$

$15\% \rightarrow 115\% = \frac{115}{100} \begin{array}{l} \div 5 \\ \div 5 \end{array} = \frac{23}{20}$

So $15\% \rightarrow \frac{23}{20} \times \text{price}$

T: I like this clear setting out of your working. Why did you decide on so many steps?

S: I had to do lots of steps because I was in percentages and my first fraction had a decimal, but if I did one thing at a time I eventually got a nice fraction.