

## Estimating and Approximation

If you don't have a calculator to hand you are unlikely to be able to work out the value of

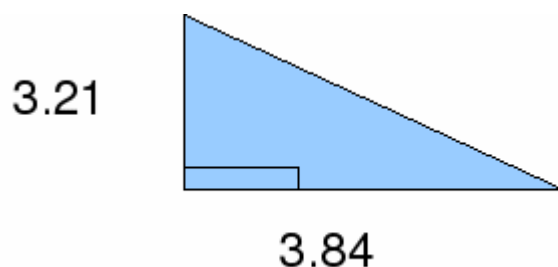
$$\frac{(2.01^3 - 4.02)}{(3.08 - 0.99)}$$

but a lot of the time this is not necessary. You may only really need to find an answer to the nearest whole number. If this is the case you would actually work out, without the aid of a calculator,

$$\frac{(2^3 - 4)}{(3 - 1)} = \frac{(8 - 4)}{2} = \frac{4}{2} = 2$$

For many of these calculations you don't even have paper. You need to give an instant answer and must work out the answer mentally.

For example to estimate  $8.67 * 3.23$  you could do  $9 * 3 = 27$ . You only need to know the 9 times table for this. Frankly to answer these question you can never be inaccurate enough. Sometimes these help to to check the answers to actual calculations done with the aid of a calculator.



We could use Pythagoras theorem to find the exact length of the hypotenuse, the longest side in the right angled triangle above.

$$a^2 + b^2 = c^2$$

$$c = \sqrt{(a^2 + b^2)} = \sqrt{(3.21^2 + 3.84^2)} = 5.004967532$$

To check the calculation we could find

$$c = \sqrt{(3^2 + 4^2)} = \sqrt{(25)} = 5$$

Example:

Estimate  $(4.98^2 - 5.2) * (5.9 - 2.1)$

We work out  $(5^2 - 5) * (6 - 2) = (25 - 5) * (6 - 2) = 20 * 4 = 80$

Example

Estimate  $\frac{(9.81^2 + 10.2)}{(7.8 + 3.1)}$

We work out  $\frac{(10^2 + 10)}{(8 + 3)} = \frac{(100 + 10)}{11} = \frac{110}{11} = 10$