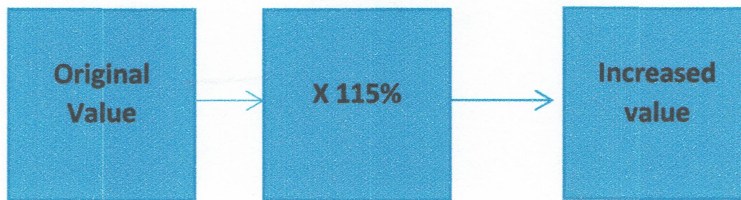# Percentage Change

Percentage Increase & Decrease

- Always treat the original quantity as 100%
- When a quantity has been **_increased_** by a given percentage, the outcome is **_larger_** than the original.
- So if a quantity has been increased by 15%, it becomes 100% + 15% = 115% of the original amount.

Original Value	→	X 115%	→	Increased value

- Your Casio calculator has a % button, above the (button. So to increase £120 by 15% you would type:

% multiplier $100 + 15 = 115\%$

$120 \times 115\% = £138$

- When a quantity has been **_decreased_** by a given percentage, the outcome is **_smaller_** than the original.
- So if a quantity has been decreased by 12%, it becomes 100% - 12% = 88% of the original amount.

Original Value	→	X 88%	→	Decreased value
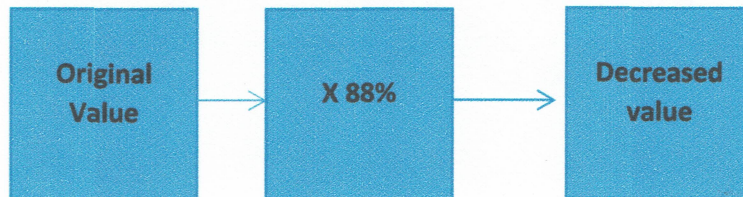
- So to decrease 245kg by 12% you would type:

% multiplier $100 - 12 = 88\%$

$245 \times 88\% = 215 \cdot 6 \text{ kg}$

Intermediate Tier Numeracy PPQs

1.

(a) *You will be assessed on the quality of your organisation, communication and accuracy in writing in this part of the question.*

Gemma bought a tablet last year for £240.
She sold it to a friend after a year for 35% less than she paid for it.

She sees a new tablet on sale for £365 with a special offer of '20% off'.
Gemma decides to use the money she has from selling her old tablet towards buying this new one.

How much extra will Gemma have to pay towards the new tablet using the special offer?
You must show all your working $(\%\text{ multiplier} = 100 - 35 = 65\%)$ **[8]**

Money she gets from selling $= 240 \times 65\% = £156$

$(\%\text{ Multiplier} = 100 - 20 = 80\%)$

Money she needs for new tablet $= 365 \times 80\% = £292$

So Gemma will need an extra $292 - 156 = £136$

2. Jane and Tomos own a sandwich business.

(a) They decide to price sandwiches individually each morning.
At 3 p.m. any unsold sandwiches are reduced by 45%.
Any sandwiches still unsold by 4:30p.m. are reduced by a further 20%.

Jane says

> Why not reduce sandwiches by 65% at 4:30p.m.;
> it works out the same.

Tomos disagrees with Jane.

Using multipliers, show that Jane is incorrect. **[4]**

If a sandwich costs £2

@ 3pm it costs $2 \times 55\% = £1.10$

@ 4:30 it costs $1.10 \times 80\% = £0.88$

Same sandwich with one 65% reduction will cost

$£2 \times 35\% = £0.70$

Prices are different, so Jane is incorrect.

Reverse Percentages (Grade B)

At Intermediate Tier you need to look carefully at the information in a question to see if you are being to find the increased/decreased value (Grade E/D) or being asked to **find the original amount** following an increase/decrease

Once this has been spotted, the solution is straightforward using the reverse number machine idea:

- **In a sale, a pair of jeans has been reduced by 20%. If the sale price was £64, how much were the jeans to buy before the sale?**
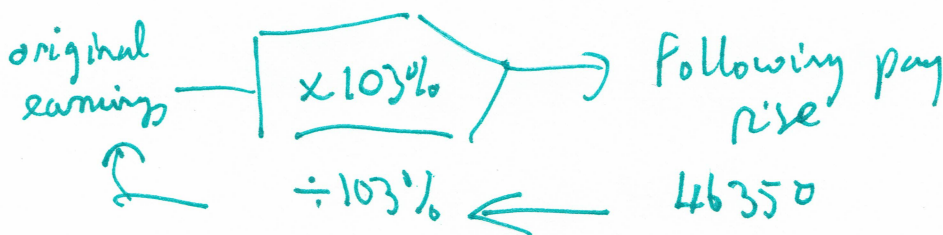
% multiplier = $100 - 20 = 80\%$.

original Cost ———| $\times 80\%$ |———→ reduced price

$\div 80\%$ ———←——— $£64$
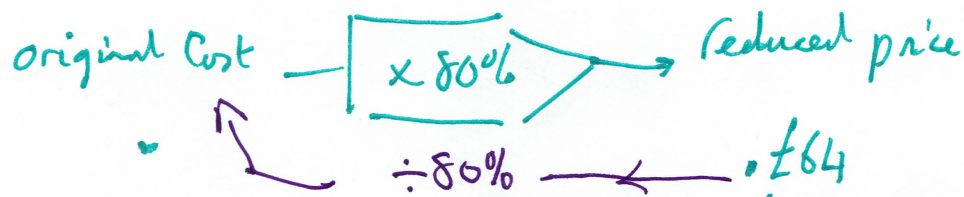
So original cost $= 64 \div 80\% = £80$

- **Following a 3% pay rise, Sally ~~was~~ *is now* earning £46 350 pa. How much was she earning before the increase?**

% multiplier $= 100 + 3 = 103\%$

original earnings ———| $\times 103\%$ |———→ Following pay rise

$\div 103\%$ ———←——— 46350

$46350 \div 103\% = £45000$

Intermediate Tier Numeracy PPQ

3. *(b)* The television was reduced in the sale by 26% of its original price.
It cost Marta £710.40 in the sale.
What was the original price of the television? [2]

$$710.40 \div 74\% = 960$$

Original price £ __960.__

Compound Percentages (Grade B)

- If a quantity is being repeatedly increased/decreased over time, for example money earning annual interest payments in a bank account or a car losing value as it gets older, then the

% multiplier is raised to the power of the time period

Sounds complicated, but it isn't!

- **A bank pays 1.8% pa interest on its savings accounts. If I pay £10 000 into the account, how much will it be worth in 8 years?**

% multiplier = $100 + 1.8 = 101.8\%$

1 yr = $10000 \times 101.8\%$
$\times 101.8\%$
$\times 101.8\%$
$\times 101.8\%$
$\times 101.8\%$
$\times 101.8\%$
$\times 101.8\%$
8th yr = $\times 101.8\%$

$10000 \times (101.8\%)^8$

$= £11534.06$

- **A new car loses 19% of its value during the first year and 5% per year thereafter. Calculate the value of a car after 10 years that cost £30 000 when new.**

1st yr multiplier $= 100 - 19\% = 81\%$

other years $= 100 - 5 = 95\%$

$30\,000 \times (81\%)^1 \times (95\%)^9 = 15\,315.06$

Intermediate Tier Numeracy PPQs

4.   Carys decides to invest £380 in a savings account for 6 years. The account pays a rate of 2·54% AER.

   Will Carys have sufficient money in her savings account to be able to buy a motor scooter costing £460 in 6 years' time? You must show all your working and give a reason for your answer.   [4]

% multiplier $= 100 + 2.54 = 102.54\%$

$380 \times (102.54\%)^6 = £441.72$ in her account after 6 years.

No she doesn't she is $460 - 441.72 = £18.28$ short

5. The price of softwood changes each year.
   The price has increased by 6% per annum for each of the last 5 years.
   Before this, the price had decreased by 2% per annum.
   Seven years ago the price of softwood was £34 per m^3.

   Calculate the current price of softwood. [3]

   Multiplier #1 = 100 + 6 = 106%
   Multiplier #2 = 100 - 2 = 98%.

   $34 \times (106\%)^5 \times (98\%)^2 = £43.70$

6.

Mali's scooter depreciated (decreased) in value by 24% in the **first** year.
In all further years, her scooter depreciated by 13% of its previous year's value.
She originally paid £850 for her scooter.
Calculate the value of Mali's scooter after 7 years. [3]

$850 \times (76\%)^1 \times (87\%)^6 = £280.12.$

After 7 years, the value of Mali's scooter was £ ....