Q07, recounting from tens to icons

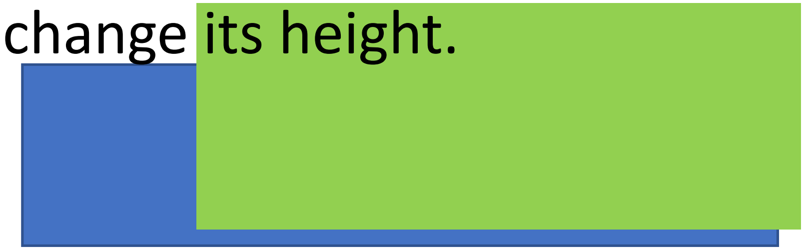
"How to change unit from tens to icons?"

Asking 'T = 2.4 **tens** = 24 = ? **8s**', we just recount 24 in **8s**:

T = 24 = (24/8)x8 = 3x8 = 3 **8s.**

Formulated as an **equation** we use ***u*** for the unknown number, ***u***x8 = 24.
Recounting 24 in 8s shows that ***u*** is 24/8.
So, equations are solved by moving
to opposite side - with opposite sign

To keep its size, a block changing its unit must also change its height.



T = 2.4 **tens** = 3 **8s**

$$\boldsymbol{u} \text{ x } 8 = 24 = (24/8)\text{x}8$$
$$\boldsymbol{u} = 24/8 = 3$$

Q8, recounting from icons to tens (multiplication) 3 **7s** = ? **tens**

"How to change unit from icons to tens?"

Asking 'T = 3 **7s** = ? **tens**', the recount-formula cannot be used since the calculator has no ten-button. However, it gives the answer directly by using multiplication alone: T = 3 **7s** = 3x7 = 21 = 2.1 **tens**, only it leaves out the unit and the decimal point.

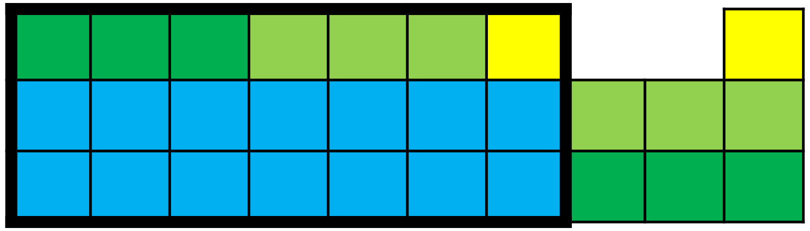
Alternatively, we may use 'less-numbers', so 7 = **ten** less 3

T = 3x7 = 3 x (**ten** less 3) = 3 x **ten** less 3x3 = 3**ten** less 9 = 2**ten**1 = 21,

or with 9 = **ten** less 1:

T = 3**ten** less (**ten** less1) = 2**ten** lessless 1 = 2**ten** & 1 = 21.

showing that 'lessless' cancel out

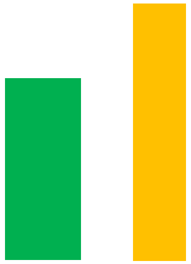


MATHeCADEMY

Recounting large numbers in or from tens:
same size, but new form

Recounting 6 **47s** in **tens** | Recounting 476 in **7s**

*BundleWriting seprates **INSIDE** bundles from **OUTSIDE** singles*

T = 6 x 47 = 6 x 4B7	T = 476 = 47.6 **tens**
= 24B42	= 47B6
= 28B2	= 42B56
= 28.2 **tens**	= 6x7B8x7
	= 68 x 7
	

Q09, ReCounting sides in a block: Trigonometry

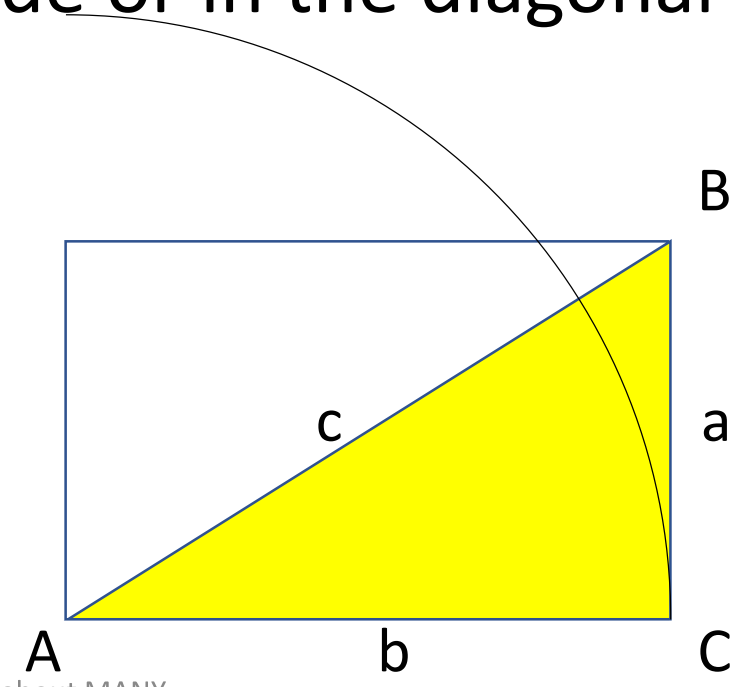
A right triangle is a block halved by its diagonal giving 3 sides: base b, height a and diagonal c connected with the angles when recounting one side in the other side or in the diagonal

$a = (a/c)*c = \sin A \; * c$

$b = (b/c)*c = \cos A * c$

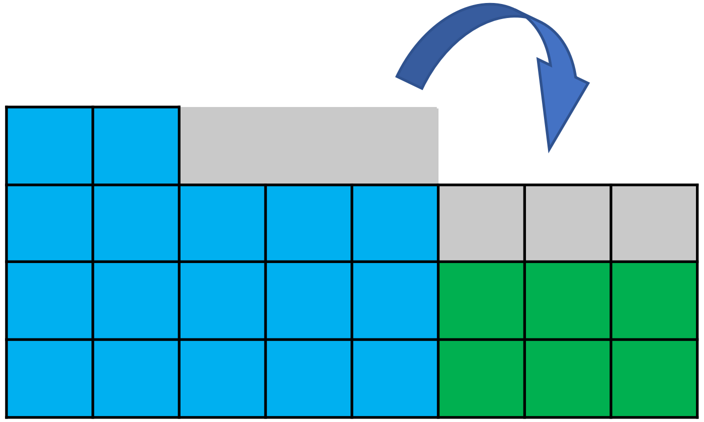
$\tan A = a/b = \Delta y/\Delta x = \text{gradient}$

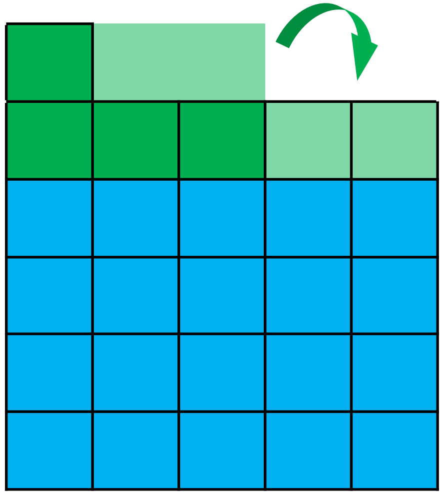
Circle: circum./diam. = $\pi \approx$ **n*tan(180/n)** for n large



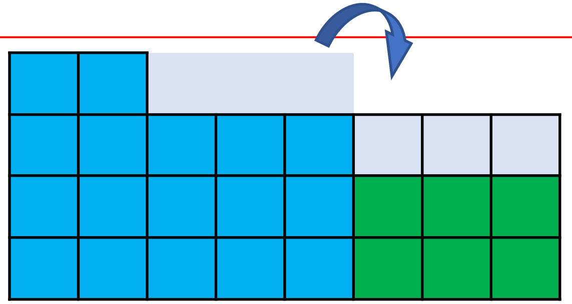
Once counted & recounted, Totals can be added

BUT: NextTo	**or OnTop**
4 5s + 2 3s = 3B2 8s	4 5s + 2 3s = 4 5s + 1B1 5s = 5B1 5s
The areas are integrated *Adding areas = Integration*	The units are changed to be the same *Change unit = Proportionality*





Q11, next-to addition



"With T1 = 4 **5s** and T2 = 2 **3s**, what is T1+T2 when added next-to as **8s**?"

Outside, next-to addition geometrically means adding areas.
Next-to addition is also called integral calculus.

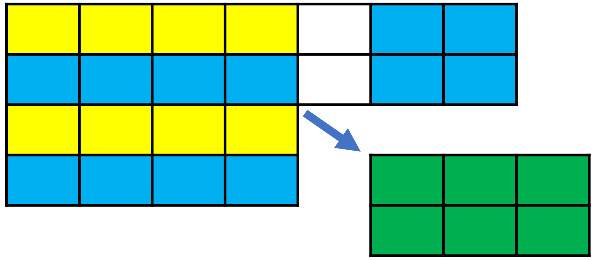
Inside, the recount formula algebraically predicts the result.
Here multiplication precedes addition.

T = (T/**B**) x **B**

= ((4x5 + 2x3)/8) x 8 = 3.2 **8s**

(4x5 + 2x3)/8	**3.some**
(4x5 + 2x3) – 3x8	**2**

Q12, reversed next-to addition



“If T1 = 2 **3s** and T2 add next-to as 4 **7s**, what is T2?”

Outside, we remove the initial block T1 and recount the rest in **4s**.

Thus reversed next-to addition geometrically means subtracting areas.

Reversed next-to addition is also called differential calculus.

Inside, the recount formula algebraically predicts the result.

Here subtraction precedes division; which is natural as reversed integration.

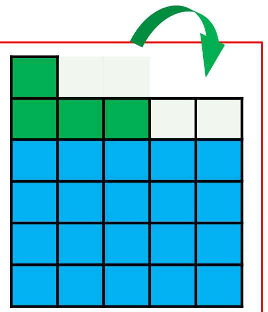
T2 = (T2/**B**) x **B**

= ((4x7 – 2x3)/4) x 4 = 5.2 **4s**

(4x7 – 2x3)/4	**5.some**
(4x7 – 2x3) – 5x4	**2**

MATHeCADEMY

Q13, on-top addition

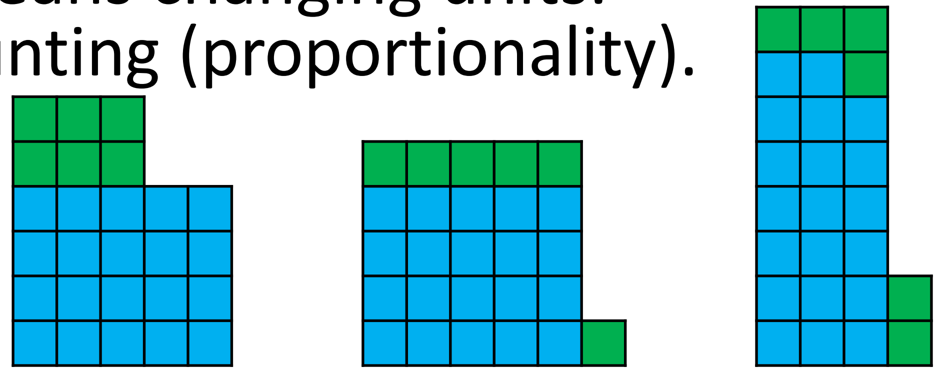


"With T1 = 4 **5s** and T2 = 2 **3s**, what is T1+T2 when added on-top?"

Outside, on-top addition geometrically means changing units.
On-top addition thus often involves recounting (proportionality).

T = 4 **5s** + 2 **3s** = 4 **5s** + 1.1 **5s** = 5.1 **5s**

T = 4 **5s** + 2 **3s** = 6.2 **3s** + 2 **3s** = 8.2 **3s**



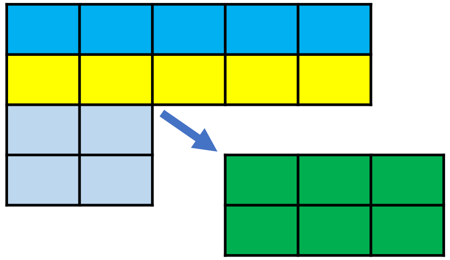
Inside, the recount formula algebraically predicts the result.
Here again, multiplication precedes addition.

T = (T/**B**) x **B**

= ((4x5 + 2x3)/5) x 5 = 5.1 **5s**

(4x5 + 2x3)/5	**5.some**
(4x5 + 2x3) – 5x5	**1**

Q14, reversed on-top addition



"T1 = 2 **3s** and how many **5s** (T2) add on-top as 4 **5s**?"

Outside, we remove the initial block T1 and recount the rest in **5s**.

Thus reversed next-to addition geometrically means subtracting areas.

Reversed on-top addition is also called differential calculus.

Inside, the recount formula algebraically predicts the result.

Here again, subtraction precedes division.

T2 = (T2/**B**) x **B**

= ((4x5 – 2x3)/5) x 5 = 2.4 **5s**

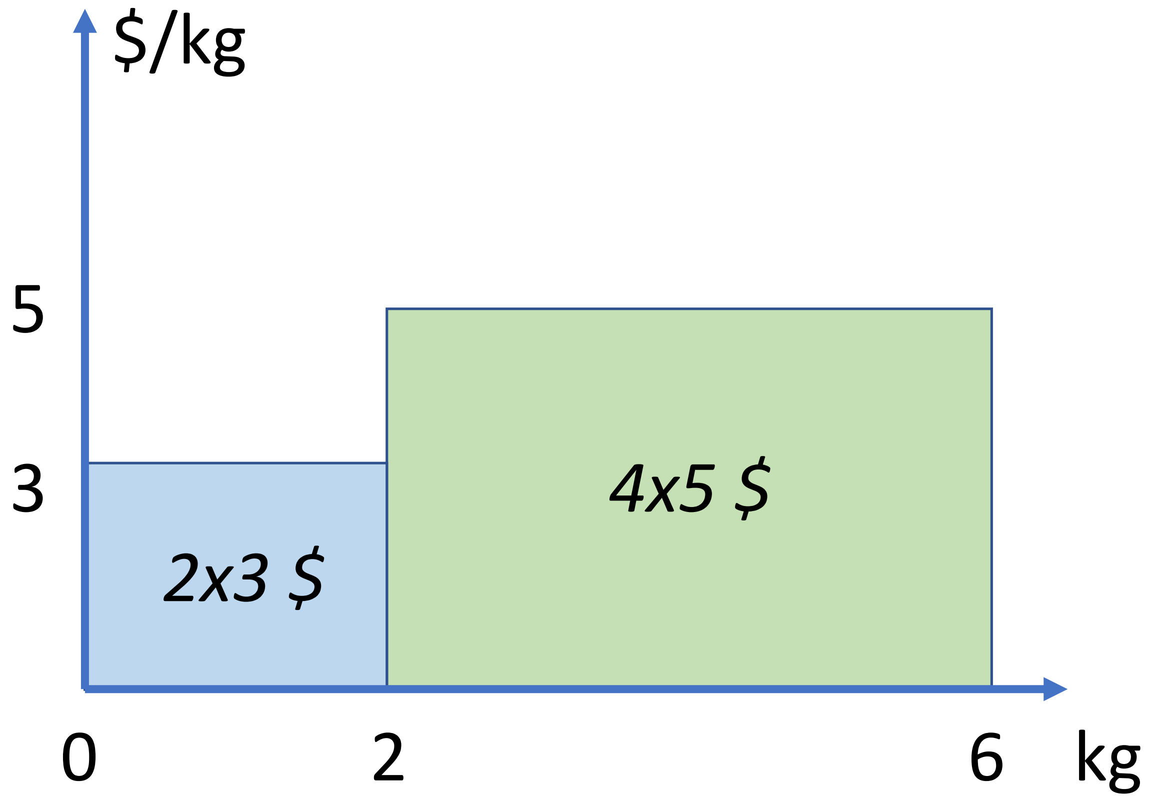
(4x5 – 2x3)/5	**2.some**
(4x5 – 2x3) – 2x5	**4**

Q29, adding PerNumbers as areas (integration)

"2kg at 3$/kg + 4kg at 5$/kg = 6kg at **?** $/kg?"

2 kg	at	3 $/kg
+ 4 kg	at	5 $/kg
(2+4) kg	at	**?** $/kg

- Unit-numbers add on-top.
- Per-numbers add next-to as **areas** under the per-number graph. Here multiplication precedes addition.



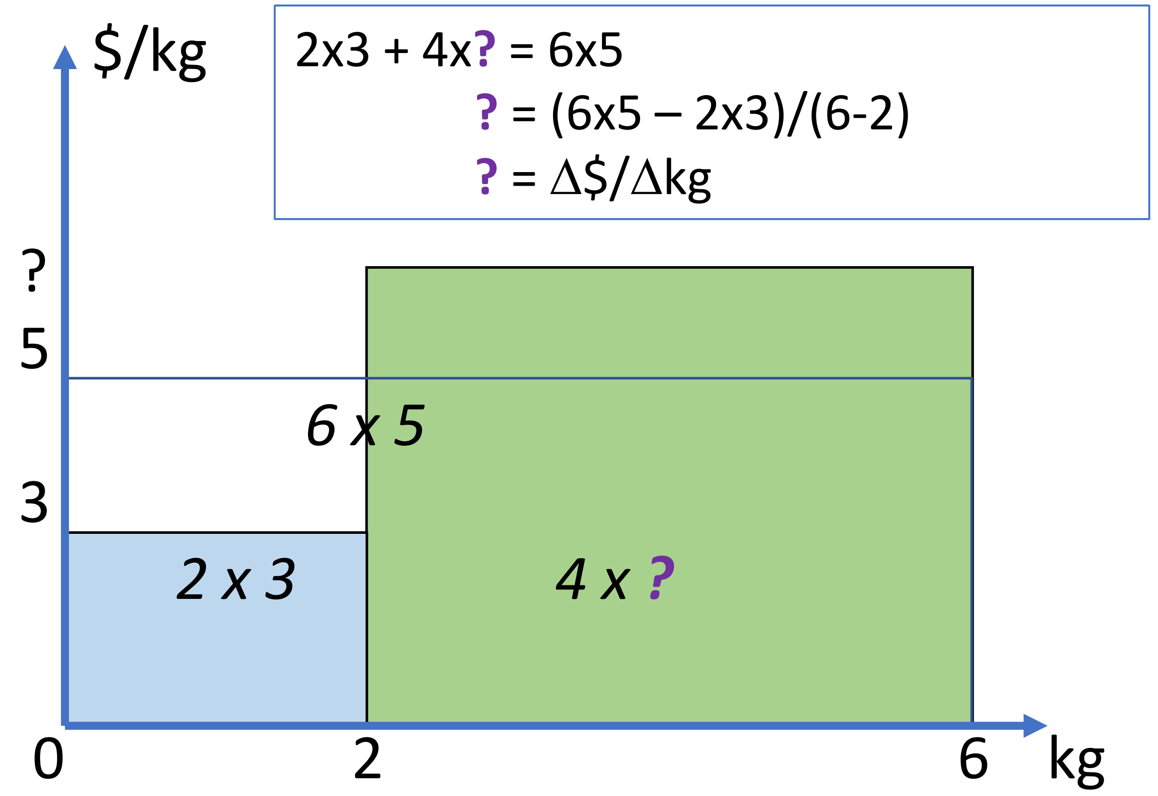
Q30, subtracting PerNumbers (differentiation)

"2kg at 3$/kg + 4kg at **what** = 6kg at 5$/kg?"

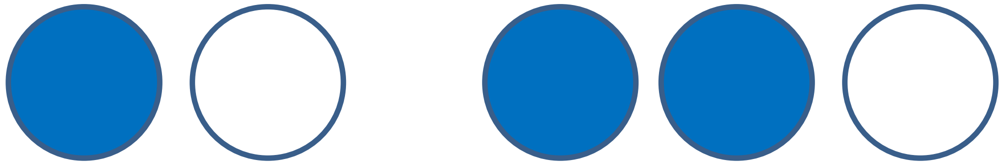
2 kg	at	3 $/kg
+ 4 kg	at	? $/kg
6 kg	at	5 $/kg

Outside, we remove the initial 2x3 block and recount the rest in 4s. Geometrically, reversed per-number addition means subtracting areas to be reshaped, called differential calculus.

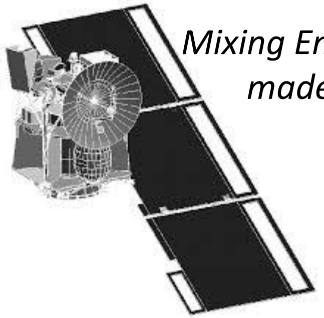
Inside, the recount-formula algebraically predicts the result. Here subtraction (giving a change, Δ) precedes division.



Never add without units, the fraction paradox

The Teacher	The Students
What is 1/2 + 2/3?	Well, 1/2 + 2/3 = (1+2)/(2+3) = 3/5
No! 1/2 + 2/3 = 3/6 + 4/6 = 7/6	But 1/2 of 2 cakes + 2/3 of 3 cakes is 1+2 of 2+3 cakes, i.e. 3/5 of 5 cakes! How can it be 7 cakes out of 6 cakes?
Inside this classroom 1/2 + 2/3 **IS** 7/6 !	

Fractions are not numbers, but operators, needing numbers to become numbers.
2+3 IS 5! No, 2weeks + 3days is 17days; and 2m + 3cm = 203cm.
2*3 IS 6! Yes, since 3 is the unit, and 2 **3s** can be recounted to 6 1s.
Adding without units: MatheMatism.



Mixing English and metric units made NASA's Mars Climate Orbiter fail in 1999.