Mistakes, Mistakes Everywhere

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AMATYC 2016
Denver, CO
In Food
Oreo Double Stuf
Double = 1.86

<table>
<thead>
<tr>
<th></th>
<th>Original</th>
<th>Double</th>
<th>Mega</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 cookies</td>
<td>115.66g</td>
<td>146.66g</td>
<td>176.48g</td>
</tr>
<tr>
<td>1 cookie</td>
<td>11.57g</td>
<td>14.67g</td>
<td>17.65g</td>
</tr>
<tr>
<td>Creme</td>
<td>3.61g</td>
<td>6.71g</td>
<td>9.69g</td>
</tr>
</tbody>
</table>

5 wafers = 19.92g

⇒ each wafer = 3.98g

Source: Math teacher Dan Anderson
Is Subway’s “Footlong” a foot long?

Source: NY Post

Source: Matt Corby (Australian Subway customer)
How many grams in an ounce?

1 ounce = 28.3495 grams
16 ounces = 453.592 grams

Source: threesixty360.wordpress.com
McDonald’s Quarter Pounder vs. A&W’s Third-Pounder (1980s)

• A&W wanted to offer a **bigger** burger for the same cost
• A&W’s burger beat McDonald’s quarter pounder in blind taste tests
• But American’s would not purchase the third-pounder
• A&W held some focus groups only to find….
More than half of the participants in the Yankelovich focus groups questioned the price of our burger. "Why," they asked, "should we pay the same amount for a third of a pound of meat as we do for a quarter-pound of meat at McDonald's? You're overcharging us."

-Threshold Resistance by Alfred Taubman
  (then owner of A&W)

Source: Mental Floss
Terra Nova Expedition (1910-1912)

- Robert Falcon Scott estimated 4,500 calories per day for his men.
- Given the toboggans being hauled and the high altitude, we now know this ration is insufficient for the mission.
- Explorers died from exhaustion and starvation.

Swiss Miss Marshmallows (Hot Cocoa Mix) (2010)

How many mini marshmallows are in a serving?

Intended answer: 92 (but if you compute correctly, you’ll get 29)
Marshmallows

Students at Bay State Middle School (MA) wrote to Swiss Miss. Swiss Miss corrected the error:

Source: Lewis (2015)
In Film/TV
Disney’s Zootopia (2016)

“Prey outnumber predators 10 to 1.” - Bellweather

“Prey make up 90% of Zootopia.” - Bellweather

Source: YouTube
The Man Without a Face (1993)

“Draw a circle ABC. Draw within it any straight line AB. Now, bisect AB at D and draw a straight line at DC at right angles to AB.” –Justin McLeod
The Wizard of Oz (1939)

“The sum of the square roots of any two sides of an isosceles triangle is equal to the square root of the remaining side.”

-Scarecrow

Source: Warner Home Video
Star Trek (1967)

[searching for a lost crew member] “Gentlemen, this computer has an auditory sensor. It can, in effect, hear sounds. By installing a booster, we can increase that capability on the order of one to the fourth power.” -Captain Kirk

Source: Math Mistakes in Movies and TV; Singh (2013)
Fox News Chicago (2012)

Source: flowingdata.com
Homer’s Last Theorem

\[ 3,987^{12} + 4,365^{12} = 4,472^{12} \]

Message Board: “I know this would seem to disprove Fermat’s Last Theorem, but I typed it in my calculator and it worked. What in the world is going on here?”

Source: Singh (2013)
Doh!

\[3,987^{12} + 4,365^{12}\] is just 0.0000000002% larger than \[4,472^{12}\].

Source: Singh (2013)
In Customer/Public Service
Verizon Phone Call

.002 dollars ≠ .002 cents

Source: verizonmath.blogspot.com; Diane Briars (NCTM President, 2014-2016)
Parking Tickets (2008)

- **Dave Alsop.** Entry time **2:49 P.M.**; paid for 75 minutes; covered through **4:04 P.M.**
- **Traffic Warden Math:**
  
  \[14.49 + 0.75 = 15.24\]

  Conclusion: The ticket expires at 3:24 P.M.

- Dave returns to his car at 3:41 P.M. and finds a £50 fine.

Source: Lewis (2015)
California Water Bill (2007)

• Parlier, California
• 2007: City Council approves a 90% increase in water fees
• 2012: An error is discovered

Interim City Manager Shun Patlan said, “One of the staff members inputted the decimal point in the wrong place.”

Source: http://abc7.com/archive/9205145/

Source: Lewis (2015)
In Social Media
Facebook (2016)

Source: NBC Connecticut
Source: Facebook

Powerball 1.3 Billion
\[ \div \text{U.S. Pop 300 Million} \]
Everyone receives 4.33 USD.

Breakfast Solved!!

- Do The Math

$1.3 \text{ BILLION DIVIDED BY 300 MILLION}$

IS $4.33 \text{ PERSON NOT }$4.3 MILLION
In Government
House Bill No. 246 “Indiana Pi Bill” (1897)

• Contained Physician Edwin Goodwin’s “solution” to squaring the circle (squaring the circle was proved impossible in 1882)
• “…the ratio of the diameter and circumference is as five-fourths to four.”

\[ \pi = \frac{\text{circumference}}{\text{diameter}} = \frac{4}{5/4} = 3.2 \]

• Introduced to Indiana House of Representatives, passed on to the Financial Committee, transferred to the Committee of Education, passed on Feb 6, 1897.
• Senate is ready to ratify; Mathematician C.A. Waldo (Purdue University) comes to the rescue.

Source: Singh (2013); agecon.purdue.edu/crd/Localgov/Second%20Level%20pages/indiana_pi_bill.htm
Calculation Errors

• Laufenburg Bridge across the Rhine River
• Different countries use different reference points for “sea level."
  • Germany uses the North Sea
  • Switzerland uses the Mediterranean Sea
  • A difference of 27 cm
• This was carefully considered when building the bridge to ensure a proper connection over the Rhine.
• However, one side ended up quite a bit higher than the other…What happened?

Instead of canceling out the difference, it was **doubled**.

- The German side was 54 cm higher than the Swiss side.
- The German side was eventually lowered to complete the project.

Mars Climate Orbiter (1998-1999)

• Purpose: An interplanetary weather satellite for Mars ($125 M)
• NASA was using the metric system but contracting some of the work to Lockheed Martin Astronautics (some of the code used English units)
• Modeling the trajectory of the orbiter
  • Data was supposed to be in Newton-seconds (not pound-seconds)
  • Error propagation in the trajectory
• Calculations had the orbiter remaining at least 226 km above Mars (had to remain at least 80 km above Mars to stay in orbit).
• Reality: The orbiter entered at 57 km above the surface
• Did it burn up? Continue into space?

Source: Lewis (2015)
Vasa Warship (1628)

- Tragically sank on its maiden voyage (30 died)
- Brought to the surface in 1961
  - Found to be far thicker on one side of the warship
  - **Suspicion**: Using different measurement systems
- Swedish foot = 12 inches
- Dutch foot = 11 inches
- Both workmen assembled/built the ship
- No consensus for measures of stability, stiffness, etc.

Hurricanes Katrina and Rita (2005)

• Estimated value of goods: $85 M
• True value: $18.5 M

• Why the error?

Source: Lewis (2015)
Units

• 1 spork was counted as a case of 1000
  • $36,000,000 ≠ $36,000

• 1 roll of toilet paper was counted as a package of toilet paper
  • $1,500,000 ≠ $18,000

Source: Lewis (2015):
The Gimli Glider (July 23, 1983)

- Air Canada Boeing 767
- Routine flight: Montreal to Edmonton
- Fuel gauges were not working but it was deemed safe to fly so long as the calculation was done correctly (and double-checked)
- Need: 22,000 kg of fuel  Had: 22,000 lbs of fuel
- Aircraft would run dry about halfway through the trip!!

Source: Lewis (2015); National Post
Mayday!

- Left engine failed first (41,000 ft)
- Plan: Land in nearby Winnipeg (39 miles)
- **Side Note: Captain Pearson is an experienced glider**
- Dropping about 1000 feet for every 3 miles traveled.
- Gimli
  - Air Force Base
  - “Family Day”
  - Nose caught fire; front landing gear was crushed
How did this happen?

- Canada was undergoing metrication (mid 1970s)
- **Old:** gallons, pounds  **New:** liters, kilograms
- Boeing 767 used **kg** for fuel loads (not **lbs**)
- **THE MATH (VOLUME TO WEIGHT CALCULATION)**

\[
\begin{align*}
7,682 \text{ L} \times 1.77 &= 13,597 \text{ kg} \\
8,703 \text{ kg} \div 1.77 &= 4916 \text{ L} [5,000 \text{ L}] \\
7,682 \text{ L} + 5,000 \text{ L} &= 12,682 \text{ L}
\end{align*}
\]

1.77 is the conversion factor from L to lbs (not L to kg). Reality: the 12,682 L ≠ 22,447 kg but actually 22,447 lbs (around 10,200 kg)

Source: Lewis (2015)
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