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Regulars

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New maths column

From Dean Browell <browells@earthlink.net>

Just an F.Y.I. that a new section and article with a mathematic skew has debuted in the online magazine Skewed Perspective. It's the featured work in a new section on Math, Math Theory and Life called Congruence In Z by Brad Abbott. The article is called "Art Imitates Life, Life Imitates Infinity" and you can find it right off the front page here:

<http://www.skewedperspective.com/>

Check it out, we'd love to hear back from you on what you think!

Plus editors' comment

"Congruence in Z" now looks like a semi–regular mathematical column on this site, with two articles so far and a mathematical contest too. Let's hope a *Plus* reader wins.

Gyros lighter while spinning

From Michael Kiss <Michael.Kiss@maritz.com>

In a recent special on the Discovery channel about electromagnetic forces there was brief discussion about gyros. The show explained that for reasons unknown spinning gyros defied Newton's first law of gravity, I found this hard to believe and have been looking for an explanation. "Galloping Gyroscopes" by Kona Macphee and Hugh Hunt helped clarify some things but, I don't think it addressed the actual weight of a gyro spinning and not spinning. Does a gyro actual weight less while spinning than not? To prove this theory during the show a small electro magnetic, (about the size of a coffee warmer) was turned on and a very small gyro was suspended above the magnet about 8 inches. This was, according to the program "proof." Any more light that you could shed on this quandary would go along way to solving a office bet.

Plus's reply

a small electro magnetic, (about the size of a coffee warmer) was turned on and a very small gyro was suspended above the magnet

You can buy a lovely toy based on this principle, the Levitron. It has nothing to do with a gyroscope weighing less when spinning; the downward force of the gyroscope's weight is counteracted by the repulsion of two magnets. If the "floating" magnet were stationary, it wouldn't work as it wouldn't be stable – it would just flip over or bounce off onto the table. If the floating magnet is spinning, and if the weights are very carefully adjusted, however, the resulting gyroscopic stability allows it to continue to "float" for as long as it is spinning fast enough.

The "anti-gravity" claims usually made for gyroscopes seem to rest on the way a spinning gyroscope mounted on a horizontal axle can balance on the end of the axle. Still, the full weight of the gyroscope is exerted on the part where it's resting, so there's no diminution in weight.

More generally the answer to your question is no: there is no experiment of any kind that will show a gyroscope's weight to be less when it's spinning, nor any sensible theory to suggest it should be. The above, combined with the fact that in all its gory detail the mathematics of gyroscopes is quite delicate and can be confusing, no doubt explain the currency of stories to the contrary. I've certainly heard claims that you can fly by bolting two gyroscopes together, or similar nonsense. A quick search of the usual urban folklore websites failed to find the authoritative debunking I was looking for, but I did find various examples of the claim, the clearest being at

http://www.padrak.com/ine/NEN_4_8_4.html

Probably his balance is sensitive to where on the scale the weight is resting; when the gyroscope isn't spinning, he can't balance it on the pedestal. Another possibility is that the gyroscope isn't perfectly symmetric and is being lifted slightly by air resistance (like a helicopter rotor). Plans for gyroscopic flight are at, for example,

<http://www.gyro-scope.co.uk/gpds.htm>

<http://www.gyro-scope.co.uk/masstran.htm>

In practice gyroscopes are completely understood mechanically; there's nothing "unknown" about them at all. A good description of them is at

<http://school.discovery.com/homeworkhelp/worldbook/atozscience/g/241240.html>

I hope you win your office bet.

Regards,

Mark Wainwright

Longest number

From Emma Freelove <emma@twolimbs.freeseve.co.uk>

My maths homework is to find out what the longest number is, please help!!!

Plus's reply

Dear Emma,

I'm afraid you'll have to work this one out for yourself!

The opinion here is that 8 is quite wide, and 1 looks long if you tip it over.

Mike

Softball teams problem

From Denis Charbonneau <denischarbonneau@videotron.ca>

Hello!

I am the captain of a softball team and we are getting ready to do the draft soon. Each captain has to draft 9 players, those players are rated from 1 to 6 based on skills. At the end, each captain must have a total rating for their team of 34, 35 or 36. I would like to know the different possibilities that exist using 9 numbers between 1 and 6 and getting a total of 34, 35 or 36.

Plus's reply

I am the captain of a softball team

And a right good captain too, I've no doubt.

I would like to know the different possibilities that exist using 9 numbers between 1 and 6 and getting a total of 34, 35 or 36.

Well, this is an interesting question, but here's one you might like to ask first: how many ways are there of choosing such a team? Let's say we want a team with the maximum rating, 36, and let's call the number of ways of choosing valid numbers

noteams (36, 9, 6)

Longest number

Notes and queries

i.e. the number of different teams whose value is 36, with 9 players, and each player worth at most 6. There are two possibilities – either we have at least one player worth the maximum, 6, or we don't. The number of teams of the first kind is

noteams (30, 8, 6)

because we have to score 30 with the remaining 8 players, and the number of the second kind is

noteams (36, 9, 5).

This suggests a nice little recursive function. Here's one in Python:

```
def noteams (total, players, maxvalue):
    if players <0 or total <0: return 0
    if total == 0 and players == 0: return 1
    if total == 0 or maxvalue <= 0: return 0
    return noteams (total, players, maxvalue-1) + \
           noteams (total-maxvalue, players-1, maxvalue)
```

Now let's ask the Pythian oracle how many teams there are adding up to 36:

```
>>> print noteams (36, 9, 6)
88
>>>
```

88 different ways of getting a team worth 36, and as it turns out a further 93 ways for a team of 35, and 98 ways for a team of 34. That's 279 different kinds of team in all! Perhaps you didn't realise what you were letting yourself in for when you asked for a list of them all. All the same, if you do want a list, the function above can easily be modified to actually produce the teams rather than merely count them, e.g.

```
def teams (total, players, maxvalue):
    if players <0 or total <0: return []
    if total == 0 and players == 0: return [""]
    if total == 0 or maxvalue <= 0: return []

    def addplayer (x, m=maxvalue): return str(m)+" " + x

    return teams (total, players, maxvalue-1) + \
           map (addplayer, teams (total-maxvalue, players-1, maxvalue))
```

Consulting the oracle again gives, for example, this output – a list of all 88 valid teams whose total score is 36.

Regards,

Mark Wainwright



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Plus is part of the family of activities in the Millennium Mathematics Project, which also includes the NRICH and MOTIVATE sites.