r/ThingsYouDidntKnow • 2 mo. ago
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Rocket Science: Where Math Blasts Off (Not Proven)

- Total force divided by 2.20: **2,237,897.73 N**
- Total force divided by 0.20: **24,616,875 N**
- **Subtraction:** 18,375 N - 24,616,875 N = -24,598,500 N
- **Division:** -24,598,500 N / 2,237,897.73 N ≈ -10.99

1. **Total Force Divided by 2.20:** When we divide the total ascent force (4,923,375 N) by 2.20, we get:This result represents a scaled-down value of the total force required for the ascent, possibly to simulate or compare with a different condition or model.4,923,375 N / 2.20 = 2,237,897.73 N
2. **Total Force Divided by 0.20:** Dividing the total ascent force by 0.20 yields:This represents a significantly larger force, potentially indicating a much higher threshold or required force under certain conditions, such as extreme drag or resistance.4,923,375 N / 0.20 = 24,616,875 N
3. **Subtraction of Forces:** Now, subtracting the calculated drag force (18,375 N) from the larger force (24,616,875 N):This negative result suggests that, in comparison, the drag force is much smaller than the large resistance force and could be interpreted as a difference in forces encountered during the rocket's ascent.18,375 N - 24,616,875 N = -24,598,500 N
4. **Division of Forces:** Finally, we divide this difference by the scaled-down force:This gives a value of approximately **-10.99**, which could reflect a ratio or comparison between different forces acting on the system during ascent. The negative value may indicate an inverse or contrasting relationship between forces.-24,598,500 N / 2,237,897.73 N ≈ -10.99

Contextual Explanation: This set of calculations appears to be comparing forces during a rocket's ascent, including drag and resistance. The negative result suggests that the forces involved are not just resisting each other but might also be reflecting the relationship between gravity, propulsion, and drag as the rocket climbs. While it's a simplification, this could metaphorically relate to the immense g-forces or gravitational influences (such as black holes) experienced during extreme acceleration or high-speed ascent, highlighting how forces dynamically interact during space travel.

Here's the explanation (Rough Starting Point):

To calculate the forces needed for a rocket to overcome gravity and resist drag during launch, we primarily use **Newton's Second Law** and **gravitational force equations**.

1. **Gravitational Force Calculation**

The gravitational force acting on the rocket is given by: `F_gravity = m * g`

where:

- `m` = mass of the rocket (in kg)
- `g` = acceleration due to gravity (9.81 m/s^2 on Earth's surface)

To lift the rocket off the ground and overcome gravity, the rocket's engines must produce a thrust force greater than `F_gravity`. The minimum thrust required for liftoff is: `F_thrust >= F_gravity`

If the rocket needs to accelerate upward at an additional rate `a`: `F_thrust = m * (g + a)`

3. **Drag Force and Atmospheric Considerations**

The drag force experienced by the rocket is given by: `F_drag = 0.5 * C_D * ρ * A * v²`

where:

- `C_D` = drag coefficient (depends on the rocket's shape)
- `ρ` = air density (varies with altitude; roughly 1.225 kg/m^3 at sea level)
- `A` = cross-sectional area of the rocket (in m^2)
- `v` = velocity of the rocket (in m/s)

Example Calculation for Initial Ascent

Assuming:

- `C_D = 0.3` (typical for streamlined rockets)
- `ρ = 1.225 kg/m³` (at sea level)
- `A = 10 m²`
- `v = 100 m/s` (initial velocity)

The drag force is: `F_drag = 0.5 * 0.3 * 1.225 * 10 * 100² = 18,375 N`

Total Force Needed for Ascent

The total thrust force needed to overcome both gravity and drag:

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F_total = F_gravity + F_drag
F_total = 4,905,000 + 18,375 = 4,923,375 N
```

Considerations During Ascent

- **Max Q (Maximum Dynamic Pressure)**: The rocket experiences maximum aerodynamic forces at this point, so engines may throttle down to reduce stress.
- **Fuel Efficiency**: As the rocket burns fuel, its mass decreases, affecting the gravitational force and thrust requirements.

This does not account for real-world complexities like fluid dynamics and engine efficiency.