

**It was the night of Christmas Eve,
And little Matthew Wright did not want to study,
Science is so boring,
This I believe!**



**Just then Santa arrived with a
reindeer and sleigh,
My dear boy, don't let science
scare you away.**

**Physics is what lets me make my
journey,
If you would like to see how,
Come, boy, let us hurry!**





SANTA!
WHY AREN'T
WE MOVING?

said little Matthew, upset that they had not moved an inch.

Santa smiled and said,

WITHOUT
A FORCE.....

AN OBJECT WILL STAY ITS COURSE!

Newton, a wise scientist, once did say,
An object at rest or an object in motion will stay that way,
Unless a force is at play.

My sleigh sits still,
A lovely sight,
But you must tell the reindeer to pull,
If you wish for flight.

And off they flew, once little Matthew knew:
the force of the reindeer pulling the sleigh was needed to move.





Later, the sleigh moves very slow, Santa says, "It's friction you know!"

Overcome the forces in the opposite direction, By increasing our reindeer force tension!

So the reindeer pulled harder and harder to increase the force, And the sleigh went faster on its course.

Little Matthew said, "Santa, why does this work?"

Santa said, "Newton's second law is in your homework!"

FORCE

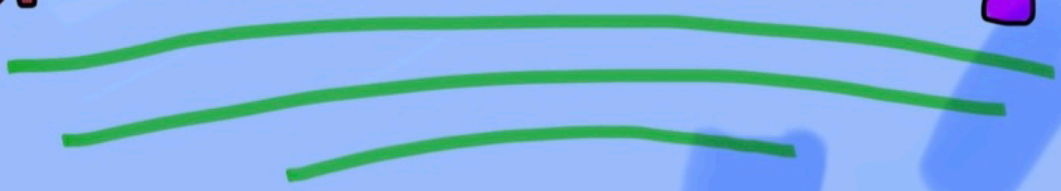
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mass

Force is related to mass and the change in speed.

If you make the force greater, and mass stays the same, the change in speed will increase to keep the equation balanced.

Little Matthew understood.

X
ACCELERATION!





Little Matthew Wright wanted to soar through the night, but the reindeer was now too tired to go faster.

But Santa had a plan.



**“Less weight will give us more speed,
At the same force indeed.”**

So Santa told little Matthew to drop the presents to other little children.

Little Matthew asked, “Santa, why is this true?” Santa said that the sleigh was lighter because of all the presents that they threw.



$$F = ma$$

Newton’s second law shows us that mass and the change in speed affect the force. The reindeer could not pull with a harder force, so we lowered the mass to speed up. A lighter sleigh speeds up faster than a heavier one!

**Then, little Matthew understood,
Physics helped Santa do so much good,
And now, study, he would.**