COMPILATION: Unit 5_Boy in Bucket w/b set

Date: Thu, 1 Nov 2001
From: John Barrere <forcejb@YAHOO.COM

In the Unit V Optional Whiteboard Set, there is a "boy in the bucket" problem that SEVERELY challenges my intuition and/or ability. If I do force diagrams for both the bucket/boy combination as well as the boy alone, I get the mathematical result that even at steady speed the bucket must be able to exert a downward force on the boy to prevent the boy lifting himself out of the bucket. (The downward force is larger if upward acceleration is desired). But this doesn't seem "reasonable" to me.

For the bucket/boy combo, I have Force of Rope up and 343N down. For the boy alone, I have Force of Rope up, Force of Floor up, and 314N down. (The boy pulls down on the rope and by N3, the rope pulls up with equal force). Due to the "same rope" argument, aren't both "Forces of Rope" the same? Even though one end of the rope is tied to the bucket and the other end is held by the boy. [What am I missing?]

Date: Thu, 1 Nov 2001
From: "Park, Nicholas" <ParkN@CFBISD.EDU>

When you are analyzing the "Boy and bucket" system, there are two Frope's exerted upward on the system -- one by the end of the rope attached to the boy's hand, and one by the end of the rope tied to the bucket. Therefore, each is only exerting 171.5 N (half of 343, since they must add up to 343 and must be equal, and therefore the tension is 171.5 N, not 343 N.

Date: Fri, 2 Nov 2001
From: Andy Edington <aedington@MTSD.K12.WI.US>

Many difficulties with force diagrams (such as the boy in the bucket) can be made clear quickly by simply thinking "The force on what by what?" For example, if Henry is standing on the table, there is a force on Henry by the earth and a force on Henry by the table. At our school, we actually have the students write out the on...by... next to each F on their force diagram. (We tell them to include the on...by... notation.)

This is also handy when looking for the so called action-reaction force pairs. If there is a force on A by B, then there must be an equal force on B by A.

Use of the on...by...notation from the very beginning of forces will pay off greatly in many ways, all year.

Date: Fri, 2 Nov 2001
From: Daniel Cervantez

Nick-

For the "boy in the bucket" problem I'm not following how there are two ropes! Looking at the problem I only see one rope, and the tension in that rope has to be the same between the point where the boy is pulling it and where it is attached to the bucket. Then using the mass of the boy and the bucket together, because that is what the rope is pulling upward on, I have 35 Kg for the system. Then finding Fg I am getting -343N using negative because I am defining 'counterclockwise' motion as the negative direction. Then to move upward at constant velocity the boy has to pull the other side of the rope with 343N, so we have 343N in the positive or 'clockwise' direction.

John-
I think where you are getting confused at in the problem is, you are comparing the force exerted on the boy from the bucket to the force exerted on the boy/bucket system from the rope! So basically, the rope is exerting 343N on the boy/bucket system like you said. However, the bucket is only exerting 313.6N on the boy alone! You are trying to say that these should be equal, but they can't be! The rope still has to exert a little on the bucket alone. This little would be 9.8*3kg or 29.4N. When you add the 313.6N for the force of the bucket on the boy to the 29.4N you get from the force of the rope just on the bucket, you get the total force of the rope exerted on the boy/bucket system. So 313.6N + 29.4N = 343N. Hope this helps!

Date: Sat, 3 Nov 2001
From: MERVIN KOEHLINGER <physteach@PRODIGY.NET>

1. Specify the system: bucket and boy.
2. Specify the reference frame: vertical axis; upward direction is positive.
3. Identify the forces: earth exerts downward gravitational force on bucket and boy system; rope exerts upward force on system at handle of bucket; rope exerts upward force on system at hand of boy.
4. Draw a force diagram: two upward forces; one downward force.
5. Recall property of rope: tension in rope must be the same throughout.
6. Conclude from N1: Total magnitude of two upward forces must equal magnitude of one downward force since system is moving at constant velocity.
7. Conclude: Each rope exerts a force of one-half weight of system.
8. Conclude from N3: Boy must be exerting a force on rope of one-half weight of system.
