Presenting using a board

Foundations for Teaching in Higher Education

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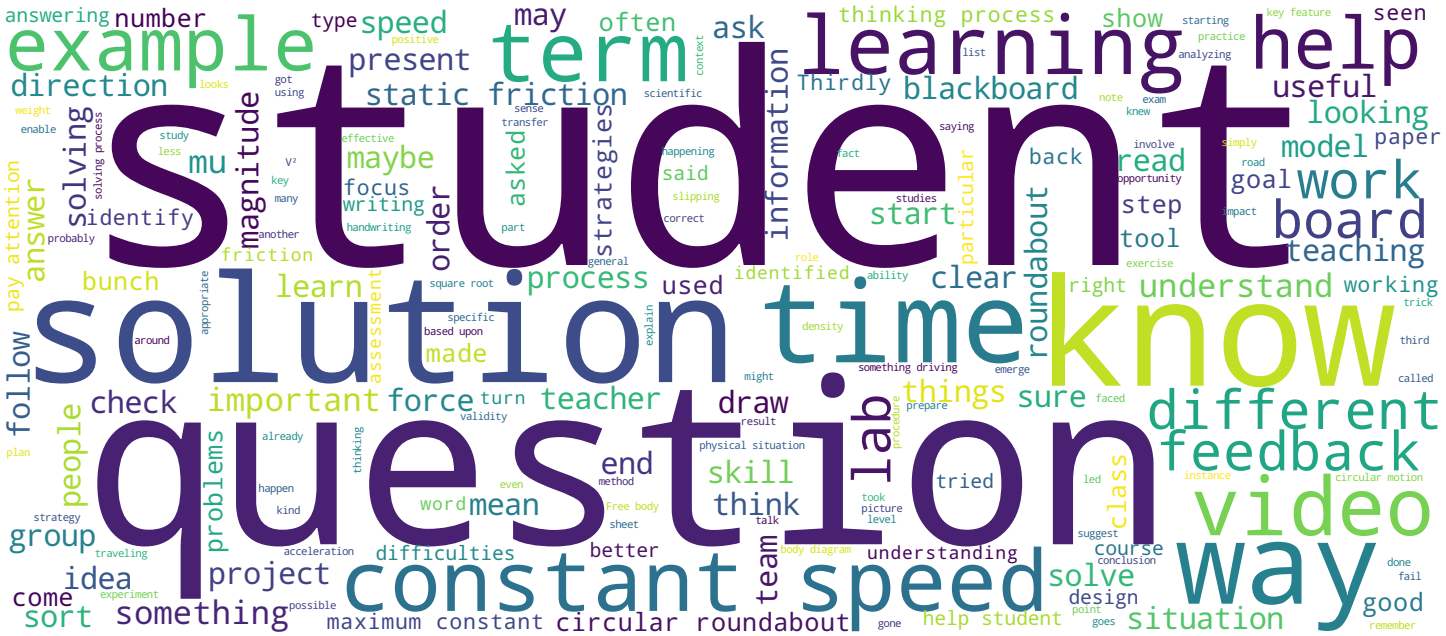

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Video

EPFL

Goals of this video

You should be able to:

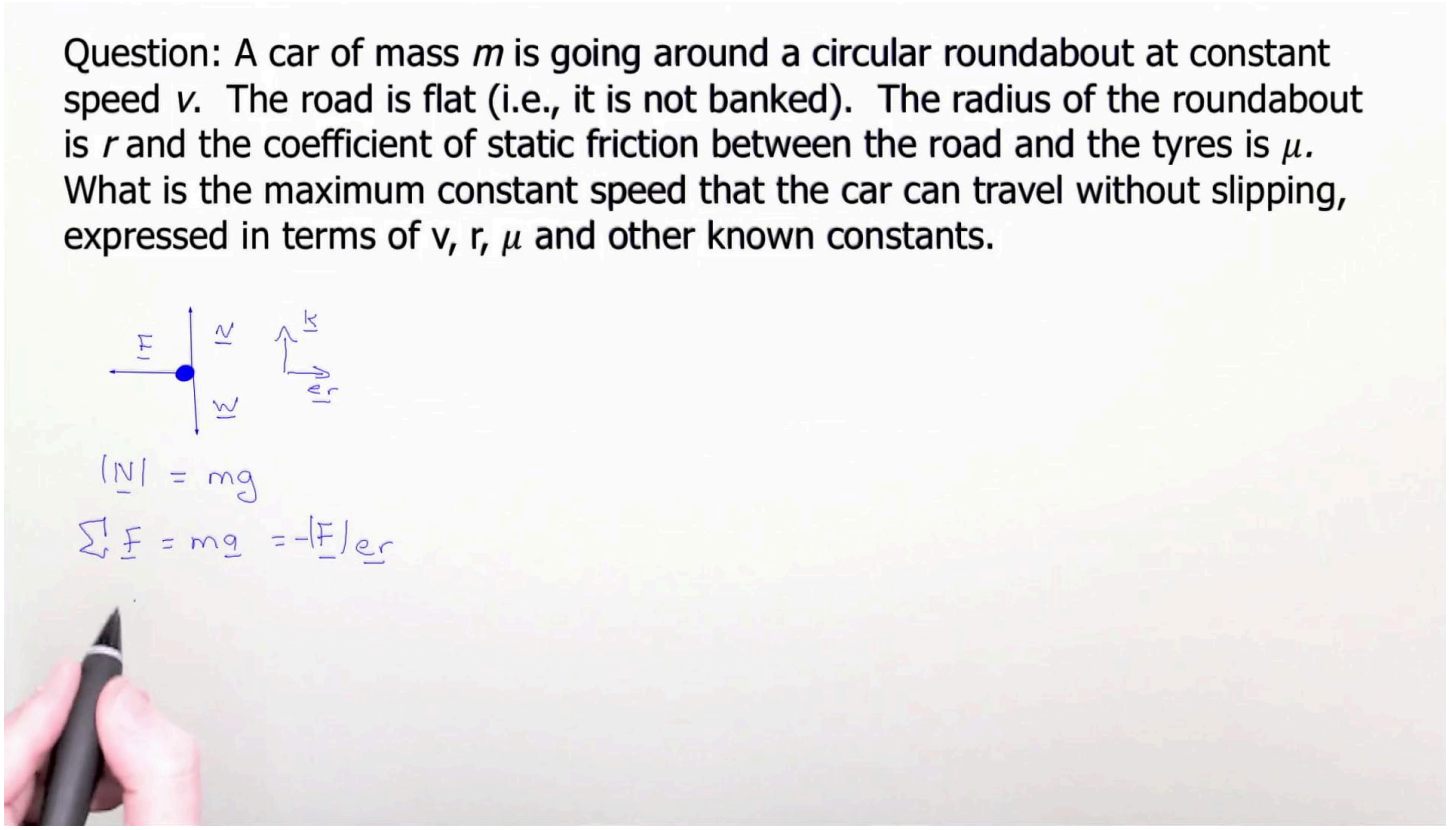
- Identify key skills in **board presenting**
- Identify how board presentations can **model scientific and problem solving thinking**

There are many tools now available like slideshows to help people make effective presentations. Nonetheless, many teachers still use a blackboard. Why is that? Well, blackboards turn out to be not just a good way of presenting ideas to students but actually showing students the way in which scientists and engineers think. So in this video we're going to focus in on how to use blackboards effectively. So this video will focus in on two things; first of all, how to use blackboards effectively, what are the key skills that you would need to have to use the blackboard for making good presentations. Secondly, we're going to look at the way in which the use of the blackboard can help to model the scientific thinking and problem-solving process.

Notes

Summary

0m 04s



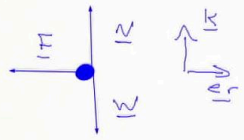
To do that, let's look at an example. I suggest you pause the video now for a moment and read this question and then we look at how a solution to it can be shown on a blackboard. Okay, if you've read the question I'm going to present the solution and I'm going to present the solution twice. First, of all I'm going to present the solution in a less optimum way and then secondly, I'm going to present it in a more optimum way. So let's start with the less optimum presentation. Okay, to solve this problem, we need first of all to know what's going on and start off with a Free body diagram, it looks something like this. we'll have weight here, we'd have the normal reaction here and we have the friction force which is causing the car to turn on the circular roundabout. We have our coordinate system here. Based upon this, we can see straight away that the magnitude of our N is going to equal to the magnitude of our weight, which is going to equal mg. So the sum of the forces is going to be equal to MA which is heading in the -ER direction and that's going to be equal to the magnitude of F. Now, here's the trick: because this is a circular roundabout and because we're going at constant speed we actually know what the A is.

Notes

Summary

0m 49s

Question: A car of mass *m* is going around a circular roundabout at constant speed *v*. The road is flat (i.e., it is not banked). The radius of the roundabout is *r* and the coefficient of static friction between the road and the tyres is μ. What is the maximum constant speed that the car can travel without slipping, expressed in terms of v, r, μ and other known constants.



$|\underline{N}| = mg$

$\sum \underline{F} = m\underline{a} = -|\underline{F}|\underline{e_r}$

$\underline{a} = -\frac{v^2}{r}\underline{e_r}$

$|\underline{F}| \leq \mu mg$

$m\frac{v^2}{r} = \mu mg$

$v^2 = \mu r g$

$v = \sqrt{\mu r g}$

So the A in this case is going to equal -V²/R. we also know what the maximum possible force of A can be because we know that the car is not slipping. So we know that F must be less than or equal to mu, which we now know is mu*m*g. so putting these things together, what we end up with is that we have mv²/ R is going to equal to mu*m*g and then multiply across here, we're going to end up with V² is equal to mu*r*g. So our V it's going to equal to the square root of mu*r*g and this is our answer.

Notes

Summary

2m 31s

Contributing to Problematic Beliefs

- "The trick here…"
- A solution appears by magic
- Not based on analyzing a physical situation
- Doesn't follow step bystep
- No checking

So what's wrong with that solution? Well. First of all, we maybe need to look at some of the thinking processes which became evident in the solution. First of all, at some point in the solution I said "the trick here is..." So suggesting the students that they need to find a trick in order to solve the problem. Secondly, the solution appeared as if by magic: there was no process which led to the solution appearing, it was something I knew and I simply then presented what I knew to the students. There was no thinking process which allowed me to find it. Thirdly, I actually didn't really pay attention to analyzing the physical situation, there's a lot going on in that situation. We know something's driving the car but we also know that there must be some resistances on the car because it's going at a constant speed. So there was no thinking about the actual physical reality in terms of coming to that solution. Fourthly, it didn't really follow a step-by-step procedure. I skipped a lot of steps along the way I made a number of jumps, which led me to the right place at the end but in actual fact, the thinking process wasn't made explicit.

Notes

Summary

3m 37s

Contributing to Problematic Beliefs

- "The trick here…"
- A solution appears by magic
- Not based on analyzing a physical situation
- Doesn't follow step bystep
- No checking

Finally, I got to the end and I said "This is the correct solution", I didn't show the students that they actually check the solution, or indeed show them how to check the solution. So let's look again at the same problem and let's look at how it can be more effectively presented.

Notes

Summary

4m 47s

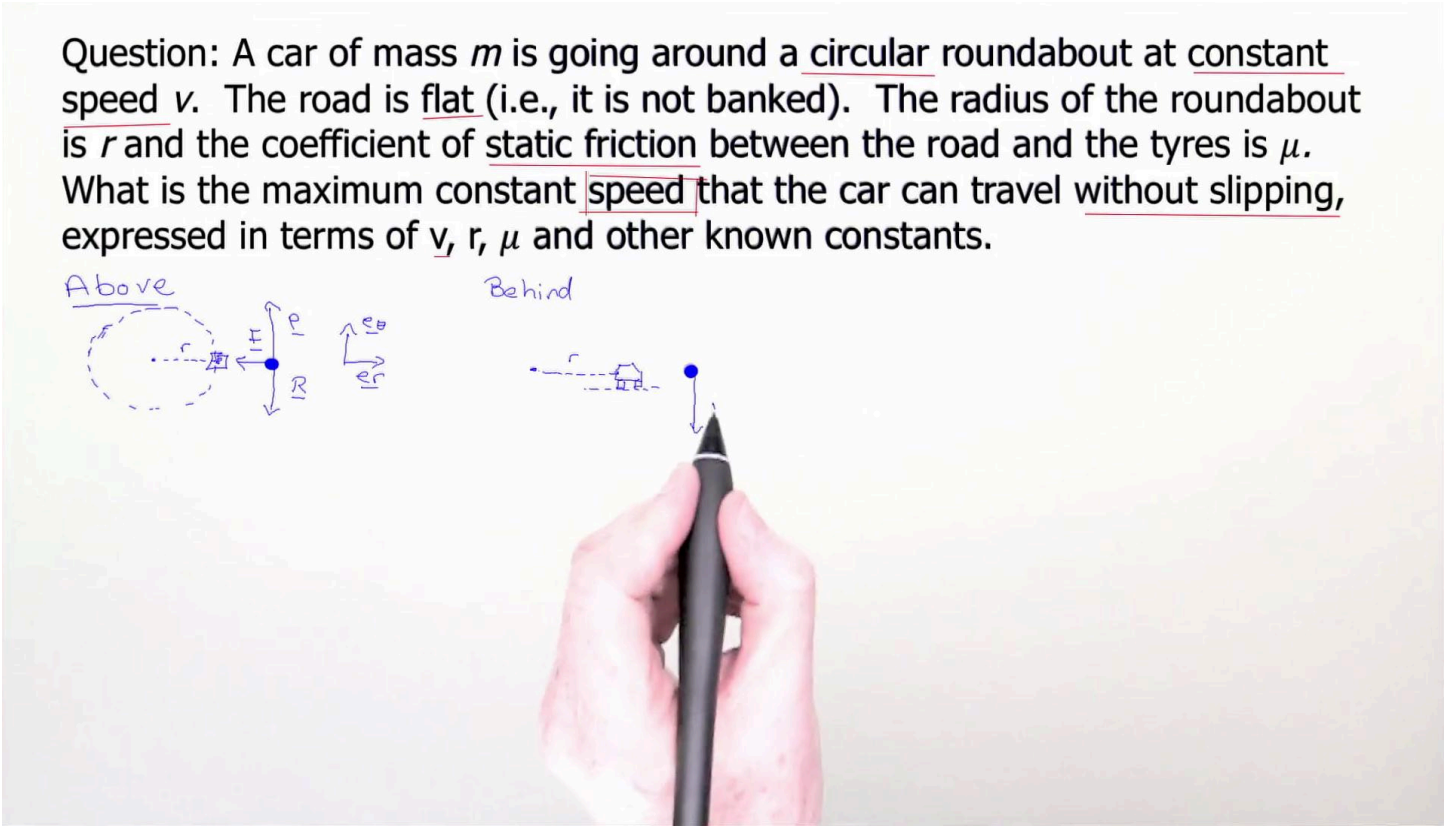
Question: A car of mass *m* is going around a circular roundabout at constant speed *v*. The road is flat (i.e., it is not banked). The radius of the roundabout is *r* and the coefficient of static friction between the road and the tyres is μ. What is the maximum constant speed that the car can travel without slipping, expressed in terms of v, r, μ and other known constants.

So the first step in looking at a question is to make sure that I actually understand the question. I need to go through this question in detail and identify the key features of it. So a car of mass M is going around a circular roundabout, okay that's important. So the roundabout is a circular roundabout. It's circular and the car is traveling at a constant speed. Okay so that's good to know. The road is flat, okay I need to recognize that and the radius of the roundabout is given and the coefficient of static friction between the road and the tires is mu so static friction is going to be a feature in this question. What's the maximum constant speed that the car can travel without slipping. So we know about static friction and we know static friction and how it relates to this idea of not slipping, so that's maybe something that we're going to find useful in this. What we're looking for is the maximum constant speed so let's just draw a box around that because speed is what we're going to need to get to. We're going to need to look for something which is going to give us a speed and our speed is expressed in terms of V in this question.

Notes

Summary

5m 05s

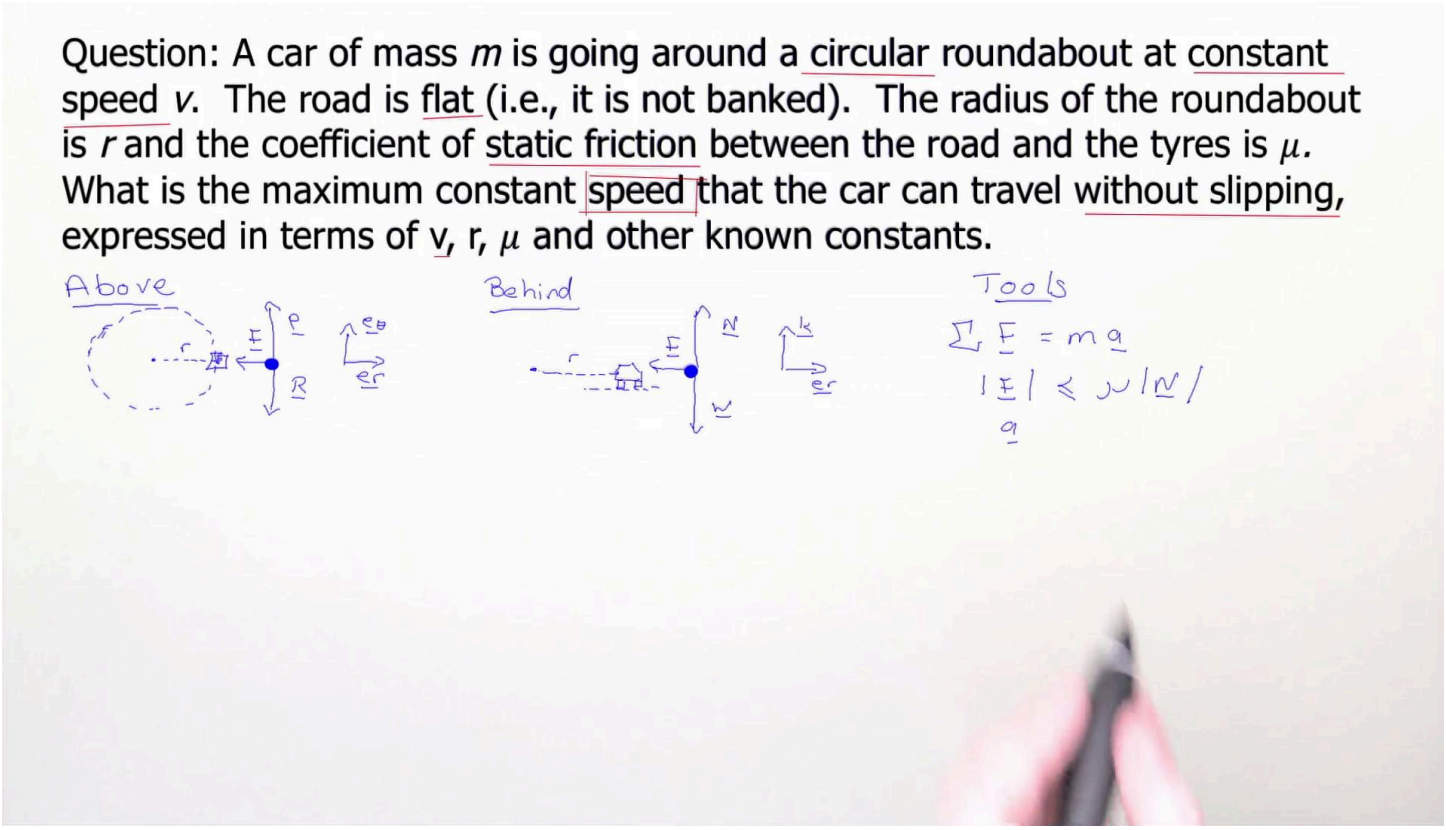


So now I've gone through the question and I've identified the key features of the question now let me try to understand a little bit more about what's going on in this situation. So maybe the first thing I'm going to do is I'm going to draw a picture. So looking at the problem from above, I'm going to have the car is traveling in a circle around the roundabout, the roundabout has a radius R. Here's my car and the car is traveling at a constant speed around the roundabout. so there's something driving the car. So we just do our Free body diagram here to go with this, there's something driving the car it's got some sort of force of propulsion and there's probably some sort of resistances on the car; friction from the road, air resistance and that's going to be constant so those are going to equal to each other. Also, the car is turning and so if it's turning there's something dragging the car in this direction and that is the force of friction on the car. So my directions here are e-r and e-theta. Those are my are my unit vectors. So that's what it looks like if I look at it from above. We now also need to look at this in different dimensions so let's look at this from behind.

Notes

Summary

6m 16s

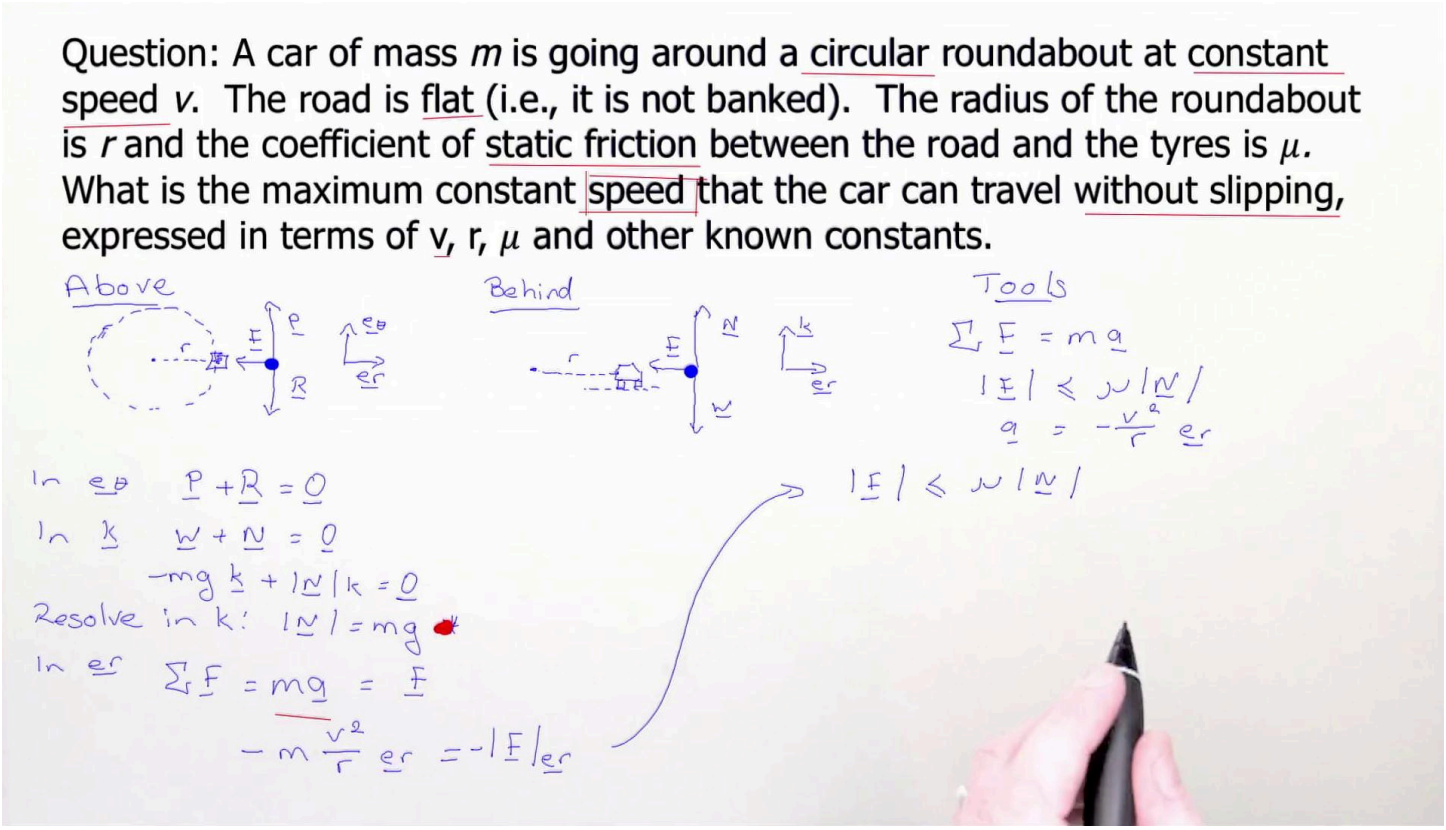


All right, so I'm starting to get an idea in terms of what's happening in this situation. what sort of tools do I have, which you're going to enable me to solve this question well we know that F net is equal to m*a, so the sum of forces is going to equal m*a, that's Newton's second law. This question is about static friction and it involves not slipping and so what do we know about static friction? Well we know that the force of friction will not be greater than mu*n and that's the magnitude of n. okay, so that's the second thing that we know. What else do we know? Well, we need something, which is related to speed. We need some sort of tool that's going to help us understand what's happening in relation to speed and as we look through the question again, we see that it's a circular roundabout and it's at a constant speed. So we actually have a bunch of things that we know about circular motion at constant speed. So if we go back and we look through the things we know about circular motion at constant speed, one of the things that we're going to find is that we actually know what the acceleration of a particle will be in this situation, that is circular motion of constant speed.

Notes

Summary

7m 46s

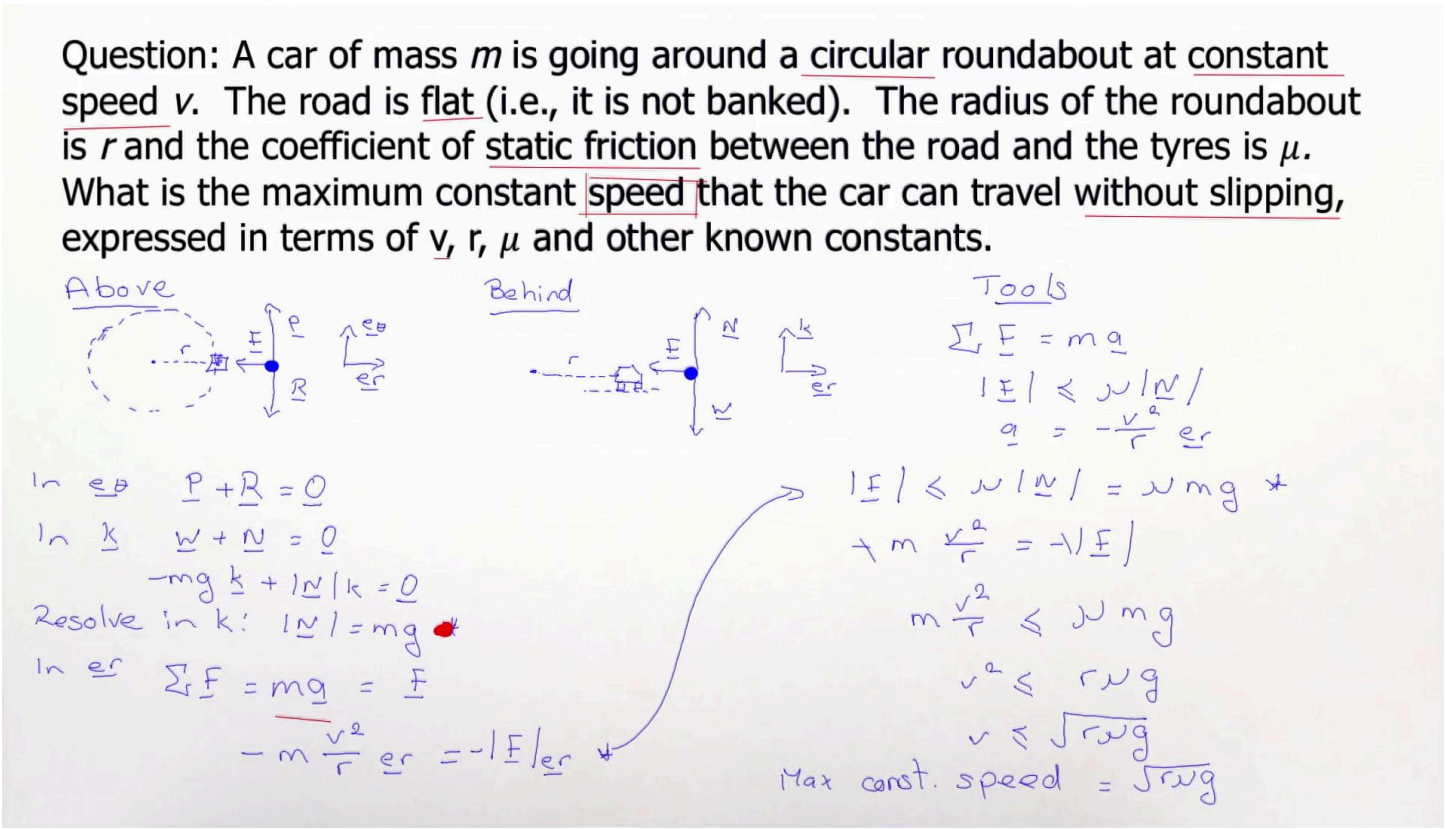


The acceleration will be equal to V²/ R in magnitude and the direction will be –ER. In other words, it will be towards the center of the circle. So actually now we have a bunch of different things which may well help us answer the question. We have something which is going to give us the speed, we have something which is going to tell us what happens when the car does not slip and we have a bunch of forces here which we can work with. So let's start looking at this, let's maybe start looking at these bunch of forces. As you'll see, I spend a lot of time here showing the students how I think about the problem in order to arrive at a solution methodology. I've tried to be explicit about saying, "I will draw a picture" or "I will list the tools". These are transferrable strategies that students can adapt when faced with different problems. My drawings are focused on understanding the physical situation, some of them don't even help solve the problem as such but they do help me understand it. The equations required to resolve the problems arise not by magic but by understanding the physical situation and by reviewing my notes to see what I already know about these kinds of situations.

Notes

Summary

9m 18s



As you will see in a later video, showing students how to analyze a problem in this way will be very useful to them because one of the most common errors students make is to insufficiently analyze problems before starting on a solution. When I get to the solution, it will also be useful to demonstrate to the students how to check what they've done. Okay, so now we've come to a solution but now we need to just check our solution make sure everything makes sense. First of all, are we answering the question in the terms on which it's asked? Well the question asks for what is the maximum constant speed. So we're not actually answering the question yet. The maximum constant speed is equal to square root of R mu G and we're expressing it in terms of V yes in terms of R in terms of MU and other known constants and that's G. So we're now answering the question. We can check back to make sure that we've made no logical errors, we checked they did that m and r were positive before we divided across, we checked that V was positive when we took the square root so it looks like we have not made any errors of judgment along the way. I think our question is correct.

Notes

Summary

10m 37s

Key skills for board writing

- Plan what your board will look like
- Model scientific and problem solving thinking
- Write slowly enough

So what does all this mean for writing on a board? Well maybe the first thing to take out of it is that you should definitely have a plan for what your board will look like. Before I started to solve this solution I took a sheet of paper and I wrote out on a paper what my solution would look like, how I would communicate it graphically to the student. Secondly, I payed explicit attention to how to model the scientific and the problem-solving process. I tried to tell what the heuristics were that I was doing, I tried to model the thinking process, which would lead the student to be able to find their own solution. Rather than saying "Look here's a solution you just need to know it", I said to the student, “If you follow these procedures, the likelihood is that a solution will start to emerge for you”. Thirdly, I paid attention to writing slowly enough. Very often one of the difficulties with making presentations using slides is that actually it just goes so fast; it goes so fast that the student can't really follow what happened. So I wrote slowly, hopefully I wrote clearly and that meant I took time. It will take time to write out solutions but that is not time wasted.

Notes

Summary

12m 02s

Key skills for board writing

- Plan what your board will look like
- Model scientific and problem solving thinking
- Write slowly enough
- Print letters, make them clear
  - 3l or 31?
  - 3k x v or 3k*v?
  - 2^z or z^2 ?

It is time that is working at the speed at what your student can actually follow what's going on, make sense of it and actually understand it. Finally, I try to pay attention to my handwriting, to make sure that my handwriting was clear. So for example, I try to avoid using joined handwriting: I try to print letters; print letters are usually easier for people to read on the board. I try to make them clear where possible. When writing, I try to avoid common mistakes or common confusions, which arise the confusion between L and 1, which you see here; in the first case is three L in the second case it's 31. I need to write my 'L's and my 'one's differently from each other. I need to write my X's differently from my multiplication signs, I need to write my 2's distinctively differently from my Z's.

Notes

Summary

13m 18s

Conclusion

- Model thinking to students
  - No “tricks”
- Work at a speed they can follow
- “Fail to prepare, prepare to fail”
- Write clearly

So what conclusions can we draw about using a blackboard. First of all blackboards are a wonderful tool because they enable us to model a thinking process to the student. When a student is in an exam they're faced with a question that they've never seen before, they need to go through a process of analyzing the question, of planning, of solving and of checking their solution in order to be successful. This is our opportunity to show them what that process looks like, to show them what these different heuristics look like in practice. Part of that is communicating to the student that there's no magic trick here, there's no intuition they need. There is an analytical procedure and if they can follow that analytical procedure there is a good chance that a solution will emerge for them. Secondly, boards allow us to work at a speed that students can understand. We can talk a lot quicker than other people can understand and boards will help to slow us down. By writing slowly on the board, we're working at a speed which is appropriate for student comprehension. Thirdly, the old motto; "if we fail to prepare, we prepare to fail".

Notes

Summary

14m 12s

Conclusion

- Model thinking to students
  - No "tricks"
- Work at a speed they can follow
- "Fail to prepare, prepare to fail"
- Write clearly

When writing on the board it is really important, really useful to have mapped out for yourselves in advance what you want your board to look like. Take the time with a sheet of paper to draw what your solution is going to look like by the time you get to the end. Armed with that, you will be able to use the board to communicate effectively. Finally, pay attention to how you write on the board. If possible, write in non-joined-up letters they're more often easier for people to read. Make sure that the font you use or that the script you use enables you to distinguish between 1's and L's and between 2's and Z's. This will be really important in terms of helping clarify for students what's gone on.

Notes

Summary

15m 24s