Physics A: Net Force

Scene #	Description	Narration
1	The definition of Net Force is showing on the screen. Below the definition the narrator draws the Sigma sign and the letter F next to it. He continues to write the Net Force as he describes it for equilibrium. He then further writes it to show when you get acceleration.	When we're looking at the effect that forces have on the motion of an object, It helps to look at the net force acting on that object. Net force is the sum of all forces acting on an object. And since forces are vectors, we can add all of those vectors together to find the net force. The symbol for that force is the Greek letter sigma and the letter F. Sigma means the sum of and F means forces. So when the sum of all forces is equal to zero newtons, we are in a state of equilibrium, meaning the object won't accelerate, decelerate, or change direction. However, when the sum of all forces does not equal zero, then we get acceleration. To help us understand this, let's look back at an example from a previous lesson.
2	An example problem is on the screen. The narrator reads the problem out loud. The narrator draws an arrow pointing south and labels it 830 Newtons. He draws a second arrow pointing north and labels it 615 Newtons. The narrator writes the sum of all forces and records the steps to solve the problem.	A skydiver is falling towards the earth. The only forces acting on them are in an 830 newton downward force of gravity and a 615 newton upward force of drag. What is the net force acting upon the skydiver? All right, let's begin by drawing the free body diagram, the situation. We have a downward force of gravity. And that's 830 newtons. We also have an upward force. It's a little bit shorter. And that's the 615 newton force of drag. So the sum of all forces, in this case, all the forces that are acting in the y direction, is equal to a 615 newton force plus a negative 830 newton force. Negative because it's in the negative direction, downward. If we add those together, we find that the sum of forces in the y direction is negative 215 newtons. So the net force acting upon the skydiver is 215 newtons downward.
3	A new problem is showing on the screen. The narrator reads the problem out loud.	Now this is a simple example because all the forces are along the same axis. They're in the same direction, the y direction. Let's look at an

		example where the forces act in multiple dimensions. What is the net force on an object with the following forces acting on it? 296 newtons west, 388 newtons east, and 112 newtons south?
	The narrator draws a green arrow going west below the problem and labels it 296 Newtons. He then draws an arrow going east and labels it 388 newtons. He drew an arrow south and labeled it 112 newtons.	All right, let's begin by drawing this one out. Again, we'll draw our object as a dot like this. We have 296 newton's West. So we'll draw that as an arrow pointing away from the object in the West direction, 296 newton's. The next one is 388 newtons east. So it's going to be a little bit larger. And again, starting at the object and pointing away, 388 newtons. And then one force, that's 112 newtons south. So this is a much shorter one. Maybe like that. And that's 112 newtons. All right, define the sum of all forces. Let's begin by finding the sum of all forces in the x direction.
	The narrator records the sum of all forces and says the steps out loud for solving the problem.	So the sum of all forces in the x direction-- well, we have one that's negative 296 newtons plus positive 388 newtons. That gives us a net force of positive 92 newtons. That's 92 newtons east.
	The narrator records the records in blue the y direction arrow going south and labels it negative 112 newtons. He then draws the x direction arrow and labels it 92 newtons and makes a triangle out of the two arrows.	All right, now time the sum of all forces in the y direction. Well, we only have one force in the y direction and that's negative 112 newtons. Negative because it's pointing south. So sum of all forces in the y direction is 112 newtons south. Now we can use trigonometry to find our final net force vector. To do that, let's sketch out what our final force vector is going to look like. It's going to be 92 newtons east, 112 newtons south. So our final vector is going to look like that.
	The narrator says and writes the Pythagorean theorem in blue. He walks through the steps to solving the problem.	Let's begin by finding the magnitude of this vector. We can use the Pythagorean theorem to find the magnitude if we call this side length c and that angle theta. We're going to use the

		Pythagorean theorem, which says a squared plus b squared equals c squared. So we can say 92 squared plus 112 squared equals c squared. That gives us c squared equals 21,008. If we take the square root of both sides of this equation, we get c, the magnitude of our force vector is equal to about 145 newtons. Now let's solve for the angle of this vector.
4	The narrator records the equation for the tangent theta on the screen and talks through the steps to solve the problem.	To do that, we're going to use the equation, the tangent of theta is equal to opposite over adjacent. Our side that's opposite angle theta is 112 newtons. Our side that is adjacent to angle theta is 92 newtons. Newtons cancel out. And if we get theta is equal to the inverse tangent of 112 over 92, enter that into your calculator and you'll find that theta is equal to about 50.6 degrees. So our final force vector F net, or net force, is equal to 145 newtons at 50.6 degrees. This is south of east. And that is the net force that's acting on this object.