Name: _____ Date: _____

WS 2.1: Newton's Laws & Force Vectors Practice

Unit 2: Dynamics and Equilibrium

1. Why do you lunge forward when your car suddenly comes to a halt? Why are you pressed backward against the seat when your car rapidly accelerates? In your explanation, refer to the most appropriate of Newton's laws.

2. Explain how you can recognize F_{net} based on the size of the force vectors.

3. If an object was in equilibrium, what would we know about the forces (no matter how many forces were involved).

4. Can an object be moving at 100 km/hr and be in equilibrium? Explain.

5. Can an object have an unbalanced force and have a velocity of zero? Explain.

6. A 4500 kg helicopter accelerates upward at 2.0 m/s^2. What lift force is exerted by the air on the propellers? Make sure you draw a FBD and write $F_{net} = ma$ to begin this solution.

7. Describe a situation where the normal force on an object is NOT equal to the gravitational force.

8. Sketch or describe three situations in the boxes on the left. In the boxes to the right of each situation, draw the appropriate FBD.

Situation	Free Body Diagram
Situation description $v = 0, a = 0$	*FBD of situation on left*
Situation description $v \neq 0, a = 0$	*FBD of situation on left*
Situation description $v \neq 0, a \neq 0$	*FBD of situation on left*

9. If you put a 1200 kg car on a scale (reading Newtons), what would it say? ie. what is the normal force supporting a 1200 kg car? Make sure you draw a FBD and write $F_{net} = ma$ to begin this solution.

10. What is the normal force supporting a 1200 kg car with a 75 kg person sitting in it and a 50 kg luggage rack on its roof?

11. What is the normal force supporting a 1200 kg car when a crane above it is pulling up on the car with a force of 500N?

12. An airplane has a mass of 3.1×10^4 kg and takes off under the influence of a constant net force of 3.7×10^4 N. What is the net force that acts on the plane's 78-kg pilot?

13. In the amusement park ride known as Magic Mountain Superman, powerful magnets accelerate a car and its riders from rest to 45 m/s (about 100 mi/h) in a time of 7.0 s. The mass of the car and riders is 5.5×10^3 kg. Find the average net force exerted on the car and riders by the magnets.

14. When a 58-g tennis ball is served, it accelerates from rest to a speed of 45 m/s. The impact with the racket gives the ball a constant acceleration over a distance of 44 cm. What is the magnitude of the net force acting on the ball?

15. A person with a black belt in karate has a fist that has a mass of 0.70 kg. Starting from rest, this fist attains a velocity of 8.0 m/s in 0.15 s. What is the magnitude of the average net force applied to the fist to achieve this level of performance?

Answers: 6: 5.3×10^4 N | 9: 1.2×10^4 N | 10: 12,985 N | 11: 11,260 N | 12: 93 N | 13: 3.5×10^4 N | 14: 130 N | 15: 37 N