Final Exam Math Problem Practice

1. Micah is playing football. In 3 seconds, he runs 8 yards forward, then 3 yards backwards.
    a. What is the total distance he traveled?
    b. What is his displacement?
    c. What is his average speed?
    d. What is his velocity?

2. Gus drops his physics book (mass 1.4 kg) off a 200-meter tall building. Assume there is no air resistance.
    a. How far does the book fall in 2 seconds?
    b. How long does it take the book to hit the ground?
    c. What is the book's velocity just before it hits the ground?

3. Leesy throws a ball straight up into the air at a speed of 42 m/s. What is the maximum height that the ball will reach?

4. David drives his car 3 $\hat{\imath}$ + 5 $\hat{\jmath}$ miles, then turns and travels - 4 $\hat{\imath}$ - 2 $\hat{\jmath}$ miles.
    a. What is the car's displacement from its starting point?
    b. Honors: If the truck travels this path in 0.25 hours, what is the speed of his car and what is the velocity of his car?

5. Avelinn is trying to push a 300-kg box across the floor (μ_s = 0.48, μ_k = 0.31).
    a. Draw a free body diagram showing all the forces on the box.
    b. What force must she exert on the box to get it moving?
    c. Once the box is moving, what force does she have to exert on the box to keep it moving at a constant velocity?

6. Evelynne is hanging a 20-kg sign from the ceiling by two wires.

$\theta = 40.0°$ $\theta = 40.0°$

Class of 2022!
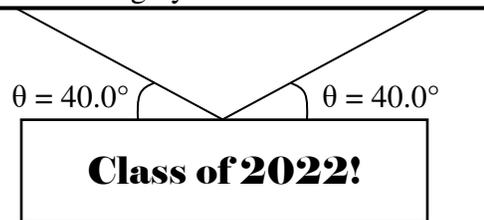
    a. Draw a free body diagram showing all the forces on the sign.
    b. Calculate the tension in the wires.

7. Tyler (mass = 70 kg) is long boarding down a hill. The top of the slope is 15 meters above the ground.
    a. Calculate Tyler's potential energy.
    b. If the hill is frictionless, how fast would he be going when he reached the bottom of the hill?

8. Jenave and Callie were on the bumper cars at Fiesta Texas. Jenave's car (mass 125-kg) was going forward with a speed of 6 m/s and Callie's car (mass 120-kg) was going backward with a speed of (4 m/s). The two cars collided and stuck together. What was the velocity of the cars as they slid? Assume there is no friction.

9. Tyler (the other Tyler) is swinging on a rope swing across the river. The length of the rope is 12 meters. How long does it take Tyler to make one complete swing (back and forth)?

10. Julien installs lights and a loud speaker on her car. Her circuit looks like this:
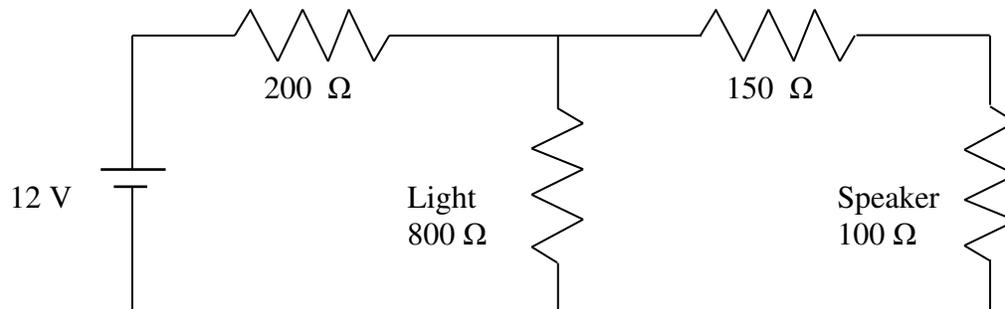
    a. What is the effective resistance of the circuit?
    b. What is the current in the circuit?

11. Aasha finds a glowing rock. She determines that it is radioactive and that it has a half-life of 20 days. When she weighed the rock, it had a mass of 312 grams. What is the rocks mass after 100 days?

12. Isabelle's car has a flat tire. She uses a hydraulic jack to raise the car so she can fix it. The small piston of the jack has an area of 0.2 m^2 and the large piston has an area of 0.9 m^2. Her car weighs 8,000 N.
    a. How much force does she have to apply to the small piston to raise the car?
    b. What is the pressure of the fluid inside the jack?

13. Ms. B made a cardboard boat and is floating it at Canyon Lake. The combined mass of Ms. B and her boat is 450 kg. When it floats, 0.8 m^3 of the boat is below the surface of the water. The density of lake water is 1020 kg/m^3.

    a. What is the weight of Ms. B and her boat?

    b. What is the buoyant force on the boat?