

# PHY 211 Recitation 4

January 22, 2020

When working through these problems, remember to apply the following steps:

- (a) Define a coordinate system for the problem and write it down. Drawing a picture may help.
- (b) Write down the equations of motion.
- (c) Translate the question that is given in plain language into a question about the variables in your equations.
- (d) Solve the problem algebraically.

## 1 Running a race

At the end of a race, a runner decelerates from a velocity of  $9.0 \text{ m/s}$  at a rate of  $2.0 \text{ m/s}^2$ .

- (a) How far does she travel in the next  $5.0 \text{ s}$ ?

- (b) What is her final velocity?

- (c) Think about your result in (b). What does it imply about how the runner moved? Does that make sense?

## 2 Angular acceleration

A wheel has a constant angular acceleration of  $5.0 \text{ rad/s}^2$ . Starting from rest, it turns through  $300 \text{ rad}$ .

(a) How much time elapses while it turns through the  $300 \text{ rad}$ ?

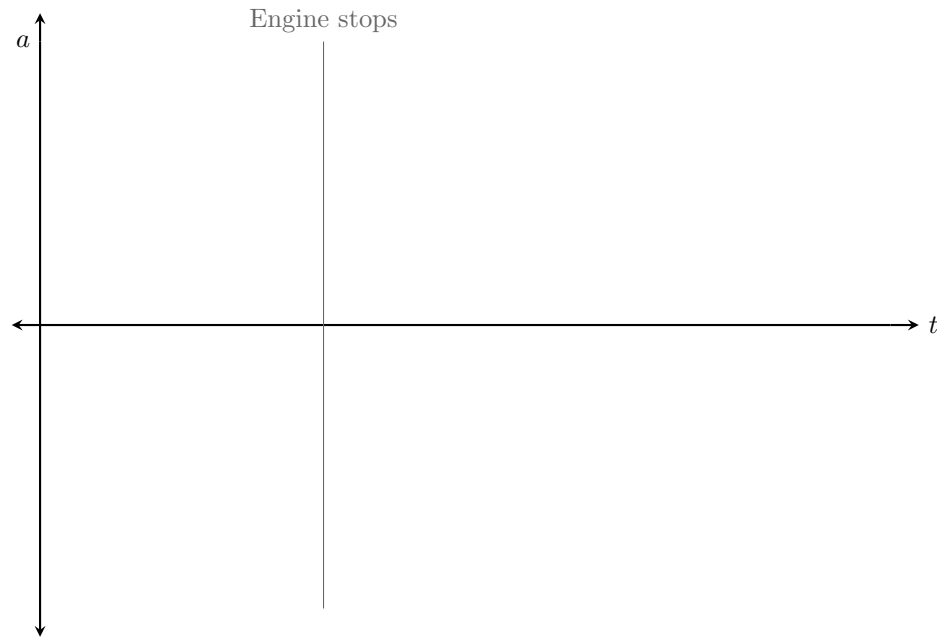
(b) What is its final angular velocity?

### 3 Rocket

A rocket is fired straight up. Its engine burns for ten seconds. While the engine is burning, the rocket accelerates upward at  $15 \text{ m/s}^2$ . After the engine stops, the rocket starts to freefall.

- (a) Since the rocket's acceleration changes in flight, you can't use constant-acceleration kinematics formulae to write down the motion for the entire flight at once. What can you do so that you *can* apply them?

- (b) Draw an acceleration versus time graph for the rocket.

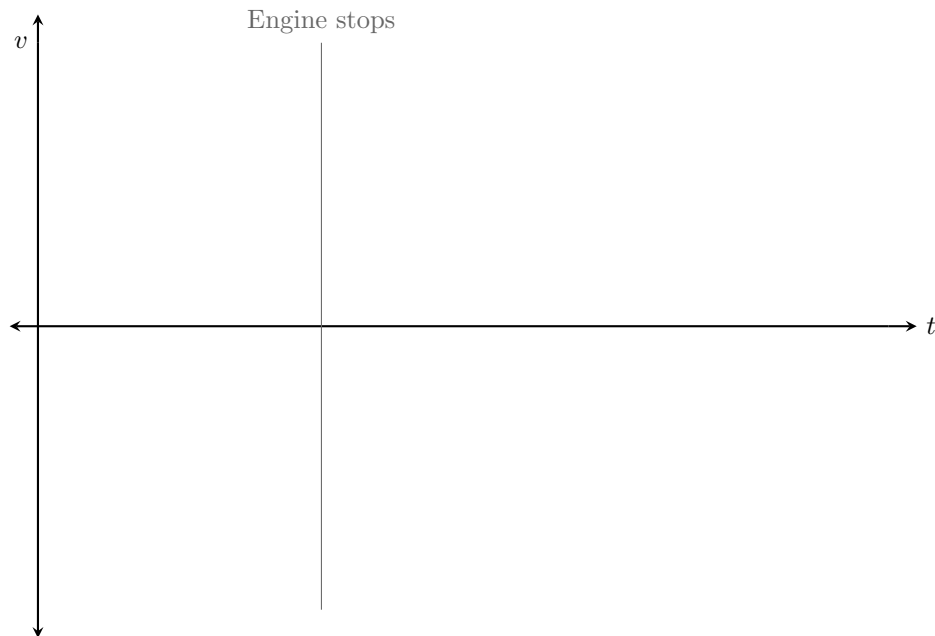


- (c) How high above the ground is the rocket when the engine stops?

(d) How fast is the rocket traveling once its motor burns out?

(e) How fast is the rocket traveling when it reaches its maximum height? Make sure to write out your reasoning. *Hint: Think carefully before you start writing down equations.*

(f) Draw a velocity versus time graph for the rocket.



(g) What is the maximum height the rocket reaches?

(h) How long does it take for the rocket to land back on the ground?

(i) Draw a position versus time graph for the rocket.

