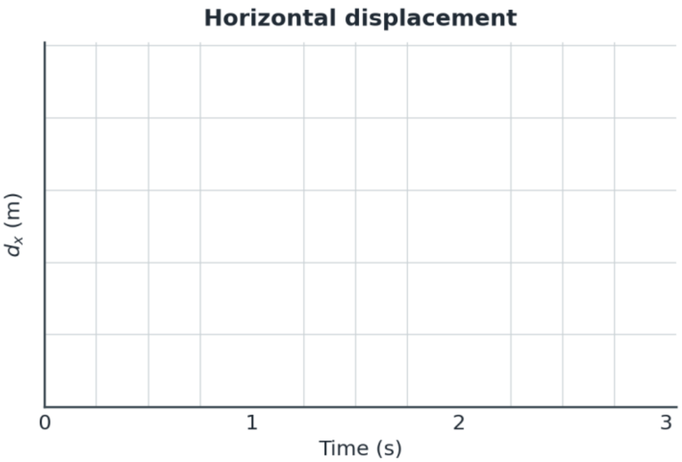
Graphing Horizontal Projectile Motion

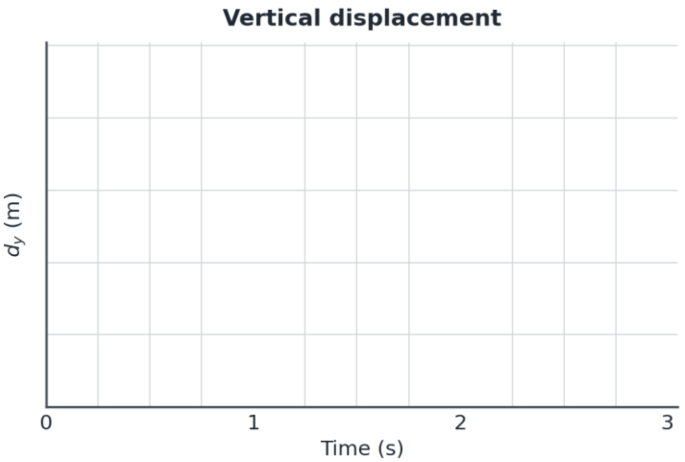
1. A ball leaves a cliff horizontally at 12.0 m/s and remains in the air for 3.00 s.

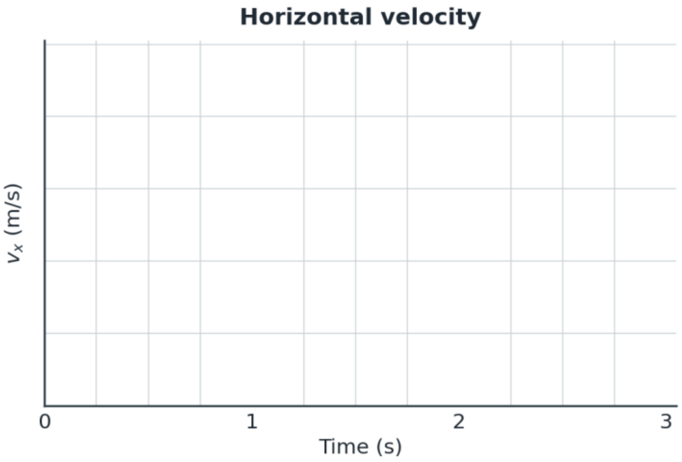
   a. Calculate the horizontal and vertical displacements and velocities at each time shown.

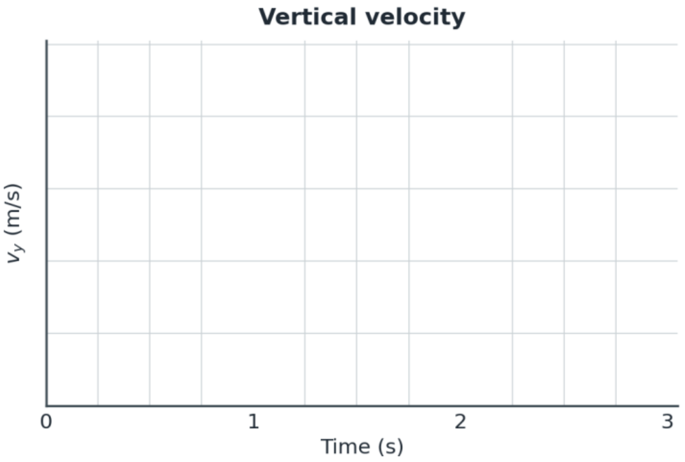
Time (s)	$d_x = v_i t + \frac{1}{2}at^2$	$v_x = v_i + at$	$d_y = v_i t + \frac{1}{2}at^2$	$v_y = v_i + at$
0 s	0 m	12.0 m/s	0 m	0 m/s
1 s				
2 s				
3 s				

   b. Plot all four relationships below. For each graph, choose a suitable vertical scale and plot your calculated points. Stop each graph at impact.









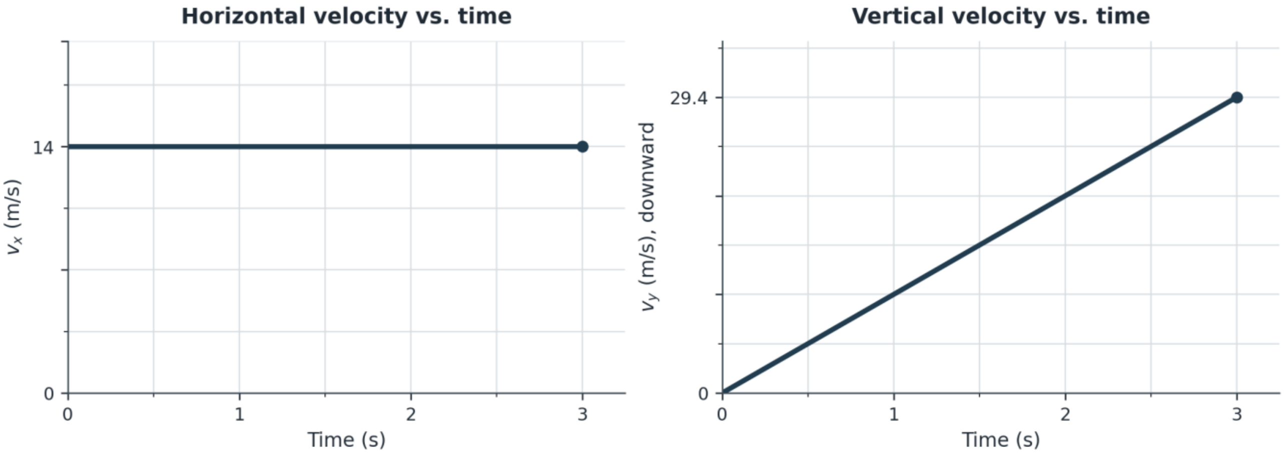
2. Two balls are launched horizontally from the same height. Ball A travels at 10.0 m/s and Ball B at 20.0 m/s. Both are in the air for 3.00 s.
   a. On the same axes, sketch horizontal displacement vs. time for both balls. Label each line.
   b. Which ball has the steeper graph? Explain what its slope represents.
   c. Would their vertical displacement–time graphs be identical or different? Explain.

3. Two balls leave different heights with the same horizontal launch speed. Ball A is airborne for 2.00 s; Ball B is airborne for 4.00 s.
   a. On the same axes, sketch vertical velocity vs. time for both balls. Label where each graph ends.
   b. Explain why the graphs have the same slope but end at different times.

Graph-reading reminder:

The slope of a velocity–time graph gives acceleration.
The area under a velocity–time graph gives displacement.

4. The graphs below show the horizontal and vertical velocities of a projectile from launch to impact.



   a. Determine the horizontal launch velocity.
   b. Determine how long the projectile is in the air.
   c. Calculate the vertical acceleration from the slope of the vertical velocity graph.
   d. Determine the horizontal displacement from the area under the horizontal velocity graph.
   e. Determine the vertical distance fallen from the area under the vertical velocity graph.
   f. Sketch horizontal acceleration vs. time and vertical acceleration vs. time.