

Rolling Marble Activity

Materials

- Whiteboard and Expo Marker
- Smooth Marble
- Meter Stick
- Electronic Device with Internet connection

Whiteboard Activity

1. As a class, you will hear a metronome set to **120 beats per minute**.
2. Roll the **marble** across the whiteboard at near constant speed as best as you can.
3. Mark on the whiteboard where the marble is at each metronome beat without affecting its motion.
4. Measure each dot with a meter stick from an edge of the whiteboard.

On the **Recording Sheet**,

5. Mark these dots approximately on the number line. Draw an arrow pointing to the direction of motion.
6. Record your measurements in the table. Fill out the table as much as that time it takes for the marble to go across the whiteboard. The position at time = 0 s is the initial dot on the whiteboard.
7. Plot this table (time, position) on the right column graph.

Desmos Analysis

1. Go to www.desmos.com/calculator.
2. Click on the **Add Item** icon (+▼) and select **table**.
3. Copy your position time table into Desmos .
4. Fit the data by entering $y_1 \sim mx_1 + b$ in a blank line
5. Record the equation of best fit line and the r^2 value on **Recording Sheet**.

Four Marble Situations Practice

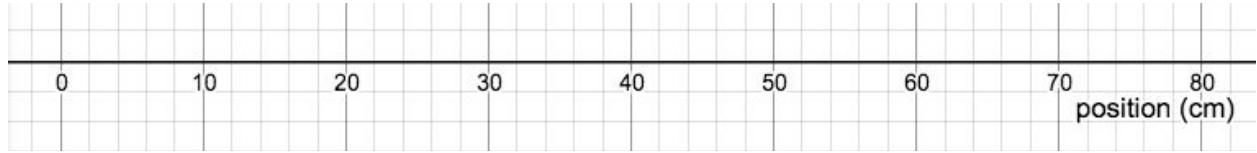
Notice the **left column** has dots which represents position as a marble rolls for **four different situations**. This is similar to the dots you marked on the whiteboard for your marble. The numbers below the dots is the time the marble is at a given position. In the center, there is a x-axis to tell you the position respect to the origin. This is similar to how you measured each mark with a meter stick from the edge of the whiteboard.

Notice the **right column** has four position-versus-time graphs. This is the column you will plot the (time, position) of the marble position as a function of time as represented by the dots on the left column.

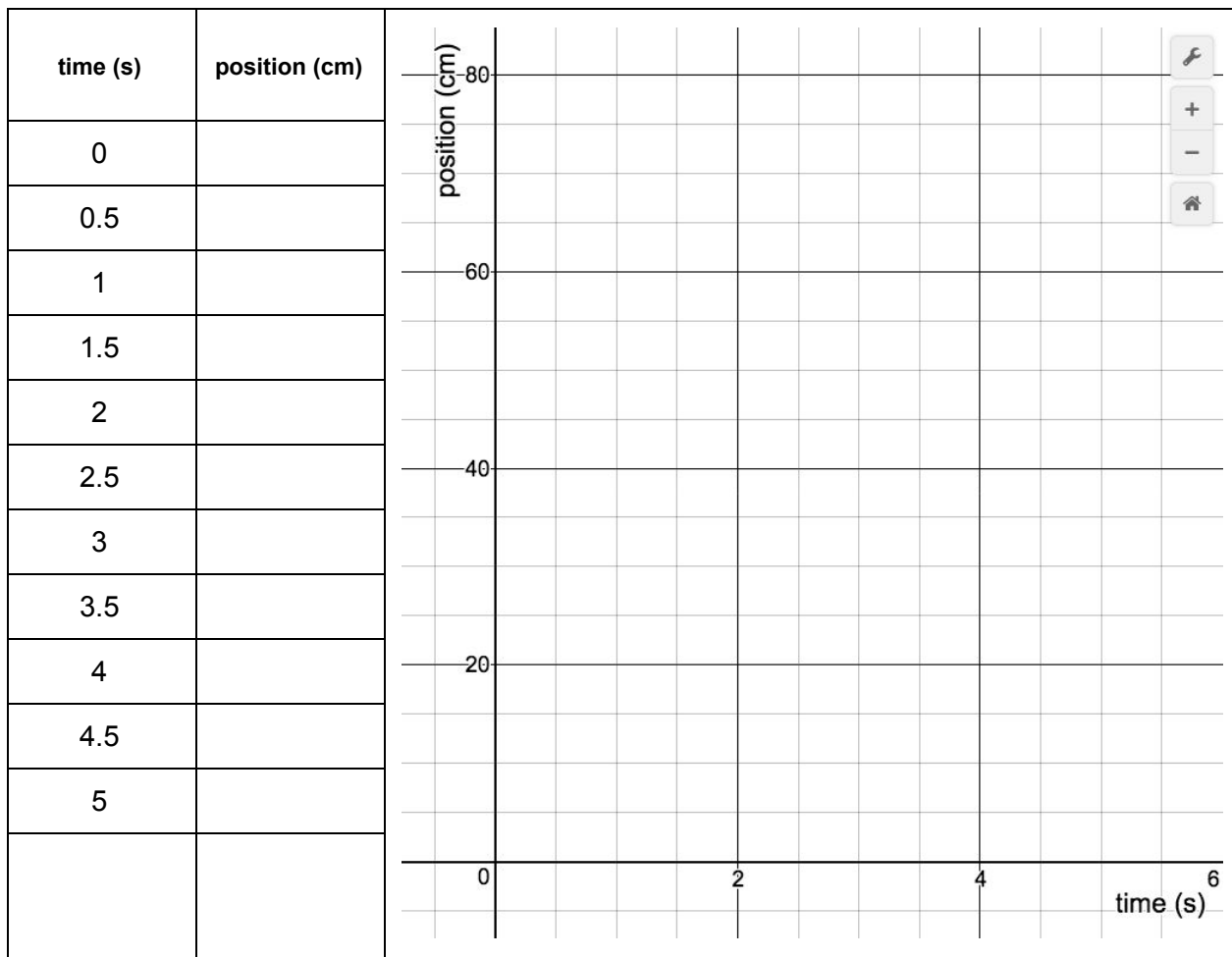
1. Observe the dots in the left column for each situation.
Write down what you think is happening to the marble in each situation.
2. Plot the time and position of the marble for the four situation in the right column using the information in the left column.
(For example start with the dot with a 0 below it on the first situation. The time is 0s. The position you read below on the x-axis in this case is 0 as well. So, mark a dot on (0,0) on the first right column graph.)
3. Connect the dots to form a line in each of the four situations. Observe each graph and think about what each of the parameters of a line may represent.
Write down what you think each parameter represents as a marble rolls across a whiteboard.

Whiteboard Activity

1. What is the pattern you observe between the marked spots?



2. What is the relationship between position and time?

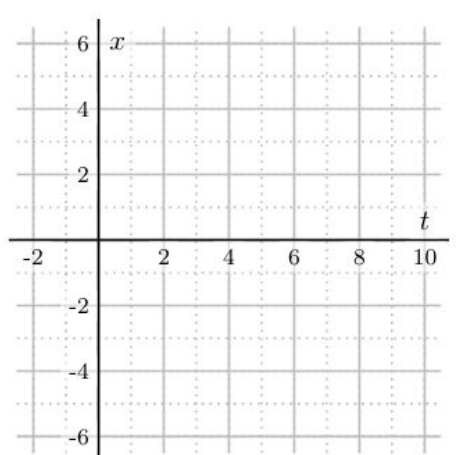
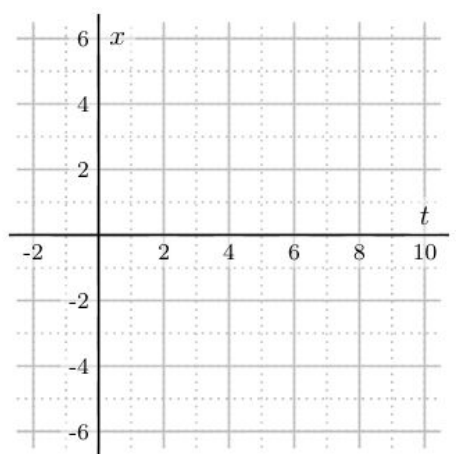
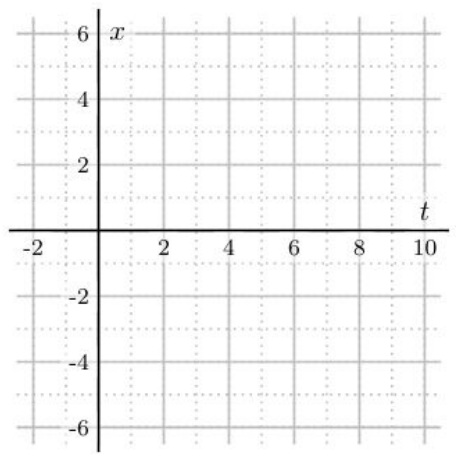
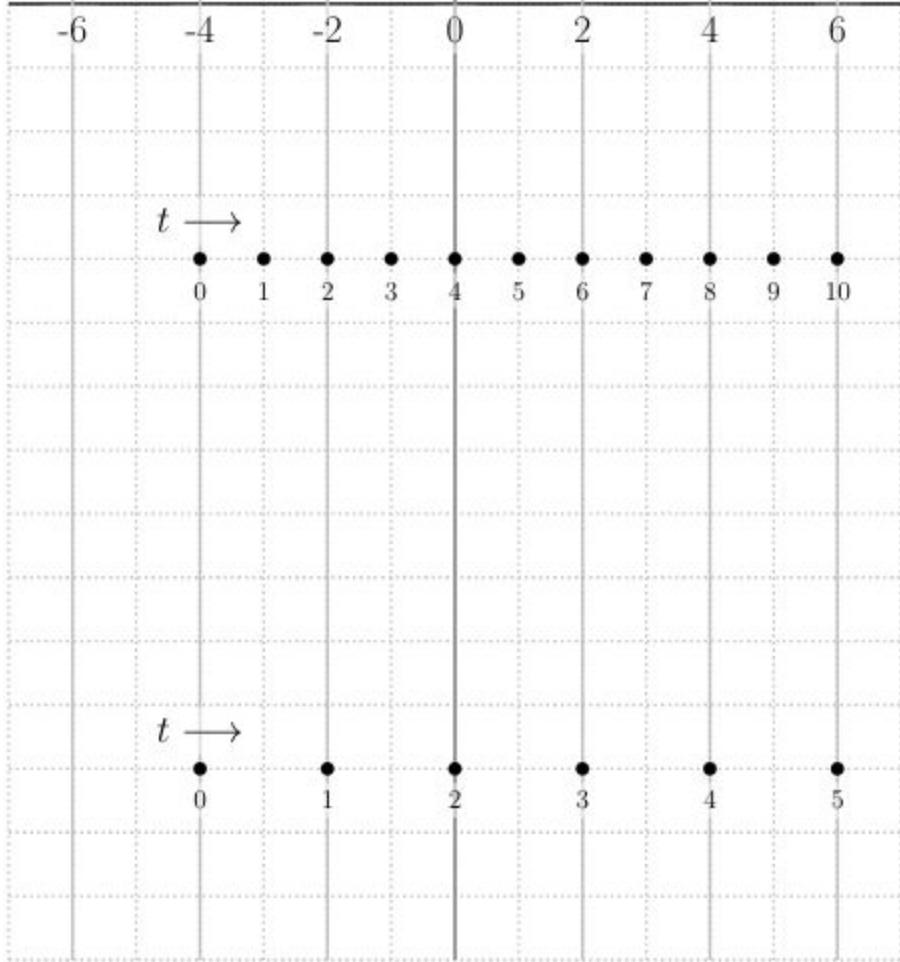
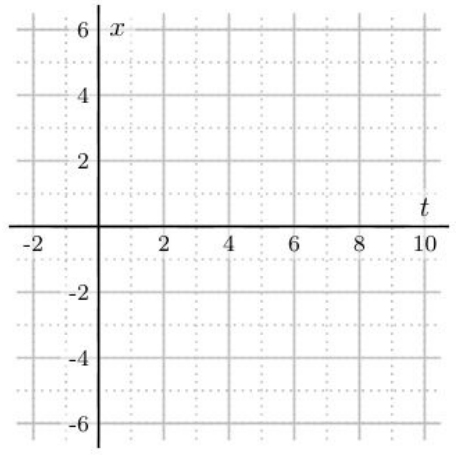
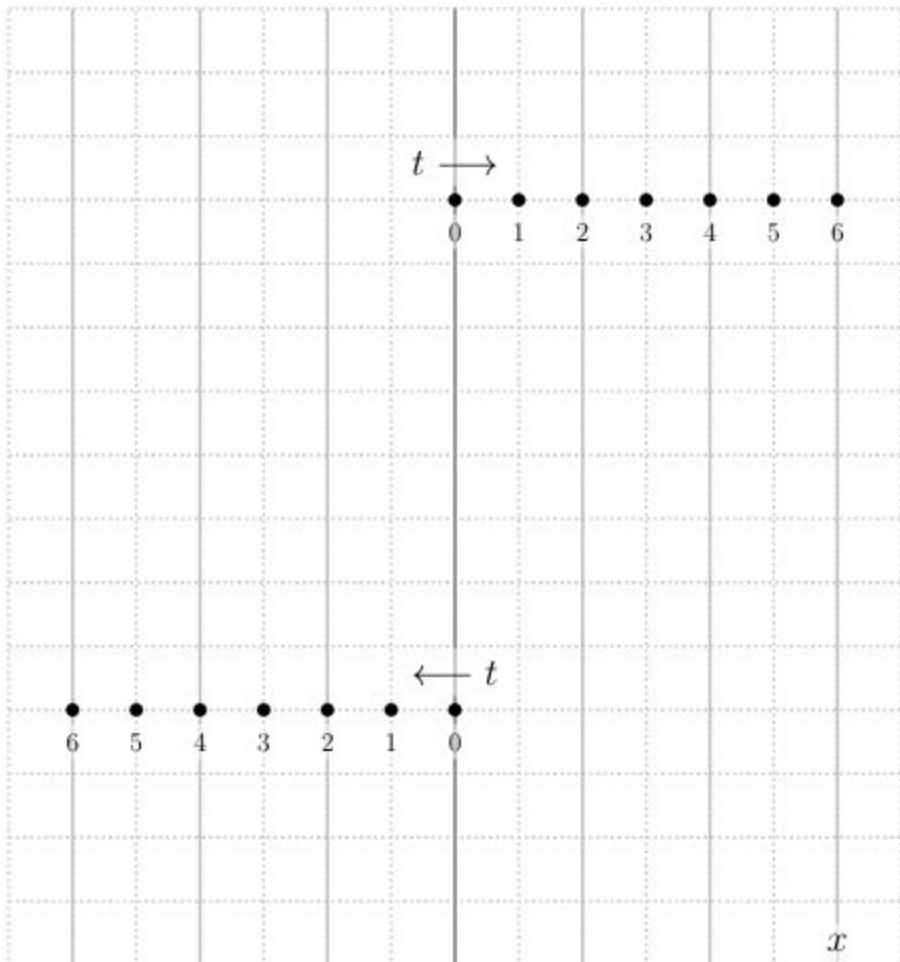


Desmos Analysis

3. Write out the equation of the best fit line between position and time.

4. r^2 value:

Four Marble Situations Practice



Four Marble Situations Practice

1. What do you think is happening to the marble in each situation on the left column?

Situation	Description
1	
2	
3	
4	

2. What does each of the parameters represent as a marble rolls across a whiteboard?

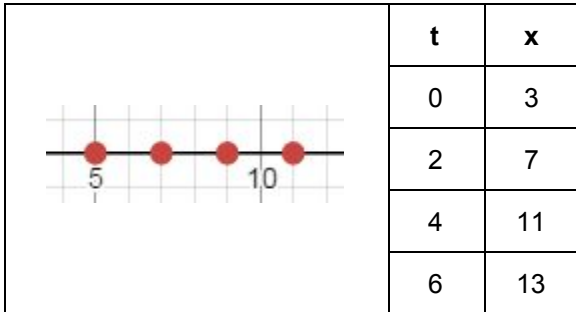
Parameter	Physical Representation
Value of the Slope	
Sign of the Slope	
Y-intercept	

Linear Model Check

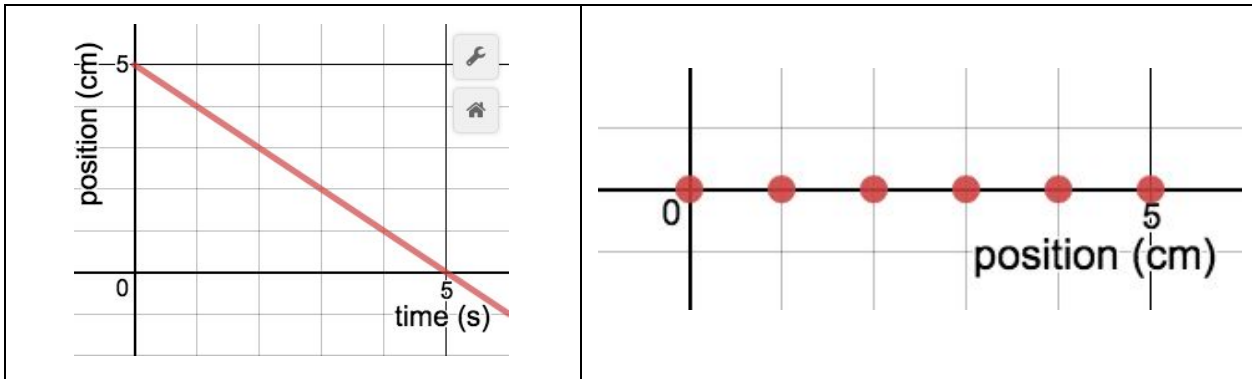
Name _____

This is to assess your understanding of our rolling marble activity and how its motion related to linear function.

1. What is the position function $x(t)$ for this marble? Hint: What is the average speed? What is the initial position?



2. Draw the direction the marble going in this graph?



3. If the marble travels 5 times as fast, draw what occurs to the graph?



4. If the starting position is moved back by 3 units from origin, draw what occurs to the graph?

