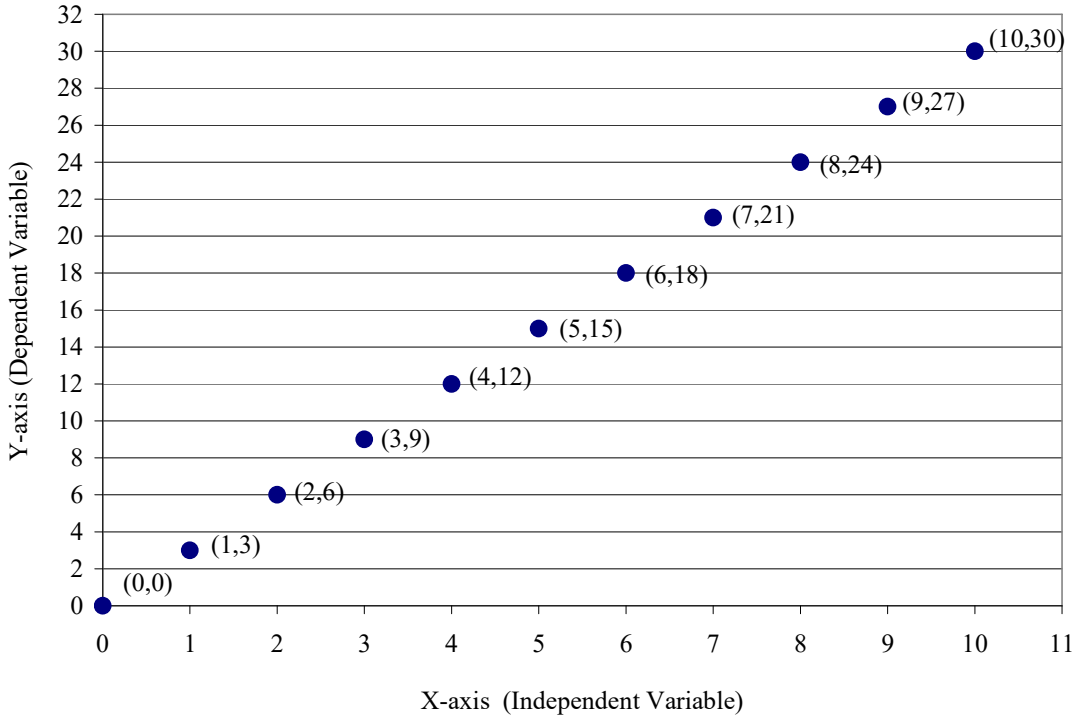
Name: _____

PHYSICS
Graphing Practice

Graphs are visual representations of data plotted that are plotted on a grid. Graphs are used to display data for analysis. The ***origin*** is defined as (0,0) where the x and y axis lines cross. Data points on scatter plot graphs are plotted as ***coordinates*** relative to the origin as (x,y). The coordinate x denotes how far left or right from the origin. The coordinate y denotes how far up or down from the origin.

The graph below shows the data points plotted on a ***scatter plot graph***. The data are represented as the solid circles. The numeric values of their (x,y) coordinates are shown for your reference.



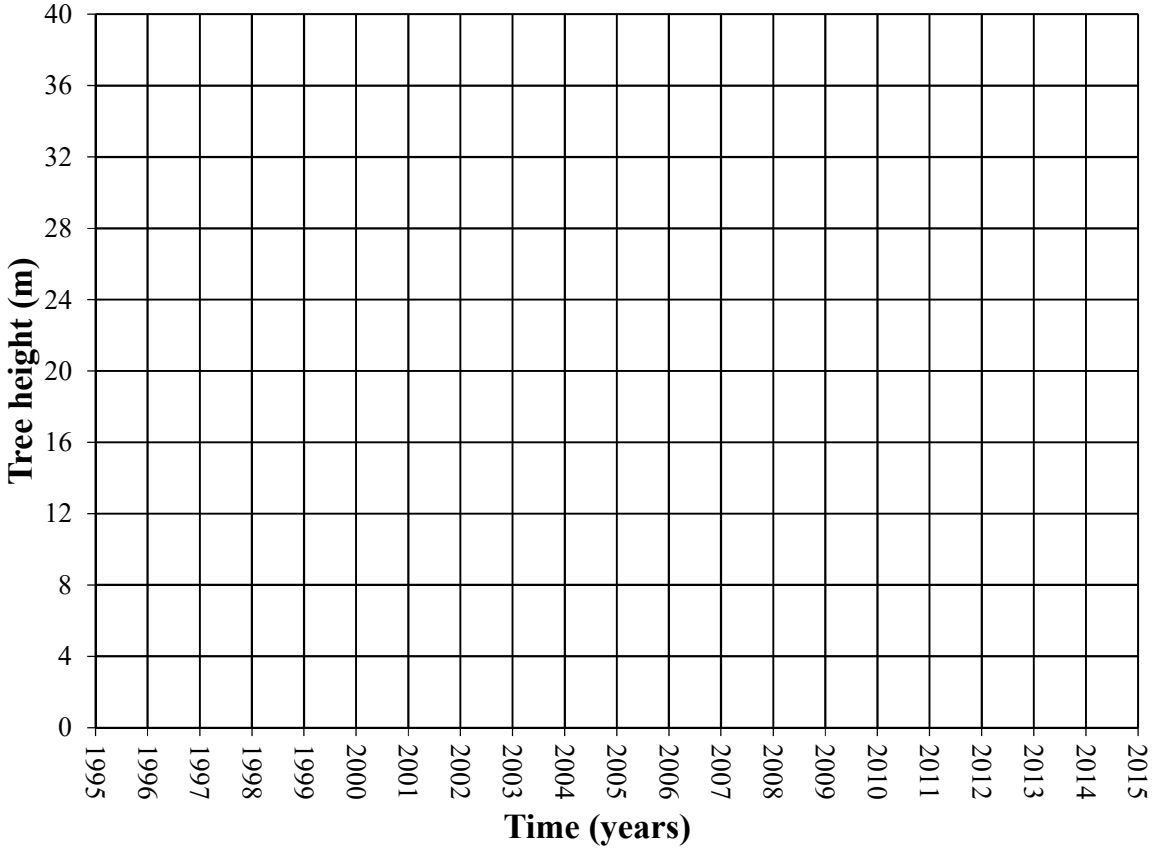
On a graph, the ***independent variable*** of an investigation or an experiment is usually represented by the values or categories on the ***x-axis***. As the independent variable is changed, the measurements or data collected is called the ***dependent variable***. The dependent variable is the outcome or result of the experiment. On a graph, the dependent variable is usually represented by the values or categories on the ***y-axis***. In other words, the independent variable is the cause and the dependent variable is the effect. A change in the independent variable will cause a change in the dependent variable.

1. You work for the Georgia Forestry Commission. Your team planted new pine tree saplings in 1995. Your team monitored the average heights of those pine trees for 20 consecutive years. The table below shows average pine tree height per year after planting.

Time (year)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Height (m)	2	6	10	14	18	20	22	24	26	28	30

continued

Time (year)	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Height (m)	31	32	33	34	35	35	36	36	36	36



What is the independent variable of this investigation? _____

What is the dependent variable of this investigation? _____

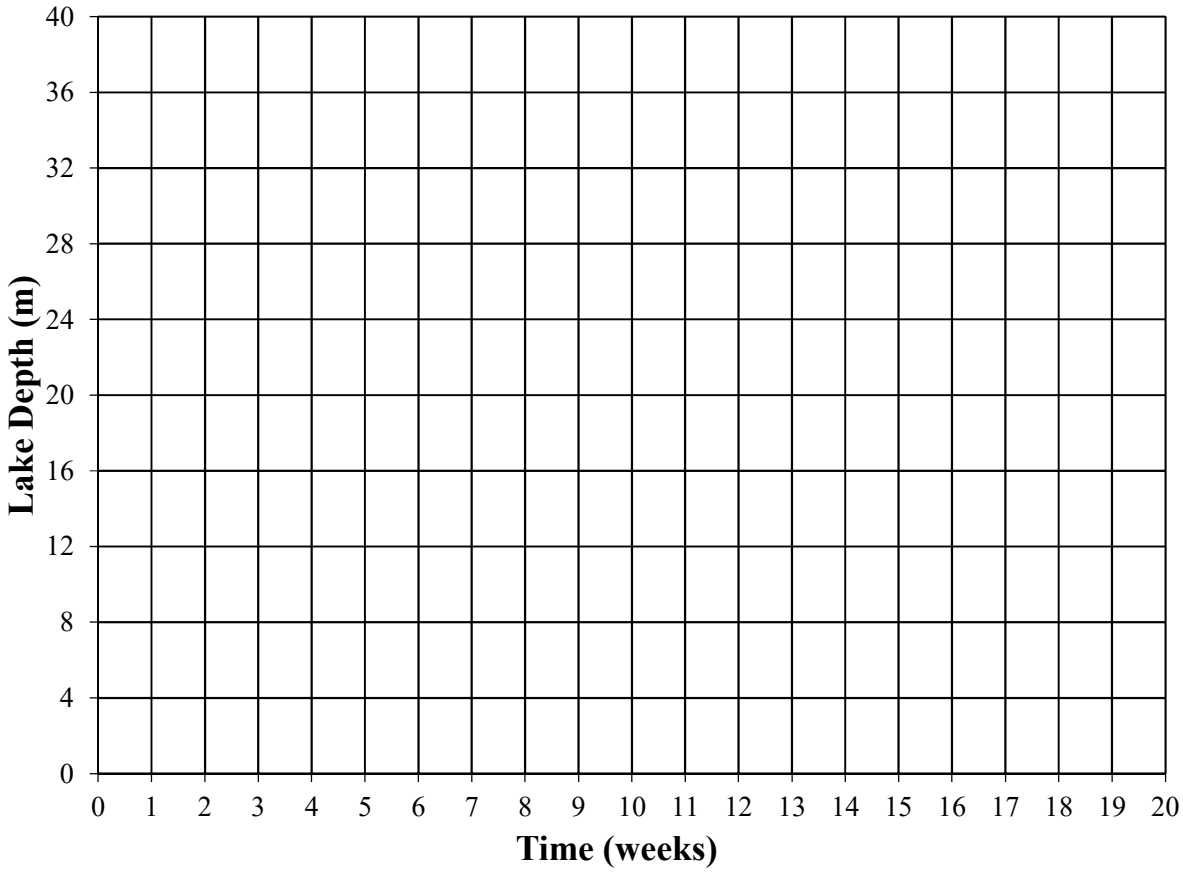
In 2-3 complete sentences, accurately describe how average tree height changes over 20 years.

2. A limnologist, a scientist that studies lake ecology and freshwater ecosystems, measures the depth of Lake Wheeler every week for 20 consecutive weeks. The table below shows the limnologist's measurements. Plot the data on the graph. Use solid circles to show data points. Neatly draw a line through all of the data.

Time (weeks)	0	1	2	3	4	5	6	7	8	9	10
Depth (m)	36	34	32	28	24	20	16	12	10	8	7

continued

Time (weeks)	11	12	13	14	15	16	17	18	19	20
Depth (m)	7	8	10	12	16	20	24	28	32	36



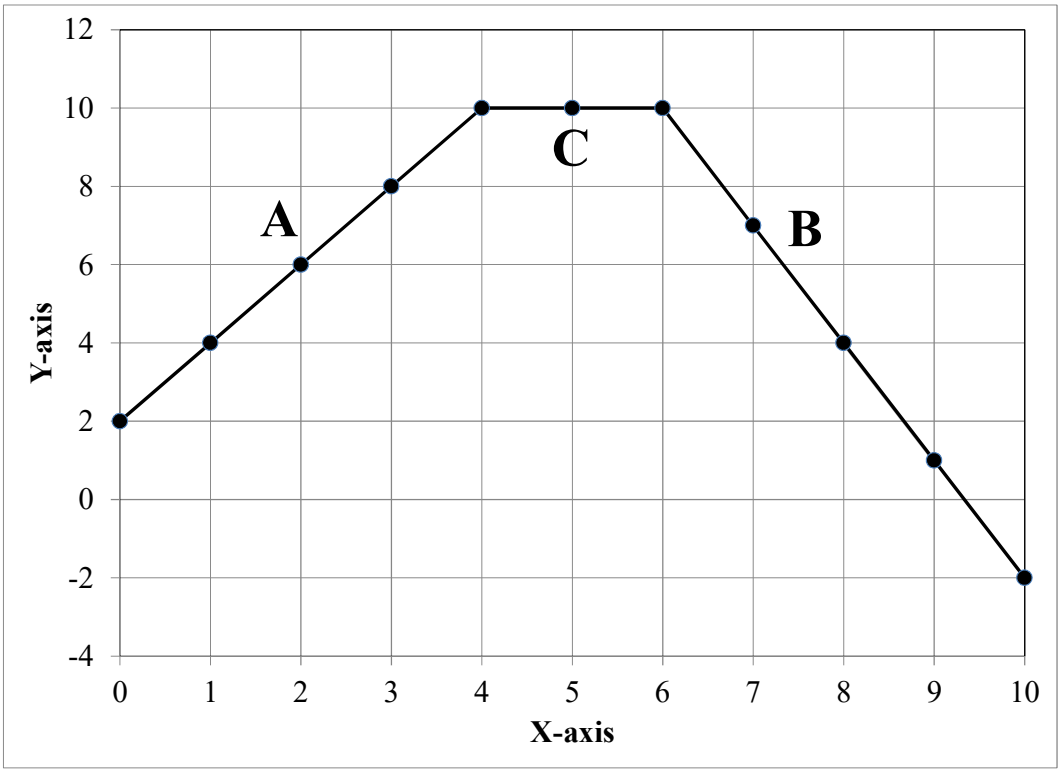
What is the independent variable of this investigation? _____

What is the dependent variable of this investigation? _____

In 2-3 complete sentences, accurately describe how lake depth changes over 20 weeks.

The **slope** of a straight line on a graph is the steepness of the line. The slope indicates the constant changing relationship between the dependent variable (y-values) and independent variables (x-values). In other words, the slope shows that "if you change x (independent variable) by this amount, y (dependent variable) will change by this amount". There are three types of slopes: Positive slopes, negative slopes, and slopes of zero.

SLOPE A = positive slope
SLOPE B = negative slope
SLOPE C = slope of zero

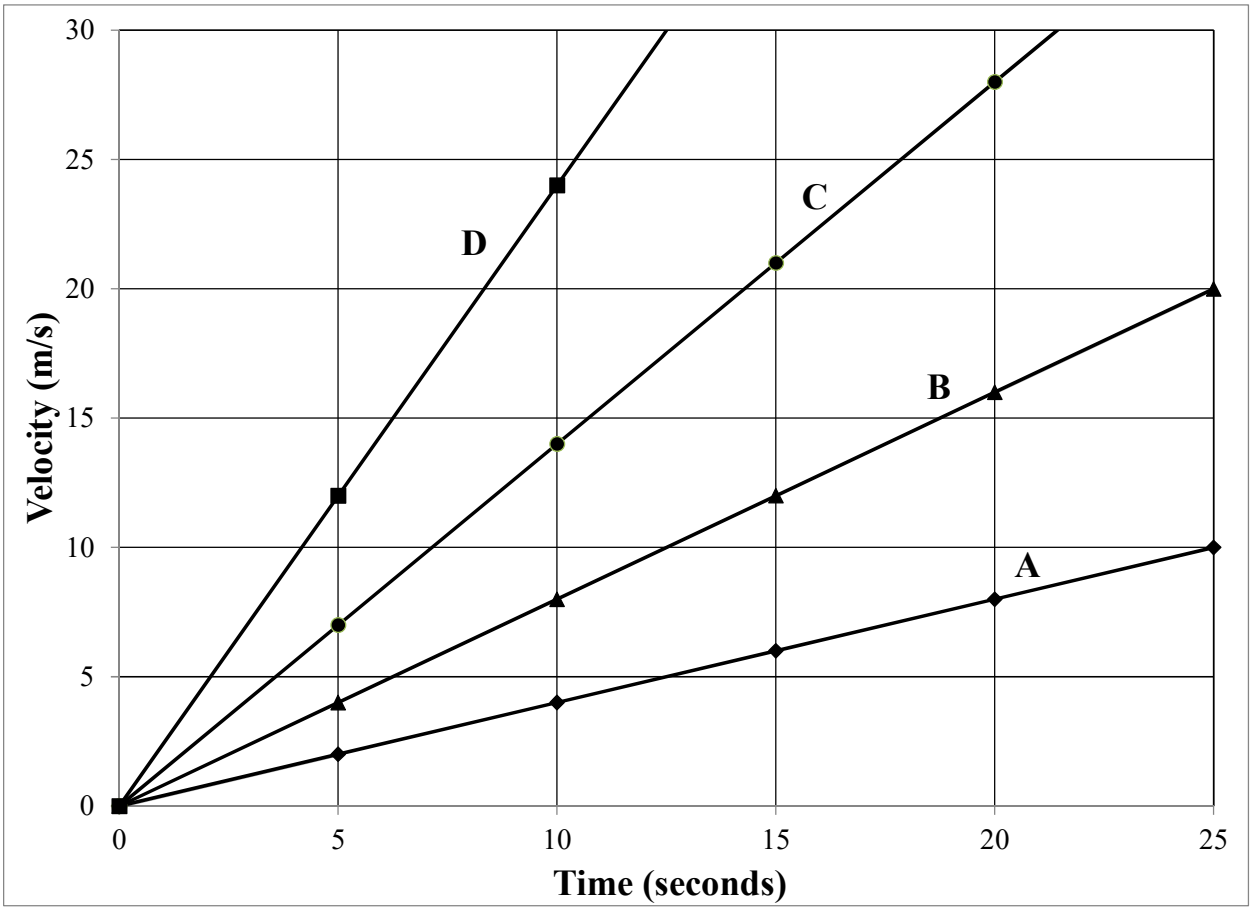


A ***positive slope*** indicates a positive correlation or ***direct proportionality*** between x and y—as the values of x increase, the values of y increase. "As x gets bigger, y gets bigger." Line segment A is a positive slope. Notice x values are increasing (0, 1, 2, 3, 4), and y values are increasing (2, 4, 6, 8, 10).

A ***negative slope*** indicates a negative or ***inverse proportionality*** between x and y—as values of x increase, the values of y decrease. "As x gets bigger, y gets smaller." Line segment B is a negative slope. Notice x values are increasing (6, 7, 8, 9, 10), and y values are decreasing (10, 7, 4, 1, -2).

A ***slope of zero*** indicates no change or constant conditions—as x becomes greater, y remains constant or is not changing. "As x gets bigger, y stays constant." Line segment C is a slope of zero. Notice x values are increasing (4, 5, 6), the y values are constant and do not change (10, 10, 10).

Slopes also represent ***rates***, or how fast a property changes with respect to another property. Steeper slopes indicate a greater rate of change—a small change in the independent variable (x value or category) creates a very large change in the dependent variable (y value or category). Conversely, gentle slows indicate a slower or gradual rate of change—a change in the independent variable creates a small change in the dependent variable. Slopes of zero mean that there is no change in the dependent variable regardless of how much the independent variable changes.



Slope A: Gentle slope, small rate of change.
Slope D: Steep slope, very large rate of change.

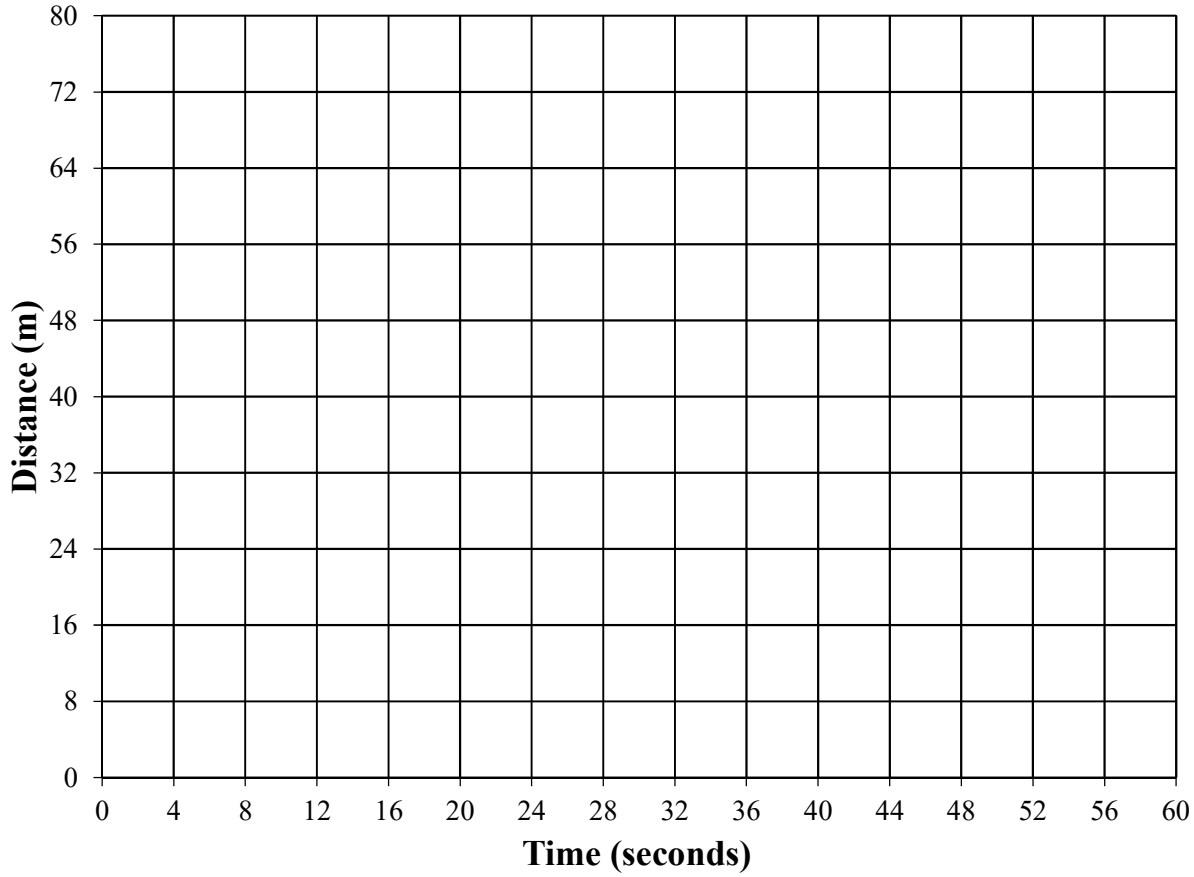
The graph above shows the changing velocities of four cars (A, B, C, and D). All four cars are getting faster with time because their velocities (how fast they move) are increasing. The line for car A has the gentlest slope. The velocity of Car A is slowly increasing—gentle slope means that the car's velocity is increasing at a slow rate, a gradual increase. In contrast, the line for Car D is the steepest. The velocity of Car D is rapidly increasing—very steep slope means that the car's velocity is increasing at a fast rate, a very large increase.

3. A man is walking on the street from his office building to the coffee shop. The data shows how far he walks (distance) as a function of time. Plot the data on the graph. Use solid black circles for data the data points. Connect the data points with straight lines. For this graph, a line with a positive or negative slope means that he is moving. A line with a slope of zero means that he is stopped.

Time (s)	0	4	8	12	16	20	24	28	32	36	40
Distance (m)	0	8	16	24	32	32	32	32	40	48	56

continued

Time (s)	44	48	52	56	60
Distance (m)	64	72	72	72	72



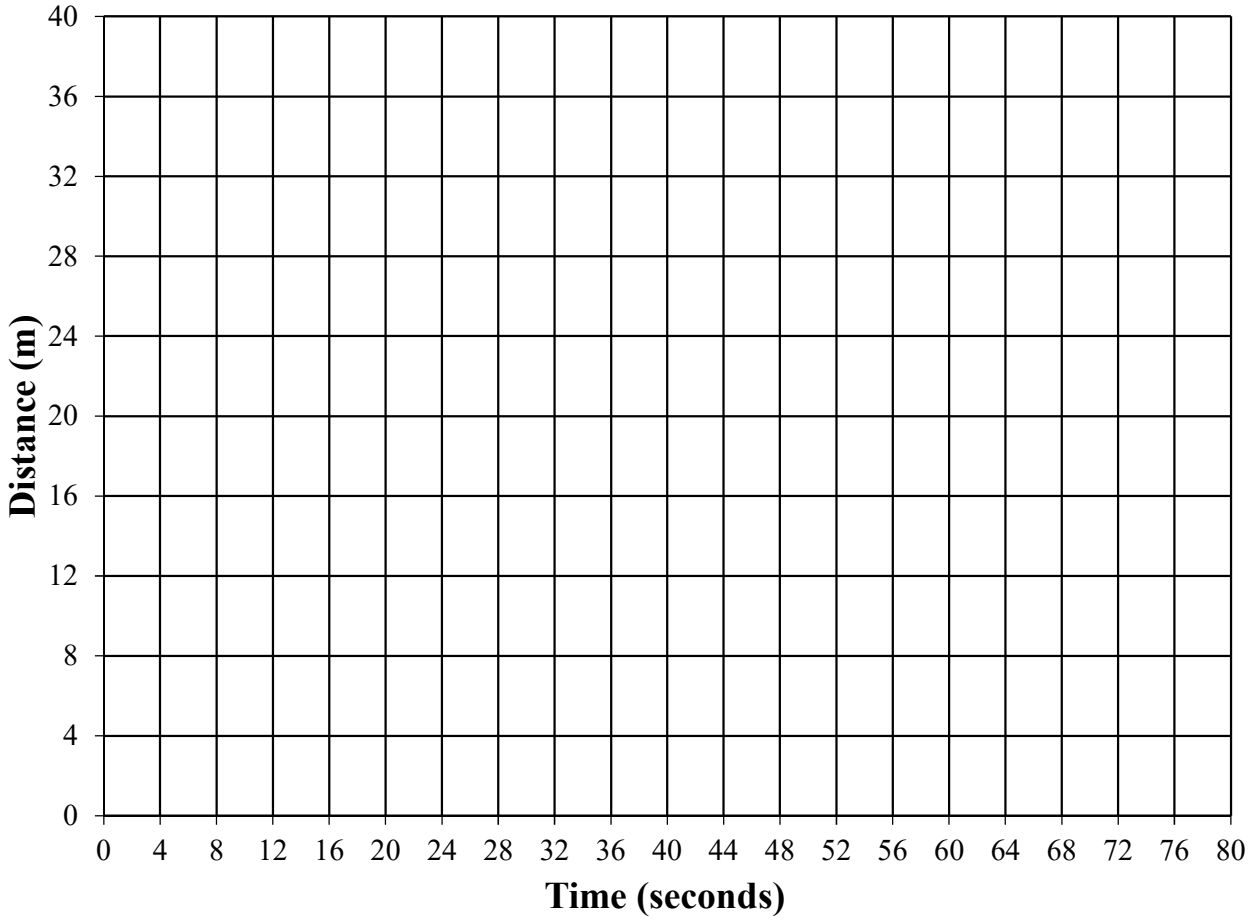
In 2-3 sentences, accurately describe the motion of the man walking to the coffee shop.

4. The night watchman at the factory walks through the corridors. The data shows how far (distance) the guard walks as a function of time. Plot the data on the graph. Use solid black circles for data the data points. Connect the data points with straight lines. For this graph, a line with a positive or negative slope means that he is moving. A line with a slope of zero means that he is stopped.

Time (s)	0	4	8	12	16	20	24	28	32	36	40
Distance (m)	0	4	8	12	12	12	16	20	24	28	32

continued

Time (s)	44	48	52	56	60	64	68	72	76	80
Distance (m)	32	32	28	24	20	20	20	16	12	8



In 2-3 sentences, accurately describe the motion of the night watchman.

A ***linear function*** is when a single, best-fit straight line can be drawn through the data points. The ***y-intercept***, b, is where the straight line crosses through the y-axis, and represents the dependent variable value when the independent variable is zero. The ***slope***, m, is defined as the change of y divided by the change in x.

$$y = mx + b$$

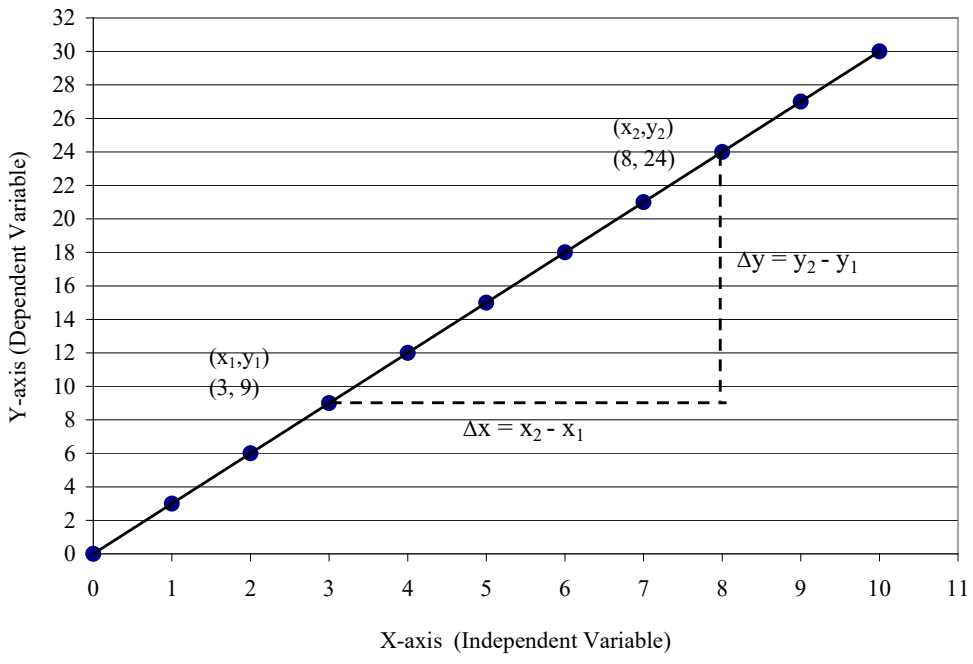
Linear Function equation

y = value of the dependent variable
x = value of the independent variable
m = slope of the straight line
b = y-intercept, the value of y when x = 0

$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

How to solve for the slope of a straight line

Step 1: Pick two data points that lie exactly on the straight line.
Step 2: Identify the coordinates (x,y) for both points.
Step 3: The numerator (upper half of the fraction) is the change in the y values. Subtract y_1 from y_2.
Step 4: The denominator (lower half of the fraction) is the change in x values. Subtract x_1 from x_2.
Step 5: Divide to determine the slope.



The slope for the line in the example to the left is

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{24 - 9}{8 - 3} = \frac{15}{5}$$

$$m = 3$$

The y-intercept in this case is equal to 0 (b = 0) because the straight line crosses through the origin.

5. At the races. Three cars race each other at the racetrack. The track has a total length of 200 m. You use a stop watch and time (seconds) the cars as they race from the starting line to the finish line.

Plot the distance vs. time data for each car on the graph. Use solid blue circles for car 1. Use solid red triangles for car 2. Use solid green rectangles for car 3. Draw a straight line from the origin through the data points for each car. Calculate the slopes of the straight lines. The slopes of the lines on this graph are equal to the cars' velocities.

Car 1

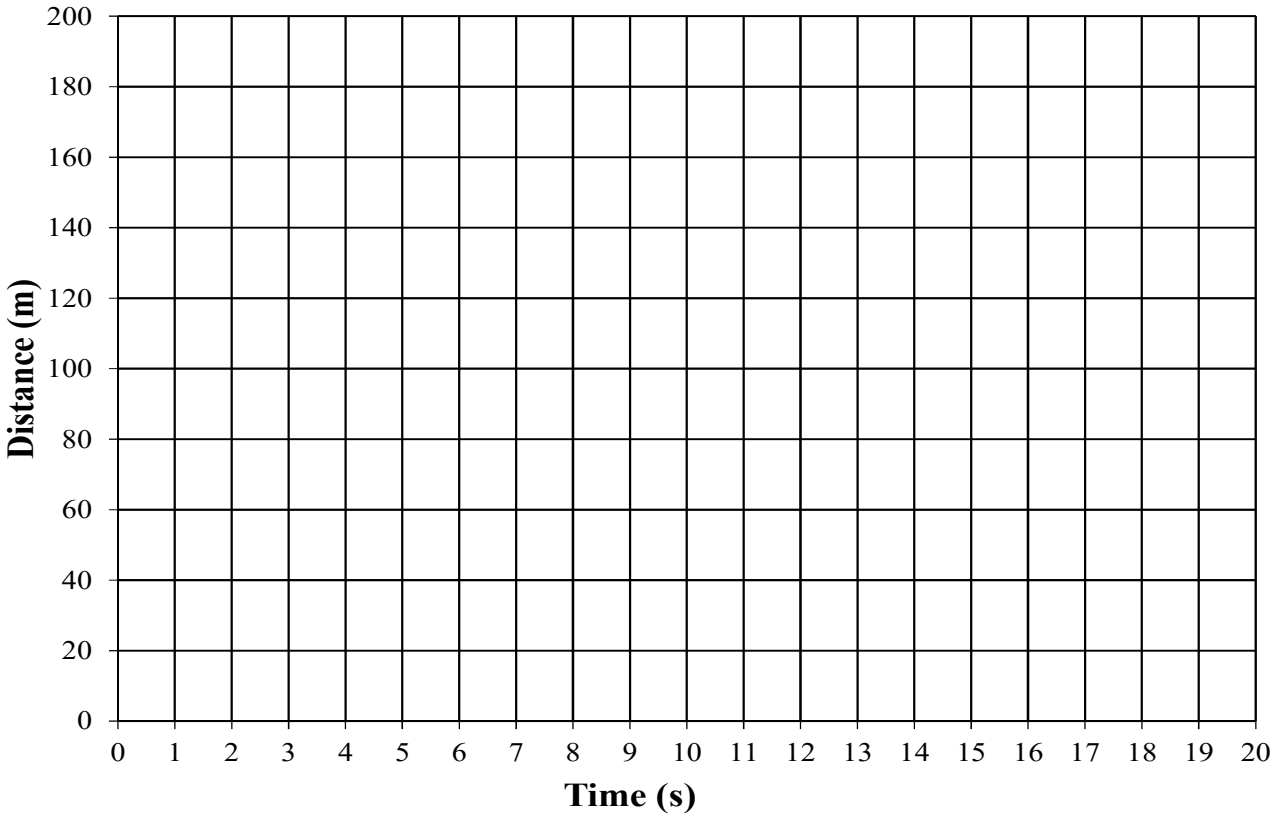
Time (s)	0	2	4	6	8	10	12	14	16	18	20
Distance (m)	0	20	40	60	80	100	120	140	160	180	200

Car 2

Time (s)	0	2	4	6	8	10	12	14	16
Distance (m)	0	25	50	75	100	125	150	175	200

Car 3

Time (s)	0	2	4	6	8	10
Distance (m)	0	40	80	120	160	200

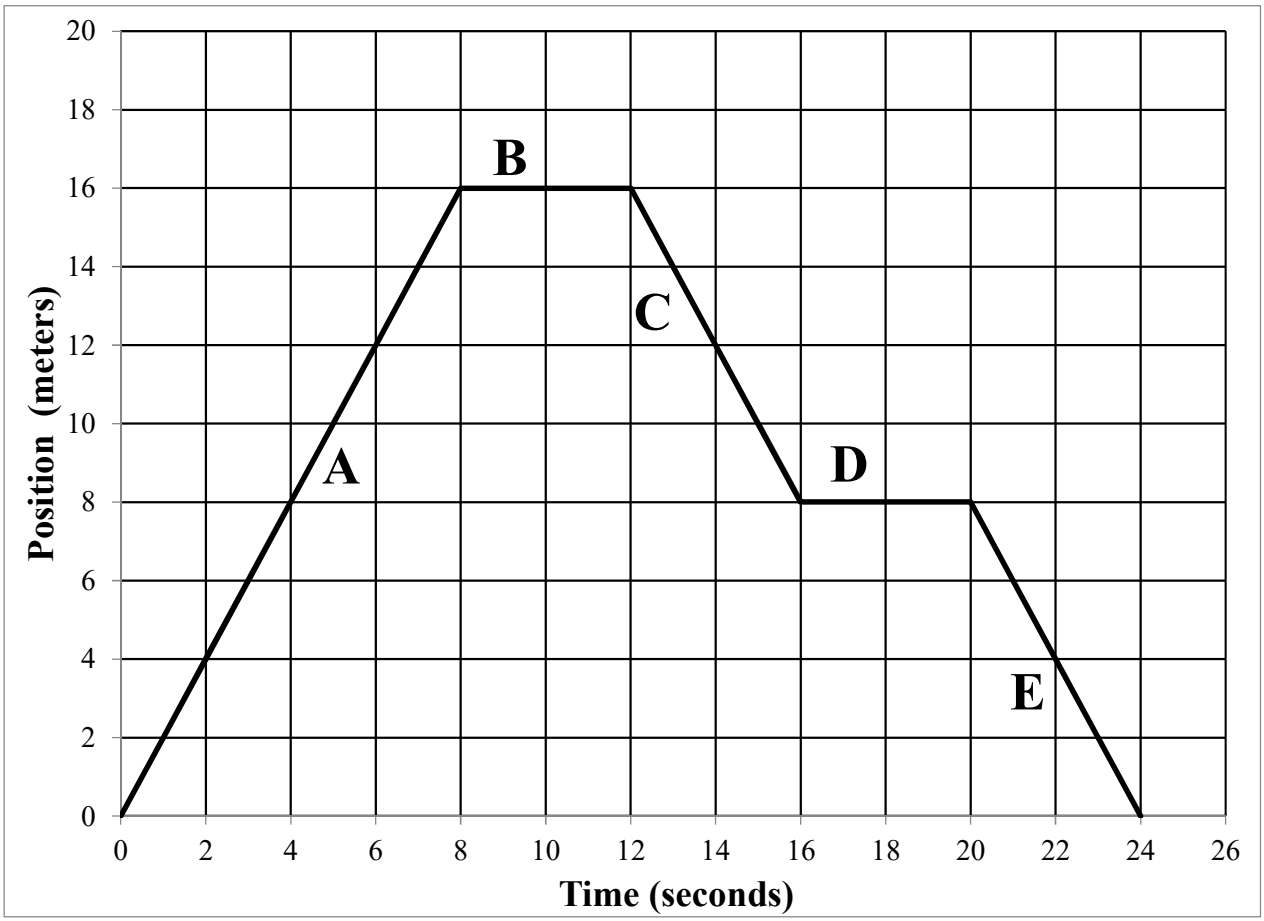


Car 1: _____ m/s

Car 2: _____ m/s

Car 3: _____ m/s

6. The graph shows the walking travels of a dog in a yard, his position as a function of time. The slopes of the lines are the dog's velocities (how fast he moves). Calculate the slopes of the line segments (how far divided by how much time).



Segment A _____ m/s

Segment B _____ m/s

Segment C _____ m/s

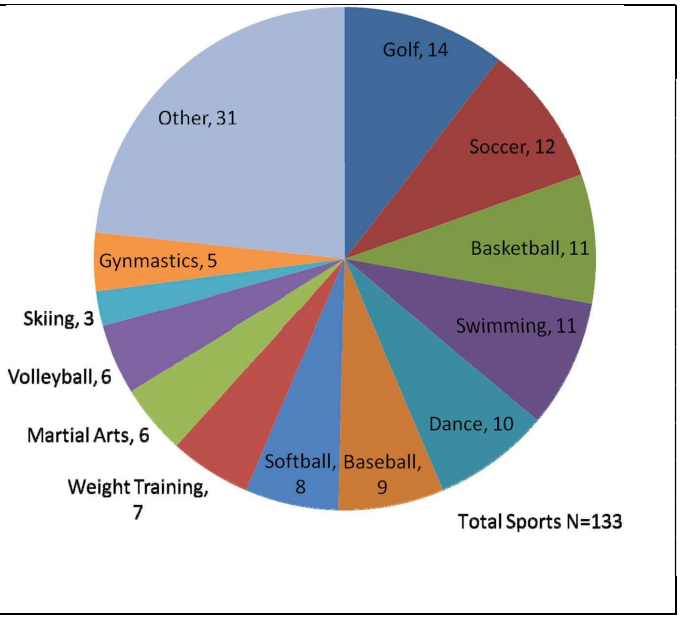
Segment D _____ m/s

Segment E _____ m/s

Pie Charts represent data as "pie wedges". Each wedge in the pie chart represents one category within a data set. The area of the pie, or circle that case may be, is 100%. The area or size of each pie wedge corresponds to the percentage that the category represents to the total number in the data set.

See the example below. 133 people play sports. They were surveyed for their favorite sport. The area of each pie wedge for each sport equals the percentage by number of that sport relative to the 133 responses. 10.5% of the people surveyed liked golf—the pie wedge for golf is 10.5% of the circle.

Sport	Number of people	% by Number
Golf	14	10.5%
Soccer	12	9.0 %
Basketball	11	8.3 %
Swimming	11	8.3 %
Dance	10	7.5 %
Baseball	9	6.8 %
Softball	8	6.0 %
Weight training	7	5.3 %
Gymnastics	5	3.8 %
Skiing	3	2.2 %
Volleyball	6	4.5 %
Martial Arts	6	4.5 %
Other	31	23.3 %
Total Sports	133	100%

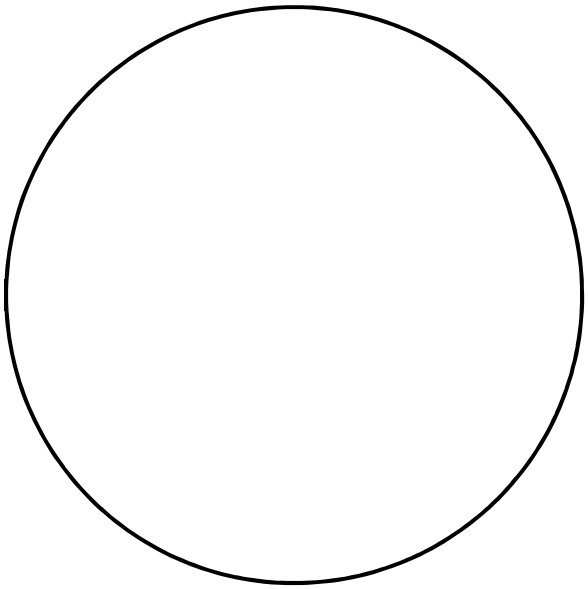


How to calculate percent: Divide the number in the category by the total number of all data, multiply by 100.

$$\% = 100 \times \frac{n_i}{Total}$$

7. 150 students were interviewed at school. Each student was asked what was his or her favorite subject at school. The studens' responses are shown in the table below. Create a pie chart that shows the relative distribution of favorite subjects at school.

Sport	Favorite subject	% by Number
History	50	
Science	30	
Math	30	
English	20	
Art/Music	20	
Total	150	



8. A parking lot has 240 cars. Three students counted the number of different brands of cars in the parking lot. See the cart below. Create a pie graph that shows the relative distribution of cars by brand in the parking lot.

Sport	Number of Cars	% by Number
Ford	32	
Honda	48	
Toyota	80	
Hyundai	28	
Volkswagon	6	
Dodge	46	
Total	240