

Math 10

Lesson 3-3 Interpreting and Sketching Graphs

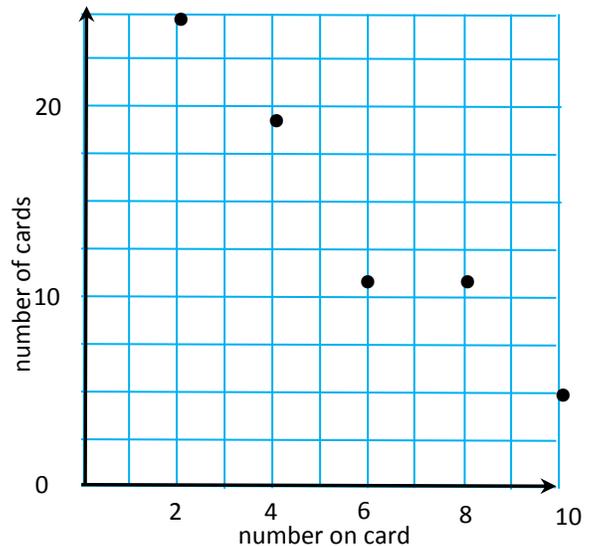
I. Lesson Objectives:

- 1) Graphs communicate how two things are related to one another. Straight, sloped lines indicate a constant change in the relationship. Curves indicate when the rate of change is not linear. Horizontal lines indicate if one quantity is not changing relative to another quantity.

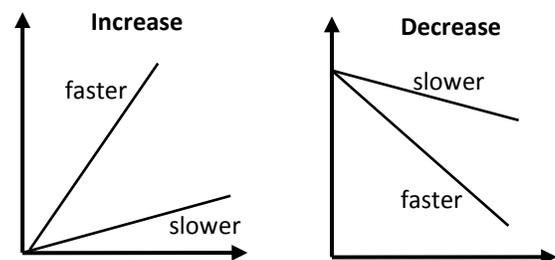


II. Graphs communicate

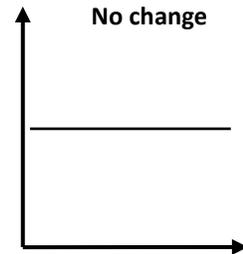
A graph is an effective way to show the relationship between two quantities. In a previous lesson we saw how a point graph can effectively represent the relationship between the number of cards with the number on the card.



Other kinds of graphs communicate different ideas. A **constant rate of change** is represented graphically by a straight line. The steepness or **slope** of the line indicates the rate at which one quantity is changing in relation to the other. A steeper line indicates a faster rate of change.



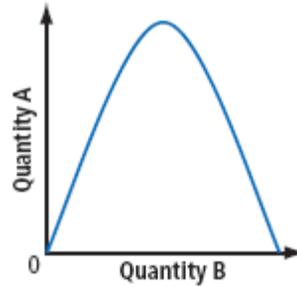
A horizontal line means that there is **no change**. Every value on the horizontal axis is related to the same value on the vertical axis.



However, not all relationships are represented by a straight line. A **curve** shows that the rate of change is not constant.



As quantity B increases, the increase in quantity A is gradual at first. It then becomes much greater.

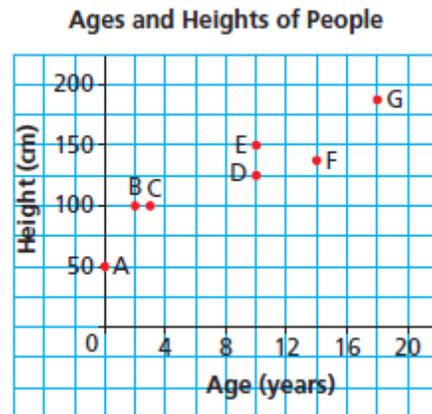


As quantity B increases, the increase in quantity A slows until quantity A reaches a maximum value. Then, quantity A decreases.

Question 1

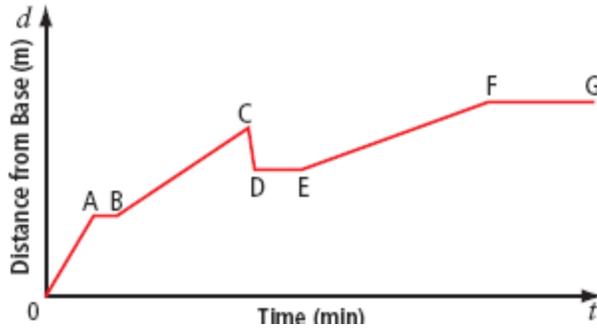
Each point on this graph represents a person.

- Which person is the oldest? What is her or his age?
- Which person is the youngest? What is her or his age?
- Which two people have the same height? What is this height?
- Which two people have the same age? What is this age?
- Which of person B or C is taller for her or his age?



Question 2

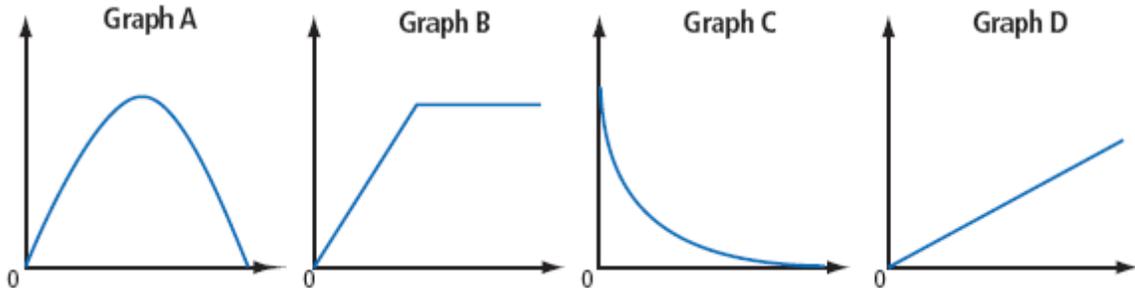
- a) The graph shows the distance a rock climber is from the base of a cliff as time passes. Using the words *climbing*, *resting*, or *descending*, describe what the climber is doing during each segment shown. Explain your choice.



- b) Is there more than one interpretation of the climber's actions during the times indicated by segments AB, CD, DE, and FG?
- c) For any section that you listed as "climbing," how would you change the graph to show that the person is climbing faster? Explain your reasoning.
- d) What would you add to the graph to show the climber's return to the bottom of the cliff?

Question 3

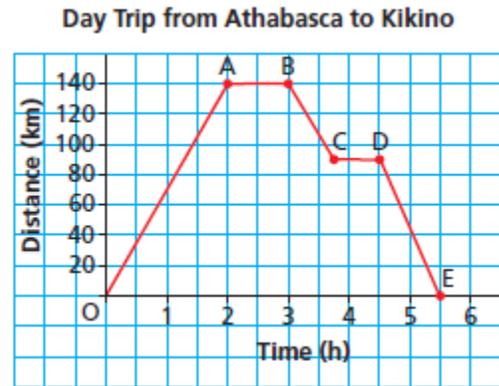
Work in pairs. Match each graph with a situation from the list. Explain your choice. Suggest titles for each axis to show the quantities being compared.



- a) the temperature of a cup of hot chocolate over time
- b) a car accelerating to a constant speed
- c) the distance a person walks during a hike
- d) the height of a soccer ball kicked across a field

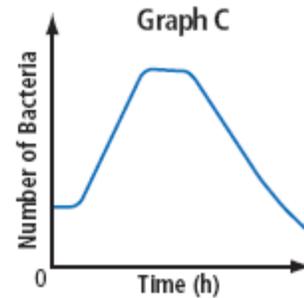
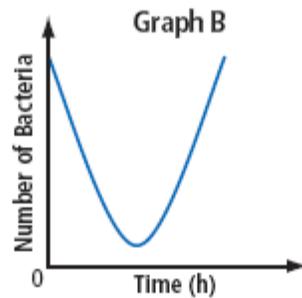
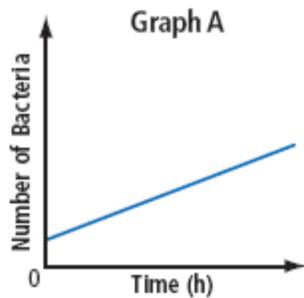
Question 4

This graph represents a day trip from Athabasca to Kikino in Alberta, a distance of approximately 140 km. Describe the journey for each segment of the graph.



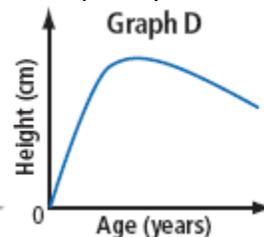
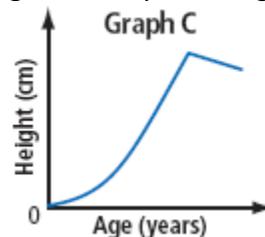
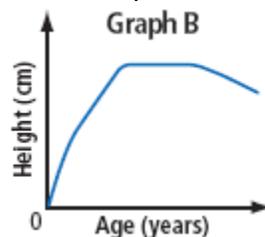
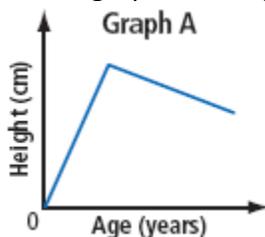
Question 5

When placed in an environment with the right temperature, moisture and food supply bacteria will grow at an exponential rate. Which graph best represents bacteria growth if the bacteria's food supply is limited? Explain your choice.



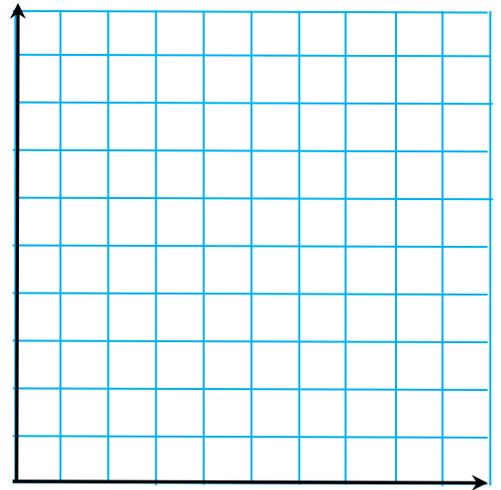
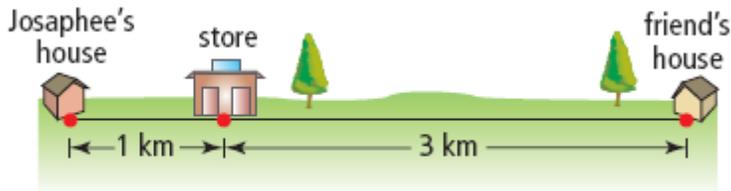
Question 6

Which graph best represents a person's height as the person ages? Explain your choice.



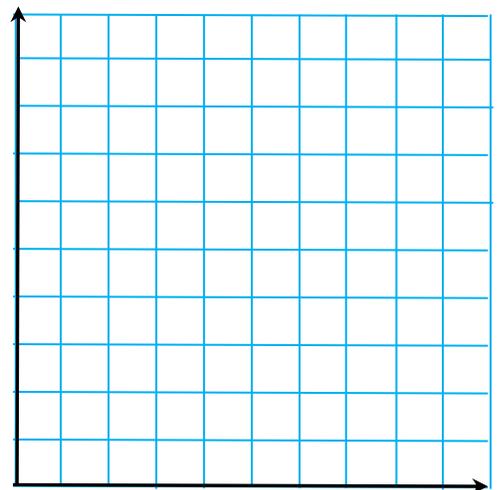
Question 7

Josaphee leaves her home and walks to the store. After buying a drink, she slowly jogs to her friend's house. Josaphee visits with her friend for a while and then runs directly home. Using the distances shown, draw a distance-time graph that shows Josaphee's distance from her house. Explain each section of your graph.



Question 8

At the beginning of a race, Alicia took 2 s to reach a speed of 8 m/s. She ran at approximately 8 m/s for 12 s, then slowed down to a stop in 2 s. Sketch a graph of speed as a function of time. Label each section of your graph, and explain what it represents.

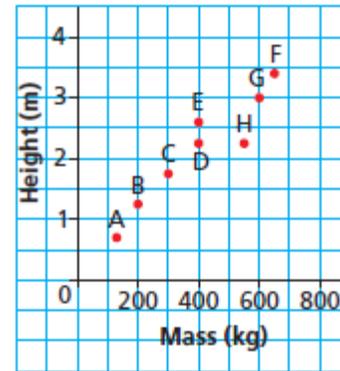


III. Assignment

1. For a graph of speed as a function of time, what does each segment represent?
 - a horizontal line segment
 - a segment that goes up to the right
 - a segment that goes down to the right

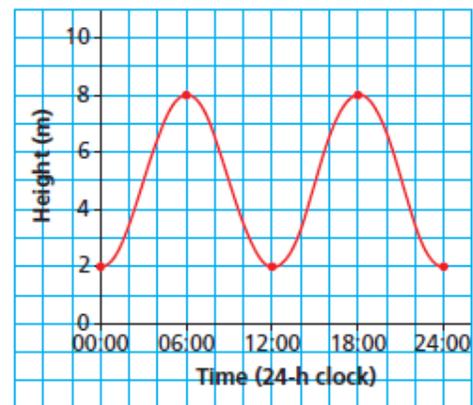
2. Each point on the graph represents a polar bear.
- Which bear has the greatest mass? What is this mass?
 - Which bear is the shortest? What is its height?
 - Which two bears have the same mass? What is this mass?
 - Which two bears have the same height? What is this height?

Heights and Masses of 8 Polar Bears



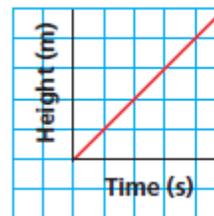
3. This graph shows the height of the tide in a harbour as a function of time in one day.
- What is the greatest height? At what times does it occur?
 - What is the least height? At what times does it occur?
 - How high is the tide at 04:00?
 - When is the tide 4 m high?

Height of the Tide in a Harbour

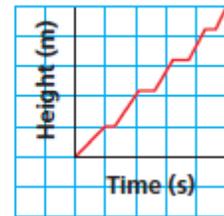


4. To raise a flag, Sepideh pulls the rope steadily with both hands for a short time, then moves both hands up the rope and pulls again. She does this until the flag has been raised. Which graph best represents the height of the flag? Give reasons for your choice.

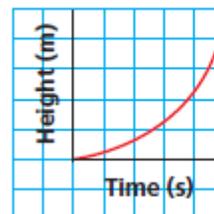
Graph A



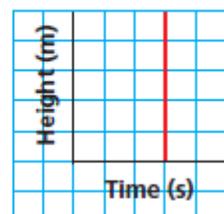
Graph B



Graph C



Graph D



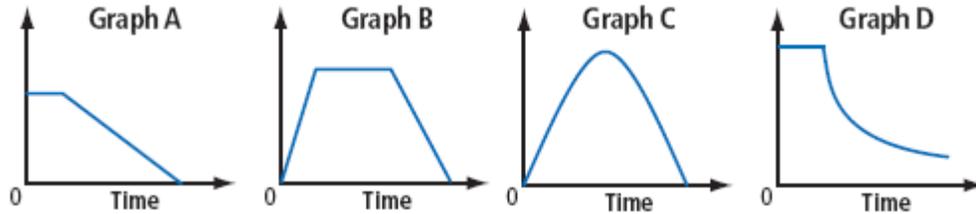
5.

a) Match each scenario with its appropriate graph.

i) the speed of a train as it arrives at a station

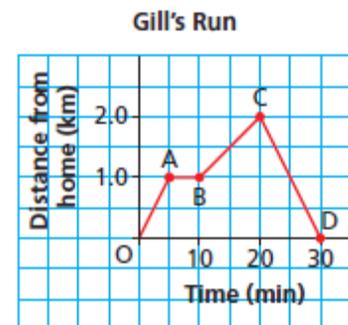
ii) a football's distance above ground as the ball is kicked

iii) the number of un-popped kernels as a popcorn maker heats up and pops the corn.

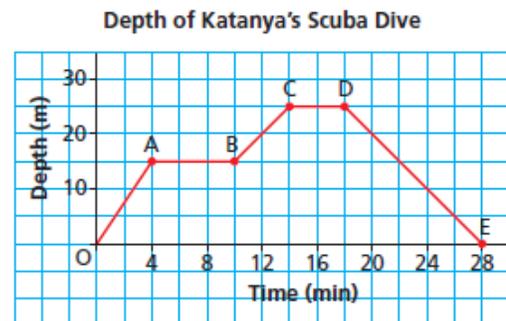


b) Describe a scenario for the graph that you did not use in part a).

6. Gill runs for exercise. This graph shows her distance from home during one of her runs. Describe Gill's run for each segment of the graph.



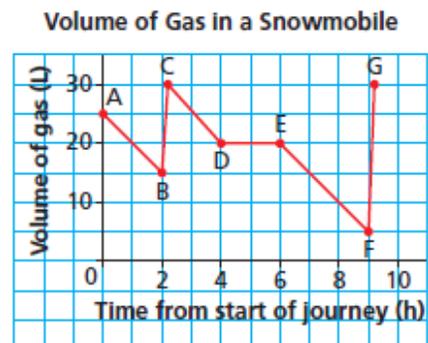
7. Katanya went scuba diving in Egypt. This graph shows her depth below sea level as a function of time on one of her dives. Write all that you know about the dive from the graph.



8.

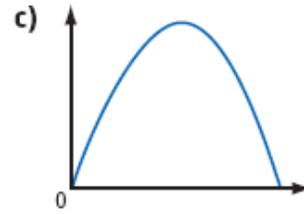
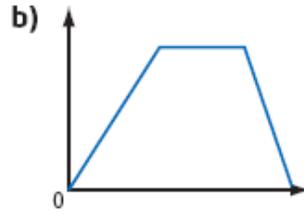
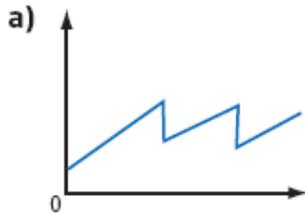
a) Describe what is happening for each line segment in this graph.

b) How much gas was in the tank at the start of the journey? Was the tank full at this time? Explain.

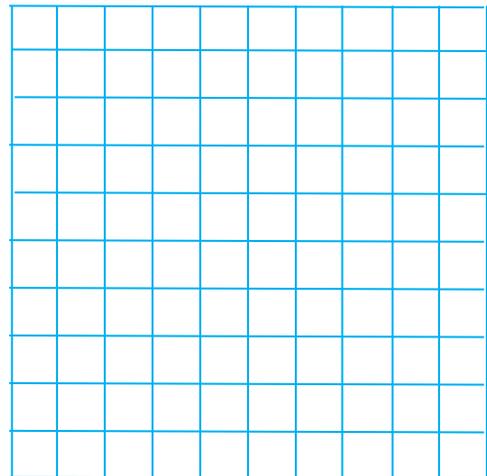


9. Label the axes using the choices given.

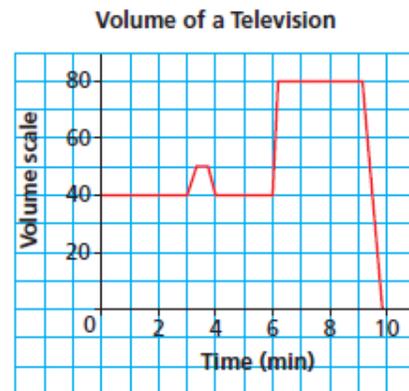
Choices for Vertical Axis	Choices for Horizontal Axis
Profit From Sales	Time
Speed of ATV	Ticket Price
Height of Grass	Distance Travelled



10. An oven is turned on at a room temperature of 20°C and it takes 10 min to reach a temperature of 190°C. A tray of cookies is placed in the oven to bake for 10 min. The oven is then turned off and returns to room temperature after 15 min. Sketch a graph of temperature as a function of time. Label each section of the graph and explain what it represents.

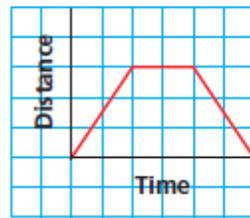


11. A student drew a graph to represent this situation.
 “Jonah is watching television. After 3 min his mom enters the room to ask him a question. He turns the volume down a bit, answers his mom, then turns the volume back up. Two minutes later, Jonah’s dad turns on the dishwasher so Jonah gradually turns up the volume. After a further 3 min, a commercial comes on so Jonah presses the mute button.”
 Describe any errors in the student’s graph.

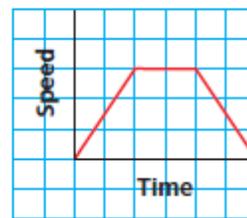


12. The two graphs have the same shape, but different vertical axes. Write and justify a possible situation that each graph represents.

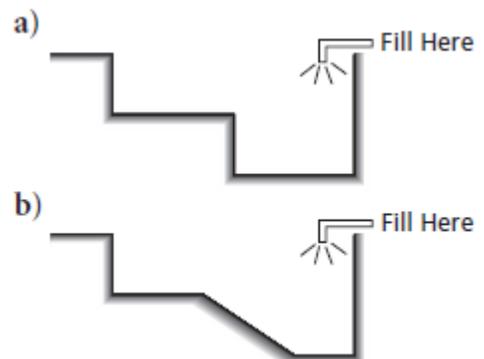
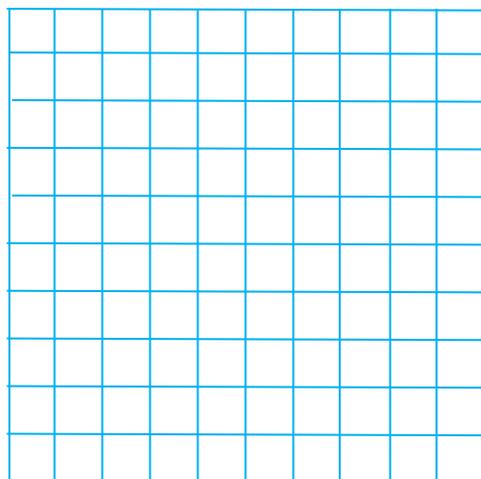
a) Graph A



b) Graph B



13. The diagrams below show cross-sections of swimming pools that will be filled with water at the same constant rate. Sketch two graphs on the same grid to represent the depth of water in each pool as a function of time. Label the axes. Justify the shape of each graph.



14. The table gives the approximate amount of water needed for various activities. Sketch a graph showing your water usage from the moment you wake up until you go to bed. On the vertical axis, record the amount of water that you use. Record time on the horizontal axis. Include a description.

Water Use	Amount
Toilet flush	6 L
Shower	10 L/min
Bath	68 L
Sink faucet	10 L/min
Dishwasher	27 L/load
Washing machine	99 L/load

15. Create a speed-time graph for this scenario.

A skydiver jumps from an airplane that is flying at a speed of 160 km/h. In about the first 10 s, the skydiver accelerates to a falling speed of 190 km/h. He stays at this speed because he has adopted the standard flat and stable, or “face to Earth,” position. After another 30 s, the skydiver opens his parachute and quickly slows his descent to about 18 km/h. He maintains this speed until just before reaching the ground. Then he uses his parachute to slow down slightly, allowing him to make a smooth landing.

16. Explain why each graph represents an impossible situation.

