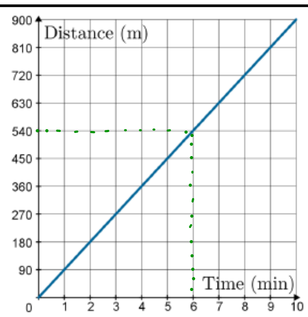
Solutions

Page 100 #s 1 - 11, 13, 14

1. The graph on the right shows Greta's distance from home, in metres, for the first 10 minutes of her evening walk.



a) Is Greta moving toward home or away from home? Explain.

b) How far from home is Greta after 6 minutes?

c) Is Greta increasing her speed, reducing her speed, or maintaining a constant speed? Explain.

d) What unit would be used to describe rate of change here?

e) Is the rate of change positive or negative? Explain.

f) How would the graph look different if Greta was moving in the opposite direction?

g) What are the independent and dependent variables in this relationship?

a) Away from home, because the distance from home is increasing.

b) 540m

c) Constant speed, because the graph is a straight line.

d) Rate of change measured in m/min

e) Positive rate of change (rising to the right)

f) Graph would fall to the right

g) Independent (time), Dependent (distance from home)

2. The graph on the right shows the amount of liquid in a 2 L container.

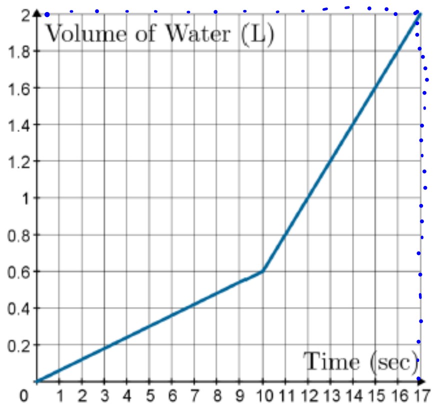
a) Describe how the amount of liquid in the container is changing.

b) How long does it take to fill the container?

c) What unit would be used to describe rate of change here?

d) Describe what happens to the rate of change of liquid in the container when the time value is 10 seconds and suggest a possible reason for what happens there.

e) What are the independent and dependent variables in this relationship?



a) Volume increases as time increases.

b) 17 seconds.

c) L / sec (litres per second)

d) Rate of change increases (line gets steeper) Maybe tap is turned on more?

e) Independent (time), Dependent (Volume of water)

3. The table on the right shows the number of new COVID-19 cases in Ontario over five consecutive days in August 2021.

a) Describe how the number of new cases changed over the five days.

b) Was the rate of change positive or negative? Explain.

c) Was the rate of change of new cases constant? Explain.

d) What are the independent and dependent variables in this relationship?

Day	Number of New Cases
1	486
2	660
3	678
4	781
5	835

a) Number of cases increases.

b) Positive rate of change (cases are increasing)

c) No. The change in cases is different from day to day.

d) Independent (Day), Dependent (Number of new cases)

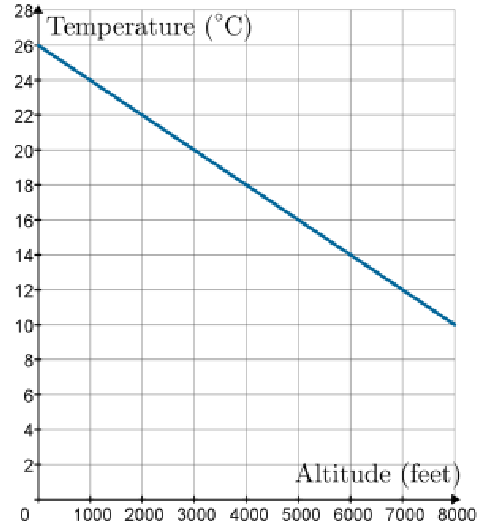
4. The graph on the right shows how outside air temperature is affected by altitude (height).

a) Describe how the air temperature changes with respect to altitude.

b) Is the rate of change of temperature positive or negative? Explain.

c) Is the rate of change in this example constant? Explain.

d) Identify the dependent variable and the independent variable in this relationship.



a) Temperature decreases as altitude increases.

b) Negative rate of change because temperatures are decreasing.

c) Yes, it is constant because the graph is a straight line.

d) Independent (Altitude), Dependent (Temperature)

5. The graph on the right shows the population of a small town over time.

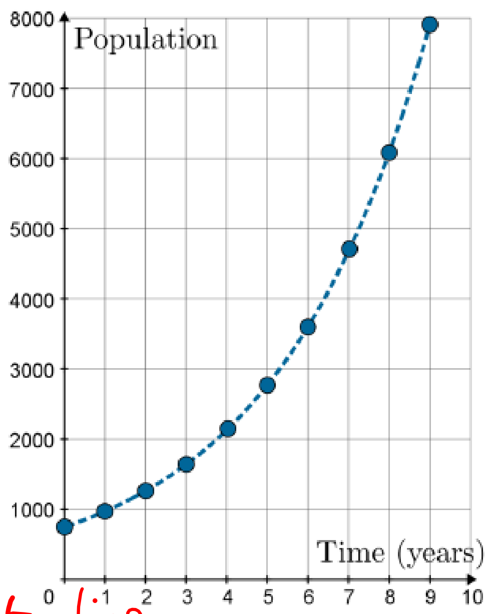
a) Describe how the population is changing over time.

b) Is the rate of change of population positive or negative?

c) Is the rate of change in this example constant? Explain.

d) Identify the dependent variable and the independent variable in this relationship.

e) Why do you think a dashed curve was used here instead of a solid curve?



a) Increasing over time.

b) Positive

c) Not constant, because the graph is not a straight line

d) Independent (Time), Dependent (Population)

e) Dashed curve used because no data for the gaps inbetween the years.

6. Suggest a quick way to determine whether the relationship shown in a graph has a positive rate of change, a negative rate of change, or a rate of change of zero.

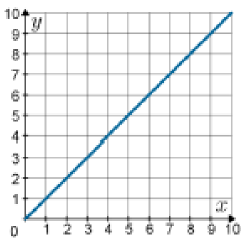
Look at the slope of the graph.

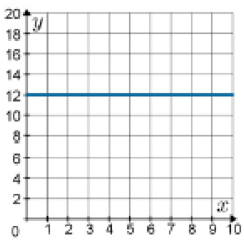
Positive rate of change ⇒ ↗ up to the right

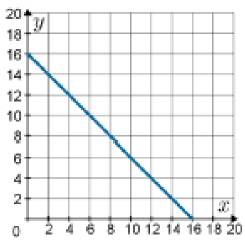
Negative rate of change ⇒ ↘ down to the right

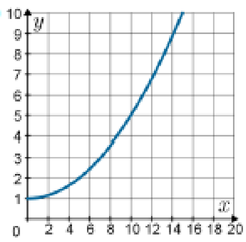
Zero rate of change ⇒ → horizontal line

7. For each of the following graphs, state whether the rate of change is positive, negative or zero.

a)


b)


c)


d)


a) Positive b) Zero c) Negative d) Positive

8. Mahdi plans to purchase a new PlayStation 5 video game system. He decides that he'll put away $20 every week until he has enough to purchase the console. Each week, Mahdi records the total amount saved. The two variables in the resulting relationship are the number of weeks passed and the total amount of money saved.

a) Does the total amount saved have a positive rate of change or a negative rate of change? Explain.

b) Is the rate of change in this example constant? Explain.

c) Identify which variable is the dependent variable and which is the independent variable.

a) Positive rate of change, because the amount saved is increasing over time.

b) Yes, it is increasing by $20 every week.

c) Independent (# of weeks), Dependent (Amount saved).

9. The graph below describes the height of a ball after it is thrown straight up into the air.

a) Over what time interval is the ball's height increasing? Decreasing?

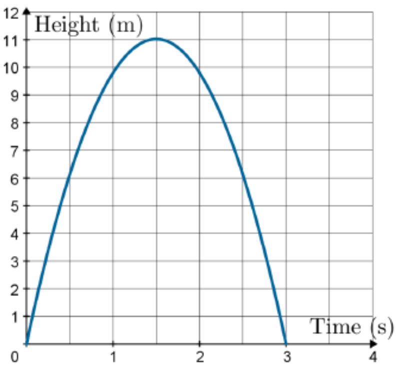
b) What unit would be used to describe rate of change here?

c) Over what time interval is the rate of change of height positive? Negative? Explain?

d) As the ball gets higher, what happens to the rate of change of height? Why?

e) What is the ball's rate of change at 1.5 seconds?

f) What are the independent and dependent variables in this relationship?



a) Increasing from 0 seconds to 1.5 seconds.
Decreasing from 1.5 seconds to 3 seconds.

b) m/s (metres per second)

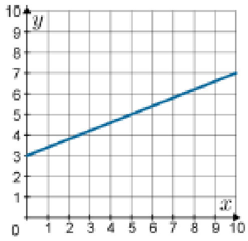
c) Positive from 0–1.5 seconds.
Decreasing from 1.5–3 seconds.

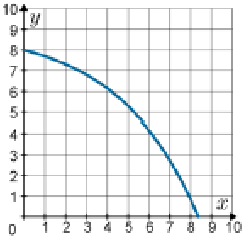
d) Rate of change decreases as the ball gets higher, due to the effect of gravity.

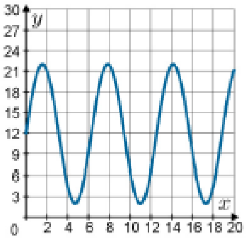
e) Rate of change is zero at 1.5 seconds.

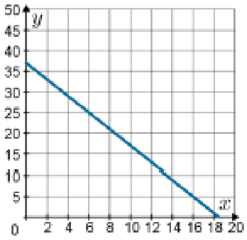
f) Independent (Time), Dependent (Height).

10. State which of the following graphs display a constant rate of change.

a) 

b) 

c) 

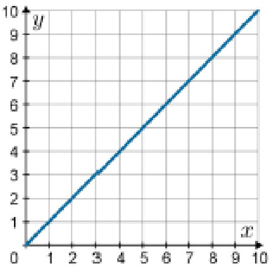
d) 

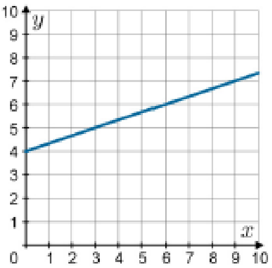
a) Constant

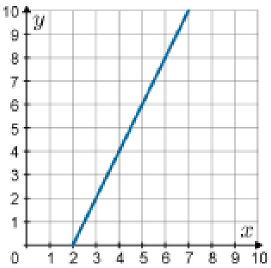
d) Constant

Note: constant rate of change gives a straight line graph.

11. Order the following from least rate of change to greatest rate of change.

a) 

b) 

c) 

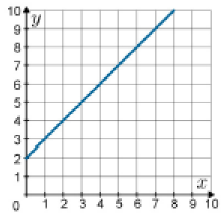
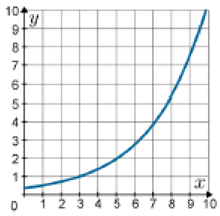
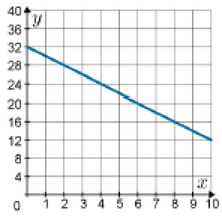
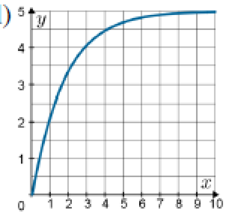
a) Middle

b) Least

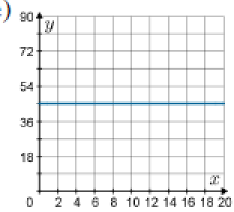
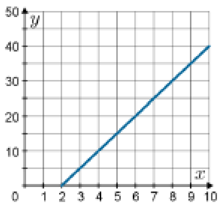
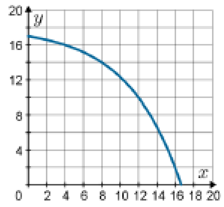
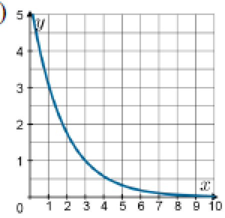
c) Greatest

Note: The steeper the line, the greater the rate of change.

13. For each relation, state whether the rate of change is constant, increasing or decreasing

a) 
b) 
c) 
d) 

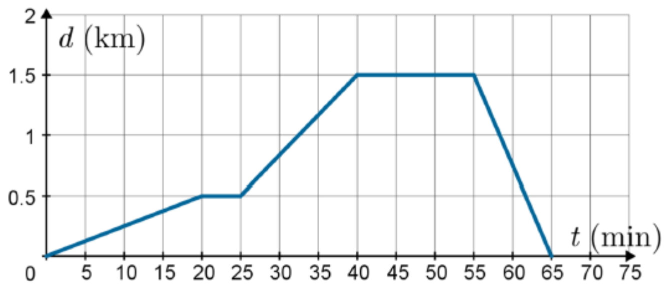
Constant Increasing Constant Decreasing

e) 
f) 
g) 
h) 

Constant Constant Increasing Decreasing

Note: increasing → gets steeper
decreasing → less steep

14. The graph below shows Pietro's distance from school, d, during lunch.



a) During what time interval(s) was Pietro moving away from the school?

b) During what time interval(s) was Pietro moving toward the school?

c) What is the farthest distance that Pietro was from school during lunch?

d) The school's lunch period occurs from 11:30 to 12:30. If Pietro left the school immediately at the beginning of the lunch period, how late was he when he returned to the school?

e) During what time interval(s) was Pietro not moving?

a) 0–20 minutes and 25–40 minutes.

b) 55–65 minutes.

c) 1.5 km

d) 11:30 – 12:30 = 60 minutes.
He took 65 minutes
⇒ 65 – 60 = 5 minutes late.

e) 20–25 minutes and 40–55 minutes.

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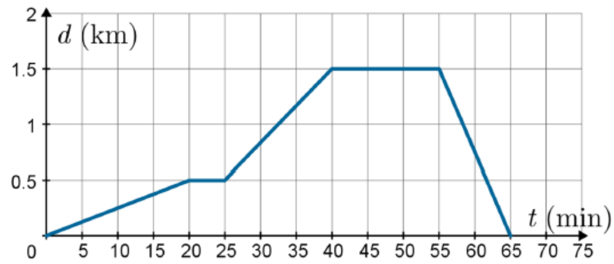

f) During what time interval(s) was Pietro moving slowest (but not stopped)?

g) During what time interval(s) was Pietro moving fastest?

h) Determine Pietro's speed, in km/min, during the first 20 minutes.

i) Determine Pietro's speed, in km/h, from 25 minutes to 40 minutes.

j) Determine Pietro's speed, in m/s, during the final 3 minutes of his journey back to school.

f) 0-20 minutes (least steep section)

g) 55-65 minutes (steepest section)

h) $\frac{km}{min} = \frac{0.5}{20} = 0.025$ km/min

i) $\frac{km}{hour} = \frac{1}{0.25} = 4$ km/h [15 mins = $\frac{1}{4}$ hour]

j) constant speed for last 10 minutes

$\frac{m}{s} = \frac{1500}{10 \times 60} = \frac{1500}{600} = 2.5$ m/s

1.5 km in metres ↗ ↖ 10 minutes in seconds