

Solutions

1. As variable x increases, variable y decreases proportionately. Which of the following statements is definitely true?

- A This is a cause and effect relationship in which x is the dependent variable.
- B This is a cause and effect relationship in which y is the dependent variable.
- C These variables share a positive correlation.
- D These variables share a negative correlation.

D

We don't know if there is a cause and effect relationship, so it can't be A or B. As we have x increasing and y decreasing, it is a negative, not positive, correlation.

2. Patients who participate in a new exercise program experience a drop in blood pressure over the same period of time. Which statement is most likely correct?

- A This is a cause and effect relationship, in which the dependent variable is amount of exercise.
- B This is a cause and effect relationship, in which the dependent variable is blood pressure.
- C This is an accidental relationship.
- D This is a presumed relationship.

B

Studies have shown that there is very likely a cause and effect relationship between exercise and blood pressure. Amount of exercise is the independent variable and blood pressure is the dependent variable.

3. In an economic study, average salaries were negatively correlated with the unemployment rate. Which of the following is most likely to be a common cause factor that accounts for this correlation?

- A the price of eggs
- B the strength of the economy
- C the current birth rate
- D movie industry revenue

B

The strength of the economy is likely to be a driver for the unemployment rate. If unemployment is high, there are many people likely to apply for jobs that are posted. As this is the case, employers do not need to pay as much because of the increased competition to get the job.

4. At a ski resort, lift ticket sales were positively correlated with hot chocolate sales.

- a) Is this likely a cause and effect relationship? Explain why or why not.
- b) Suggest a common cause that could explain this relationship.

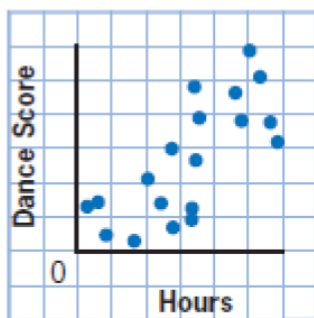
a) This is unlikely. There is a correlation, but it is more likely that everything at the ski resort had more sales when more ski lift tickets were sold.

b) A common cause for the increase in sales of hot chocolate would be an increased number of customers at the resort.

5. a) At a dance competition, how would you expect the relationship to look between dance performance score and number of hours practised? Sketch a graph to support your answer.

- b) Do you think this is a cause and effect relationship? Explain.

a)



b) There is likely to be a cause and effect relationship. The reason for this is that the more hours spent practising a skill (in this case dancing) the better you become at it.

6. Identify the most likely type of relationship between the two variables for each scenario. Assume the independent variable is mentioned first. Justify your answers.

- a) Grass growth is positively correlated with amount of rainfall.
- b) Arm length is positively correlated with leg length.
- c) Sandwich sales are negatively correlated with dog bite incidents.

a) This is an example of **reverse cause and effect** as grass growth is dependent upon the amount of rainfall.

b) This is a **common cause relationship** as arm length and leg length are both correlated to height.

c) This would appear to be an **accidental relationship** as there is no apparent link between sandwich sales and the number of dog biting incidents.

6. Identify the most likely type of relationship between the two variables for each scenario. Assume the independent variable is mentioned first. Justify your answers.

- d) Interest in televised sport is positively correlated with fitness level.
- e) Incidence of diabetes is negatively correlated with healthy eating habits.
- f) Heart disease is positively correlated with lung cancer.

d) It would seem likely that sports are of interest to people who keep fit. However, as it is difficult to prove it is deemed to be a **presumed relationship**.

e) It would seem sensible to think that these are negatively correlated. However, there are other factors aside from diet that cause diabetes, so it is a **presumed relationship**.

f) As both heart disease and lung cancer can be tied to smoking, it is most likely that this is a **common cause relationship**.

7. A researcher wonders if people who do not get enough sleep also eat a lot of fast food.

- a) Explain why this is unlikely to be a cause and effect relationship.
- b) Suggest a common cause that could explain this correlation.

a) This is unlikely because there are many reasons as to why someone may sleep less (stress, use of electronics at night, too much to do...).

b) A common cause that could explain this correlation is people's health.

8. **Communication** A student discovers that ice-cream sales are positively correlated with occurrences of heat stroke. He suggests that ice-cream consumption could be a cause of heat stroke.

- a) Do you agree with the student? Why or why not?
- b) What advice can you offer to improve his analysis?

a) This is unlikely to be true. Heatstroke is generally caused by extremely hot weather, not eating too much ice-cream.

b) The correlation that was found is likely to be a common cause relationship as ice-cream sales and incidents of heat stroke are both likely to increase on very hot days.

9. **Application** The number of deer in a region is positively correlated with the number of wolves.

- a) Explain how this could be a cause and effect relationship with the number of deer as the dependent variable.
- b) Explain how this could also be described as a reverse cause and effect relationship.

a) As there are plenty of deer, wolves will move into the area as there is a large source of food for them. (In reality this will be cyclical, as an increase in wolves will mean a decrease in deer which then mean there won't be enough food for them, so the wolves will die, or move elsewhere).

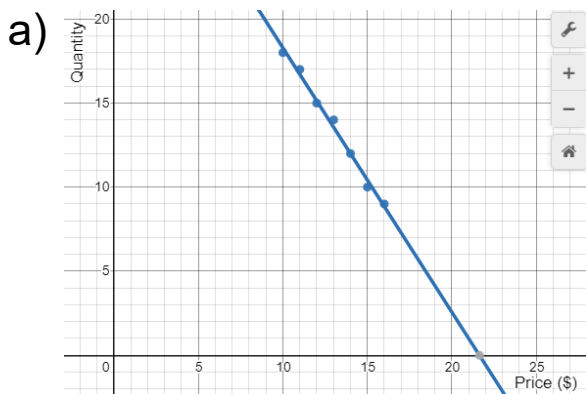
b) As above, as the number of deer decline so will the number of wolves.

11. a) Create a scatter plot of price versus widget quantity demanded. Describe the correlation.

- b) Is this likely a cause and effect relationship? Explain.
- c) Identify the independent and dependent variables. Explain your thinking.

The table shows the supply and demand for widgets at various selling price points. The demand represents the number of widgets expected to sell at a certain price. The supply represents the number that can be produced at a certain price.

Price (\$)	Quantity Demanded	Quantity Supplied
10	18	8
11	17	9
12	15	11
13	14	12
14	12	14
15	10	16
16	9	17



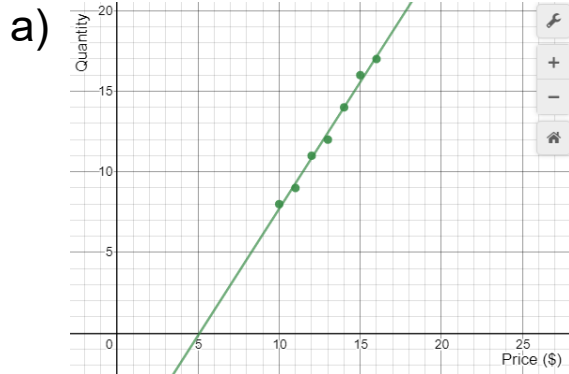
b) This is likely to be a cause and effect relationship as these, by definition, are linked together. As the price goes up, the demand goes down.

c) Price is independent - Quantity demanded is dependent. Generally the demand is affected by the price, not the other way around.

12. a) Create a scatter plot of price versus widget quantity supplied. Describe the correlation.
- b) Is this likely a cause and effect relationship? Explain.
- c) Identify the independent and dependent variables. Explain your thinking.

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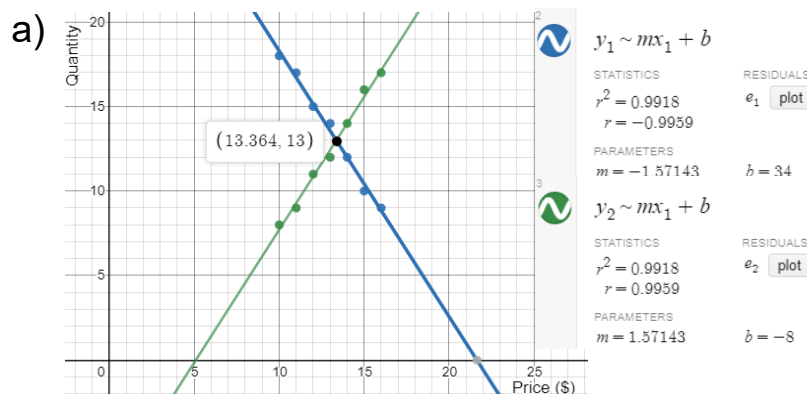
b) This is likely to be a cause and effect relationship as these, by definition, are linked together. As the price goes up, the profit from supplying also goes up (costs will likely stay the same).

c) Price is independent - Quantity supplied is dependent. Generally the amount of supply is affected by the price, not the other way around.

13. a) Perform a linear regression for the graphs in #11 and #12, and plot both functions on the same grid.
- b) Identify the point of intersection. Explain what it signifies.
- c) What will likely happen if the widget price is set
- above the intersection point?
 - below the intersection point?
- Explain your thinking.

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b) The point of intersection is (13.364, 13). This means that when the price is \$13.36 the demand and supply will be the same amount, in his case, 13 widgets.

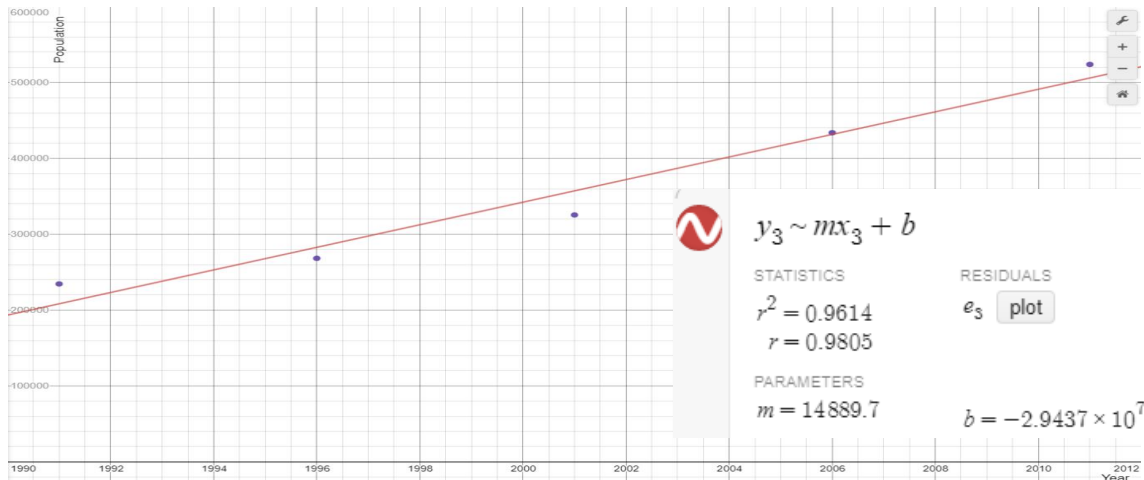
c) If the price is set above the intersection point, supply > demand, so you will have too many widgets. If the price is below it then demand > supply, you won't have enough to sell to keep up with the demand.

14. The table shows a time series for the population of Brampton.

Year	1991	1996	2001	2006	2011
Population	234 445	268 251	325 428	433 806	523 911

- a) Create a scatter plot of population versus time using technology.
- b) Does the correlation appear to be linear? Explain.
- c) Perform a linear regression. Describe the goodness of fit.
- d) Perform an exponential regression on the data. Describe the shape of the curve that appears.
- e) Compare the goodness of fit of the curve of best fit to that of the line of best fit.
- f) Why might an exponential model be appropriate for this relationship?

a)



b) The data does appear to be linear(ish) because the data appear to be in a straight(ish) line.

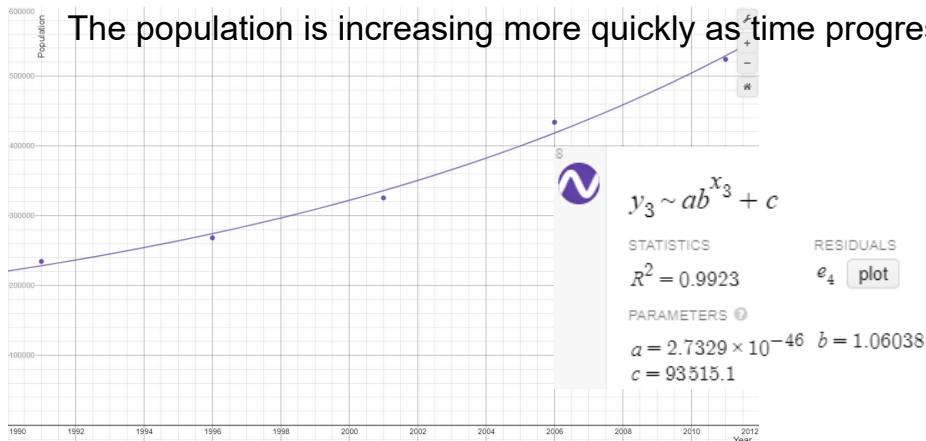
c) The linear regression gives an r-value of 0.98 which is a very strong positive correlation. The r^2 value is 0.96 which again confirms that it is a very good fit.

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- f) Why might an exponential model be appropriate for this relationship?

d) The population is increasing more quickly as time progresses.



e) The exponential regression gives an r^2 value of 0.99 which suggests that it is an even better fit than the linear model.

f) An exponential model might be more appropriate because as the city adds more housing and continues to grow, more and more people will choose to live there. The population will then increase at an even faster (increasing) rate.