

Class Discussion: 29 January 2019

Linear growth rate

Exercises

In Exercises (1)-(3), which line has the greater

- (a) Slope?
- (b) y-intercept?

1. $y = -1 + 2x$; $y = -2 + 3x$

ANSWER ⊕

WORKED SOLUTION ⊕

2. $y = 3 + 4x$; $y = 5 - 2x$

3. $y = \frac{1}{4}x$; $y = 1 - 6x$

ANSWER ⊕

In Exercises (4)-(9), could the data represent a linear function? If so, give the rate of change.

4.

x	0	5	10	15
$f(x)$	10	20	30	40

5.

x	0	10	20	30
$h(x)$	20	40	50	55

6.

x	0	100	300	600
$g(x)$	50	100	150	200

7.

t	1	2	3	4	5
$g(t)$	5	4	5	4	5

ANSWER ⊕

8.

x	-3	-1	0	3
$j(x)$	5	1	-1	-7

9.

γ	9	8	7	6	5
$p(\gamma)$	42	52	62	72	82

In Exercises (10)-(13), identify the vertical intercept and the slope, and explain their meanings in practical terms.

10. The population of a town can be represented by the formula $P(t) = 54.25 - \frac{2}{7}t$, where $P(t)$ represents the population, in thousands, and t represents the time, in years, since 1970.

11. A stalactite grows according to the formula $L(t) = 17.75 + \frac{1}{250}t$, where $L(t)$ represents the length of the stalactite, in inches, and t represents the time, in years, since the stalactite was first measured.

ANSWER ⊕

12. The profit, in dollars, of selling n items is given by $P(n) = 0.98n - 3000$.

13. A phone company charges according to the formula $C(n) = 29.99 + 0.05n$, where n is the number of minutes, and $C(n)$ is the monthly phone charge, in dollars.

14. Table 1.25 shows the cost C , in dollars, of selling x cups of coffee per day from a cart.

Table 1.25

x	0	5	10	50	100	200
C	50.00	51.25	52.50	62.50	75.00	100.00

- (a) Using the table, show that the relationship appears to be linear.
- (b) Plot the data in the table.
- (c) Find the slope of the line. Explain what this means in the context of the given situation.
- (d) Why should it cost \$50 to serve zero cups of coffee?

15. Table 1.26 gives the proposed fine $r = f(v)$ to be imposed on a motorist for speeding, where v is the motorist's speed and 55 mph is the speed limit.

Table 1.26

v (mph)	60	65	70	75	80	85
r (dollars)	75	100	125	150	175	200

- (a) Decide whether f appears to be linear.
- (b) What would the rate of change represent in practical terms for the motorist?
- (c) Plot the data points.

16. In 2003, the number, N , of cases of SARS (Severe Acute Respiratory Syndrome) reported in Hong Kong¹⁵ was initially approximated by $N = 78.9 + 30.1t$, where t is the number of days since March 17. Interpret the constants 78.9 and 30.1.

17. A new Toyota RAV4 costs \$23,500. The car's value depreciates linearly to \$18,823 in three years time.¹⁶ Write a formula which expresses its value, V , in terms of its age, t , in years.

- 18. In 2012, the population of a town was 21,510 and growing by 63 people per year. Find a formula for P , the town's population, in terms of t , the number of years since 2012.
- 19. A flight costs \$10,000 to operate, regardless of the number of passengers. Each ticket costs \$127. Express profit, π , as a linear function of the number of passengers, n , on the flight.
- 20. Owners of an inactive quarry in Australia have decided to resume production. They estimate that it will cost them \$10,000 per month to maintain and insure their equipment and that monthly salaries will be \$30,000. It costs \$800 to mine a ton of rocks. Write a formula that expresses the total cost each month, c , as a function of r , the number of tons of rock mined per month.
- 21. In each case, graph a linear function with the given rate of change. Label and put scales on the axes.
- 22. A small café sells coffee for \$3.50 per cup. On average, it costs the café \$0.50 to make a cup of coffee (for grounds, hot water, filters). The café also has a fixed daily cost of \$450 (for rent, wages, utilities).
 - (a) Let R , C , and P be the café's daily revenue, costs, and profit, respectively, for selling x cups of coffee in a day. Find formulas for R , C , and P as functions of x .
[Hint: The revenue, R , is the total amount of money that the café brings in. The cost, C , includes the fixed daily cost as well as the cost for all x cups of coffee sold. P is the café's profit after costs have been accounted for.]
 - (b) Plot P against x . For what x -values is the graph of P below the x -axis? Above the x -axis? Interpret your results.
 - (c) Interpret the slope and both intercepts of your graph in practical terms.

23. Table 1.27 gives the area and perimeter of a square as a function of the length of its side.

Table 1.27

Length of side	0	1	2	3	4	5	6
Area of square	0	1	4	9	16	25	36
Perimeter of square	0	4	8	12	16	20	24

- (a) From the table, decide if either area or perimeter could be a linear function of side length.
- (b) From the data make two graphs, one showing area as a function of side length, the other showing perimeter as a function of side length. Connect the points.
- (c) If you find a linear relationship, give its corresponding rate of change and interpret its significance.