

## Exercise Set 2.5: Average Rate of Change

For problems 1 – 8, find the slope of the line that passes through the two points.

- $(1, 7), (2, -4)$
- $(-3, 5), (6, 2)$
- $\left(\frac{1}{2}, \frac{-2}{3}\right), \left(-\frac{3}{4}, \frac{5}{6}\right)$
- $\left(\frac{-3}{5}, \frac{5}{12}\right), \left(\frac{5}{2}, \frac{-1}{4}\right)$
- $(-0.25, -1.82), (3.20, -2.97)$
- $(1.68, 4.72), (-3.32, 1.22)$
- $(4\sqrt{2}, -3\sqrt{3}), (-2\sqrt{2}, -\sqrt{3})$
- $(-3\sqrt{5}, 4\sqrt{2}), (\sqrt{5}, -6\sqrt{2})$

For problems 9 – 12, use the table of values to find the average rate of change over the given interval.

$x$	1	3.8	4.7	9	13.8	12
$y$	3	5.1	8.7	15.8	25.1	30.86

- $[1, 9]$
- $[9, 12]$
- $[3.8, 13.8]$
- $[4.7, 13.8]$

For problems 13 – 16, use the table of values to find the average rate of change over the given interval.

$x$	1	2	3	3.5	3.7	6
$y$	40	25	18	15	18	38

- $[1, 3]$
- $[2, 6]$
- $[2, 3.7]$
- $[3.5, 6]$

For problems 17 – 20, find the average rate of change of  $f(x) = x^2 + 5x + 6$  on each pair of intervals.

- $[1.9, 2]$  and  $[1.99, 2]$
- $[2, 2.1]$  and  $[2, 2.01]$
- $[0.9, 1]$  and  $[0.99, 1]$
- $[1, 1.1]$  and  $[1, 1.01]$

For problems 21 – 26, find the average rate of change of each function on the given interval.

- $f(x) = x^2 - 4x - 12$  on  $[0, 6]$
- $f(x) = x^2 - 4x - 12$  on  $[-1, 7]$
- $f(x) = 3x^2 - x - 2$  on  $[-1, 4]$
- $f(x) = 3x^2 - x - 2$  on  $[4, 7]$
- $f(x) = 0.02x^2 - 1.6x + 20.5$  on  $[25, 35]$
- $f(x) = 0.05x^2 - 1.3x + 22.8$  on  $[13, 23]$

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27. Suppose the total cost in dollars to produce  $x$  items is given by the function

$$C(x) = 0.0001x^3 + 0.04x^2 + 17x + 3500$$

- A. Find the average rate of change of the total cost when the number of items produced increases from 100 to 200 items.
- B. Find the average rate of change of the total cost when the number of items produced increases from 200 to 400 items.

28. Suppose the total cost in dollars to produce  $x$  items is given by the function

$$C(x) = 0.0003x^3 + 0.14x^2 + 12x + 1400$$

- A. Find the average rate of change of the total cost when the number of items produced increases from 100 to 300 items.
- B. Find the average rate of change of the total cost when the number of items produced increases from 200 to 500 items.

29. Suppose an object is thrown upward with initial velocity of 32 feet per second from a height of 50 feet. The height of the object  $t$  seconds after it is thrown is given by

$$h(t) = -16t^2 + 32t + 50$$

- A. Find the average velocity in the first two seconds after the object is thrown.
- B. Find the average velocity from  $t = 2$  to  $t = 4$ .

30. Suppose an object is thrown upward with initial velocity of 48 feet per second from a height of 120 feet. The height of the object  $t$  seconds after it is thrown is given by

$$h(t) = -16t^2 + 48t + 120$$

- A. Find the average velocity in the first two seconds after the object is thrown.
- B. Find the average velocity from  $t = 2$  to  $t = 4$ .

31. Suppose the demand for a product can be expressed as  $p(x) = 0.1x^2 + 1.45x + 6.1$  where  $x$  is given in units of a thousand.

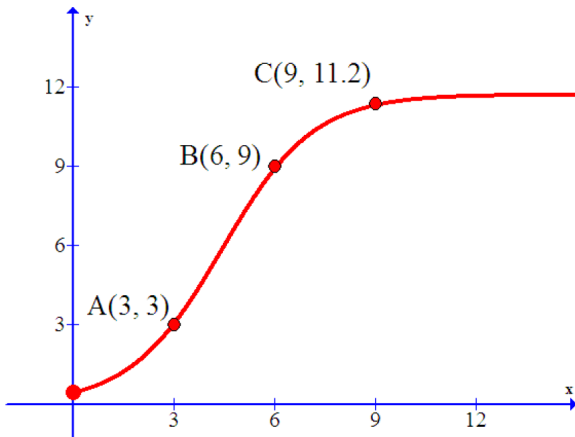
- A. Find the average rate of change of demand when the number of items demanded increases from 2 thousand units to 4 thousand units.
- B. Find the average rate of change of demand when the number of items demanded increases from 1 thousand units to 5 thousand units.

32. Suppose the demand for a product can be expressed as  $p(x) = 0.2x^2 + 1.13x + 5.2$  where  $x$  is given in units of a thousand.

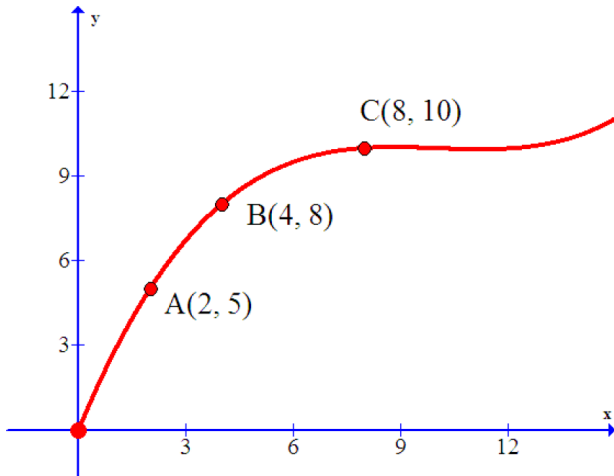
- A. Find the average rate of change of demand when the number of items demanded increases from 2 thousand units to 4 thousand units.
- B. Find the average rate of change of demand when the number of items demanded increases from 1 thousand units to 5 thousand units.

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33. Compute the average rate of change from A to B, from B to C and from A to C. Which one gives the largest average rate of change?



34. Compute the average rate of change from A to B, from B to C and from A to C. Which one gives the smallest average rate of change?



35. The table below gives the population of California since 1970:

Year	1970	1980	1990	2000	2010
Population (in millions)	20.0	23.7	29.8	33.9	37.3

- Find the average rate of change for each decade.
- During which decade was the average rate of change the largest?
- Use the average rate of change during the decade 1990 to 2000 to approximate the California population in 1993.
- Use the average rate of change during the decade 2000 to 2010 to approximate the California population in 2009.

36. The table below gives the population of Texas since 1970:

Year	1970	1980	1990	2000	2010
Population (in millions)	11.2	14.2	17.0	20.9	25.1

- Find the average rate of change for each decade.
- During which decade was the average rate of change the largest?
- Use the average rate of change during the decade 1990 to 2000 to approximate the Texas population in 1994.
- Use the average rate of change during the decade 2000 to 2010 to approximate the Texas population in 2008.

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37. The table below gives the velocity of a skydiver  $t$  seconds into free fall.

Time in seconds	0	10	20	30	40	50	60
Velocity in fps	0	147	171	175	175.8	176	176

- A. Find the average rate of change of velocity for each ten second interval.
- B. During which interval was the average rate of change the highest?
- C. Use the average rate of change from 10 seconds to 20 seconds to approximate the skydiver's velocity 15 seconds into free fall.
- D. Use the average rate of change from 0 seconds to 10 seconds to approximate the skydiver's velocity 8 seconds into free fall.

38. The table below gives the velocity of a skydiver  $t$  seconds into free fall.

Time in seconds	0	10	20	30	40	50	60
Velocity in fps	0	129	153	158	162.7	165	165

- A. Find the average rate of change of velocity for each ten second interval.
- B. During which interval was the average rate of change the highest?
- C. Use the average rate of change from 10 seconds to 20 seconds to approximate the skydiver's velocity 19 seconds into free fall.
- D. Use the average rate of change from 0 seconds to 10 seconds to approximate the skydiver's velocity 4 seconds into free fall.