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F.IF.B.6: Rate of Change 1

- 1 The value of Tony's investment was \$1140 on January 1st. On this date three years later, his investment was worth \$1824. The average rate of change for this investment was \$19 per
 - 1) day 3) quarter
 - 2) month 4) year
- 2 An astronaut drops a rock off the edge of a cliff on the Moon. The distance, d(t), in meters, the rock travels after t seconds can be modeled by the function $d(t) = 0.8t^2$. What is the average speed, in meters per second, of the rock between 5 and 10 seconds after it was dropped?
 - 1) 12 3) 60 2) 20 4) 80
- 3 One Saturday, Dave took a long bike ride. The graph below models his trip.



What was Dave's average rate of change, in miles per hour, on this trip?

- 1) 10 3) 11.6
- 2) 11 14.5 4)

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4 The graph below shows the distance in miles, m, hiked from a camp in h hours.



Which hourly interval had the greatest rate of change?

- 1) hour 0 to hour 1 3) hour 2 to hour 3
- 2) hour 1 to hour 2

- 4) hour 3 to hour 4
- 5 The Jamison family kept a log of the distance they traveled during a trip, as represented by the graph below.



Elapsed Time (hours)

During which interval was their average speed the greatest?

- 3) the sixth hour to the eighth hour
- the first hour to the second hour 2) the second hour to the fourth hour

1)

4) the eighth hour to the tenth hour Regents Exam Questions F.IF.B.6: Rate of Change 1 www.jmap.org

6 The graph below models the height of a remote-control helicopter over 20 seconds during flight.



Over which interval does the helicopter have the *slowest* average rate of change?

- 0 to 5 seconds 1) 2)
 - 5 to 10 seconds
- 3) 10 to 15 seconds 15 to 20 seconds 4)
- 7 Firing a piece of pottery in a kiln takes place at different temperatures for different amounts of time. The graph below shows the temperatures in a kiln while firing a piece of pottery after the kiln is preheated to 200°F.



During which time interval did the temperature in the kiln show the greatest average rate of change?

1) 0 to 1 hour 3) 2.5 hours to 5 hours 4) 5 hours to 8 hours

2) 1 hour to 1.5 hours 8 A graph of average resting heart rates is shown below. The average resting heart rate for adults is 72 beats per minute, but doctors consider resting rates from 60-100 beats per minute within normal range.



Average Resting Heart Rate by Age

Which statement about average resting heart rates is *not* supported by the graph?

- 1) A 10-year-old has the same average resting heart rate as a 20-year-old.
- 2) A 20-year-old has the same average resting heart rate as a 30-year-old.
- A 40-year-old may have the same average resting heart rate for ten years.
- 4) The average resting heart rate for teenagers steadily decreases.

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9 Voting rates in presidential elections from 1996-2012 are modeled below.

Voting Rates in Presidential Elections, by Age, for the Voting-Age Citizen Population: 1996-2012



Which statement does *not* correctly interpret voting rates by age based on the given graph?

- 1) For citizens 18-29 years of age, the rate of change in voting rate was greatest between years 2000-2004.
- 3) About 70% of people 45 and older voted in the 2004 election.
- 2) From 1996-2012, the average rate of change was positive for only two age groups.
- 4) The voting rates of eligible age groups lies between 35 and 75 percent during presidential elections every 4 years from 1996-2012.
- 10 A bookstore owner recorded the number of books sold and the profit made selling the books.

Books Sold	Profit
100	\$50.00
250	\$275.00
300	\$350.00
350	\$425.00

What is the average rate of change, in dollars per book, between 100 and 350 books sold?

- 1) 0.50 3) 1.50
- 2) 0.67 4) 2.00
- 11 Joey enlarged a 3-inch by 5-inch photograph on a copy machine. He enlarged it four times. The table below shows the area of the photograph after each enlargement.

Enlargement	0	1	2	3	4
Area (square inches)	15	18.8	23.4	29.3	36.6

What is the average rate of change of the area from the original photograph to the fourth enlargement, to the *nearest tenth*?

 1)
 4.3
 3)
 5.4

 2)
 4.5
 4)
 6.0

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12 The table below shows the average diameter of a pupil in a person's eye as he or she grows older.

Age	Average Pupil				
(years)	Diameter (mm)				
20	4.7				
30	4.3				
40	3.9				
50	3.5				
60	3.1				
70	2.7				
80	2.3				

What is the average rate of change, in millimeters per year, of a person's pupil diameter from age 20 to age 80?

- 3) -2.4 1) 2.4
- 2) 0.04 -0.044)
- 13 The table below shows the cost of mailing a postcard in different years. During which time interval did the cost increase at the greatest average rate?

	Year	1898	1971	1985	2006	201
	Cost (¢)	1	6	14	24	35
1898-1971		3)	1985-2	2006		
1971-1985		4)	2006-2	2012		

14 The table below shows the year and the number of households in a building that had high-speed broadband internet access.

Number of Households	11	16	23	33	42	47
Year	2002	2003	2004	2005	2006	2007

For which interval of time was the average rate of change the *smallest*?

- 1) 2002 - 2004
- 3) 2004 - 2006 2005 - 2007
- 2) 2003 2005 4)

15 The table below shows the number of reported polio cases in Nigeria from 2006 to 2015.

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Number of Cases	1129	285	798	388	21	62	122	53	60	0

What is the average rate of change, to the nearest hundredth, of the number of reported polio cases per year in Nigeria from 2006 to 2013?

1) -0.01

1) 2)

3) -134.50 2) -125.44 4) -153.71

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16 Which function has a constant rate of change equal to -3?



17 Given the functions g(x), f(x), and h(x) shown below:



The correct list of functions ordered from greatest to least by average rate of change over the interval $0 \le x \le 3$ is

- 1) f(x), g(x), h(x)
- 2) h(x), g(x), f(x)

- 3) g(x), f(x), h(x)
- 4) h(x), f(x), g(x)

F.IF.B.6: Rate of Change 1 Answer Section

1 ANS: 2 $\left(\frac{\$1824 - 1140}{3 - 0 \text{ yr}}\right) \left(\frac{1 \text{ yr}}{12 \text{ m}}\right) = \frac{\$19}{\text{m}}$ REF: 062105ai 2 ANS: 1 $\frac{0.8(10^2) - 0.8(5^2)}{10 - 5} = \frac{80 - 20}{5} = 12$ REF: 011521ai 3 ANS: 1 $\frac{55-0}{5.5-0} = 10$ REF: 062418ai 4 ANS: 1 The graph is steepest between hour 0 and hour 1. REF: 081601ai 5 ANS: 1 $\frac{110-40}{2-1} > \frac{350-230}{8-6}$ 70 > 60REF: 061418ai 6 ANS: 2 The slope of a line connecting (5, 19) and (10, 20) is lowest. REF: 081705ai 7 ANS: 1 REF: 081515ai 8 ANS: 1 REF: 011721ai 9 ANS: 2 From 1996-2012, the average rate of change was positive for three age groups. REF: 011824ai 10 ANS: 3 $\frac{425 - 50}{350 - 100} = 1.5$ REF: 082410ai

11 ANS: 3 $\frac{36.6-15}{4-0} = \frac{21.6}{4} = 5.4$ REF: 061511ai 12 ANS: 4 $\frac{4.7 - 2.3}{20 - 80} = \frac{2.4}{-60} = -0.04.$ REF: 081414ai 13 ANS: 4 $(1) \frac{6-1}{1971-1898} = \frac{5}{73} \approx .07 \quad (2) \frac{14-6}{1985-1971} = \frac{8}{14} \approx .57 \quad (3) \frac{24-14}{2006-1985} = \frac{10}{21} \approx .48 \quad (4) \frac{35-24}{2012-2006} = \frac{11}{6} \approx 1.83$ REF: 011613ai 14 ANS: 1 REF: 061603ai 15 ANS: 4 $\frac{53 - 1129}{2013 - 2006} \approx -153.71$ REF: 082323ai 16 ANS: 4 1) y = 3x + 2; 2) $\frac{-5 - 2}{3 - 2} = -7$; 3) y = -2x + 3; 4) y = -3x + 5REF: 081615ai 17 ANS: 4

Over the interval $0 \le x \le 3$, the average rate of change for $h(x) = \frac{9-2}{3-0} = \frac{7}{3}$, $f(x) = \frac{7-1}{3-0} = \frac{6}{3} = 2$, and $g(x) = \frac{3-0}{3-0} = \frac{3}{3} = 1$.

REF: spr1301ai