

- 4 The equation $t = \frac{1}{0.0105} \ln\left(\frac{A}{5000}\right)$ relates time, t , in years, to the amount of money, A , earned by a \$5000 investment. Which statement accurately describes the relationship between the average rates of change of t on the intervals $[6000, 8000]$ and $[9000, 12,000]$?
- 1) A comparison cannot be made because the intervals are different sizes. 3) The average rate of change is larger for the interval $[6000, 8000]$.
- 2) The average rate of change is equal for both intervals. 4) The average rate of change is larger for the interval $[9000, 12,000]$.
- 5 The value of a new car depreciates over time. Greg purchased a new car in June 2011. The value, V , of his car after t years can be modeled by the equation $\log_{0.8}\left(\frac{V}{17000}\right) = t$. What is the average decreasing rate of change per year of the value of the car from June 2012 to June 2014, to the *nearest ten dollars per year*?
- 1) 1960 3) 2450
2) 2180 4) 2770
- 6 A fruit fly population can be modeled by the equation $P = 10(1.27)^t$, where P represents the number of fruit flies after t days. What is the average rate of change of the population, rounded to the *nearest hundredth*, over the interval $[0, 10.5]$? Include appropriate units in your answer.
- 7 An initial investment of \$1000 reaches a value, $V(t)$, according to the model $V(t) = 1000(1.01)^{4t}$, where t is the time in years. Determine the average rate of change, to the *nearest dollar per year*, of this investment from year 2 to year 7.
- 8 In the town of Skaneateles, New York, house prices since 2008 have changed based on the function $H(t) = 200,000(1.045)^t$, where t is the number of years since 2008 and $H(t)$ is the median house price. Determine the average rate of change for the median house price in Skaneateles, from 2010 to 2018 to the *nearest dollar per year*. Explain what this rate of change means as it relates to median house prices.

- 9 The world population was 2560 million people in 1950 and 3040 million in 1960 and can be modeled by the function $p(t) = 2560e^{0.017185t}$, where t is time in years after 1950 and $p(t)$ is the population in millions. Determine the average rate of change of $p(t)$ in millions of people per year, from $4 \leq t \leq 8$. Round your answer to the *nearest hundredth*.
- 10 Which function shown below has a greater average rate of change on the interval $[-2, 4]$? Justify your answer.

x	f(x)
-4	0.3125
-3	0.625
-2	1.25
-1	2.5
0	5
1	10
2	20
3	40
4	80
5	160
6	320

$$g(x) = 4x^3 - 5x^2 + 3$$

- 11 The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where x is the number of years since 1900. The population of India since 1900 is summarized in the table below:

Years since 1900	Population (millions)
0	243
10	254
20	268
30	285
40	324
50	376.3
60	450.6
70	555.1
80	699
90	873.3
100	1056.6
110	1234.3
120	1380

Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

F.IF.B.6: Rate of Change 4

Answer Section

1 ANS: 4

$$(1) \frac{B(60) - B(10)}{60 - 10} \approx 28\% \quad (2) \frac{B(69) - B(19)}{69 - 19} \approx 33\% \quad (3) \frac{B(72) - B(36)}{72 - 36} \approx 38\% \quad (4) \frac{B(73) - B(60)}{73 - 60} \approx 46\%$$

REF: 011721aii

2 ANS: 1

$$\frac{N(6) - N(0)}{6 - 0} \approx -8.93$$

REF: 012012aii

3 ANS: 1

$$\frac{N(10) - N(1)}{10 - 1} \approx -2.03, \quad \frac{N(20) - N(10)}{20 - 10} \approx -1.63, \quad \frac{N(25) - N(15)}{25 - 15} \approx -1.46, \quad \frac{N(30) - N(1)}{30 - 1} \approx -1.64$$

REF: 061807aii

4 ANS: 3

Define f(x) =	Value
$\frac{f(8000) - f(6000)}{8000 - 6000}$	0.013699
$\frac{f(12000) - f(9000)}{12000 - 9000}$	0.009133

REF: 081922aii

5 ANS: 3

$$\log_{0.8} \left(\frac{V}{17000} \right) = t \quad \frac{17,000(0.8)^3 - 17,000(0.8)^1}{3 - 1} \approx -2450$$

$$0.8^t = \frac{V}{17000}$$

$$V = 17000(0.8)^t$$

REF: 081709aii

6 ANS:

$$\frac{P(10.5) - P(0)}{10.5 - 0} \approx 10.76 \text{ fruit flies per day}$$

REF: 082332aii

7 ANS:

$$\frac{V(7) - V(2)}{7 - 2} \approx 48$$

REF: 012427aai

8 ANS:

$$\frac{H(10) - H(2)}{10 - 2} \approx 11524 \text{ From 2014-2018, the median house price increased } \$11524 \text{ per year on average.}$$

REF: 062434aai

9 ANS:

$$\frac{p(8) - p(4)}{8 - 4} \approx 48.78$$

REF: 081827aai

10 ANS:

$$\frac{f(4) - f(-2)}{4 - (-2)} = \frac{80 - 1.25}{6} = 13.125 \text{ } g(x) \text{ has a greater rate of change}$$

$$\frac{g(4) - g(-2)}{4 - (-2)} = \frac{179 - (-49)}{6} = 38$$

REF: 061636aai

11 ANS:

$$\text{China: } \frac{P(120) - P(50)}{120 - 50} \approx 13.5 \text{ India: } \frac{1380 - 376.3}{120 - 50} \approx 14.3 \text{ India}$$

REF: 082433aai