LESSON MAKER PRO

Rate Change Lab

Build and evaluate difference quotients.

HIGH SCHOOL · MA.912.F.1.4

MA.912.F.1.4 "Write an algebraic expression that represents the difference quotient of a function. Calculate the numerical value of the difference quotient at a given pair of points."

NAME _____ **DATE** _____

THE BIG IDEA

A difference quotient compares the change in output to the change in input: [f(b)-f(a)]/(b-a). To write a general difference quotient, use [f(x+h)-f(x)]/h, substitute carefully, and simplify.

WORKED EXAMPLE

For g(x) = 8x - 17, write and simplify the difference quotient.

1. Start with [g(x+h)-g(x)]/h.
2. Substitute: [(8(x+h)-17)-(8x-17)]/h.
3. Simplify the numerator: (8x+8h-17-8x+17)/h = 8h/h.
4. Simplify: 8h/h = 8.

Answer: 8

PRACTICE 6 problems

1 For f(x) = 3x + 4, write the difference quotient [f(x+h)-f(x)]/h. Do not simplify.

ANSWER _____

2 For p(x) = x^2 - 6x, write and simplify [p(x+h)-p(x)]/h.

ANSWER _____

3 For q(x) = x^2 + 9, calculate the difference quotient from x = 1 to x = 4.

ANSWER _____

4 For r(x) = x^2 - 3x + 1, calculate the difference quotient from x = -1 to x = 2.

ANSWER _____

5 For s(x) = x^3 + 2x, write and simplify [s(x+h)-s(x)]/h.

ANSWER _____

6 A function has points (-4, 7) and (2, -5). Calculate the difference quotient between these points.

ANSWER _____

APPLY IT Show your work

1 A student tracks followers on a video channel. The follower function F(d) has F(3) = 270 and F(9) = 414, where d is days after posting. Write and calculate the difference quotient from day 3 to day 9.

WORK SPACE

ANSWER _____

2 A gaming app models a player's points after t rounds with $P(t) = t^2 + 6t$. Calculate the difference quotient from t = 1 to t = 5.

WORK SPACE

ANSWER _____

CHALLENGE One step up

For $k(x) = x^2 - 4x + 7$, find $[k(x+3)-k(x)]/3$. Then explain why your result depends on x.

WORK SPACE AND ANSWER

Rate Change Lab

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For f(x) = 3x + 4, write the difference quotient [f(x+h)-f(x)]/h. Do not simplify.	**[(3(x+h)+4)-(3x+4)]/h**
2	For p(x) = x^2 - 6x, write and simplify [p(x+h)-p(x)]/h.	**2x + h - 6**
3	For q(x) = x^2 + 9, calculate the difference quotient from x = 1 to x = 4.	**5**
4	For r(x) = x^2 - 3x + 1, calculate the difference quotient from x = -1 to x = 2.	**-2**
5	For s(x) = x^3 + 2x, write and simplify [s(x+h)-s(x)]/h.	**$3x^2 + 3xh + h^2 + 2$**
6	A function has points (-4, 7) and (2, -5). Calculate the difference quotient between these points.	**-2**

PART 2 · APPLY IT

1. **24 followers per day** Use [F(9)-F(3)]/(9-3) = (414-270)/6 = 24. The channel gained an average of 24 followers per day.
2. **12 points per round** Find P(5) = 55 and P(1) = 7. Then [P(5)-P(1)]/(5-1) = (55-7)/4 = 12.

CHALLENGE

2x - 1. It depends on x because the function is quadratic, so its rate of change changes at different x-values.

Accept equivalent forms of the algebraic difference quotients, including reordered terms. For numerical problems, accept equivalent fraction forms before simplification.