



MATH 122

CLIFTON

2.1: INSTANTANEOUS
RATE OF
CHANGE

MATH 122

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OUTLINE

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1 2.1: INSTANTANEOUS RATE OF CHANGE



DEFINITION

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DEFINITION 1

The *instantaneous rate of change* of f at a is defined to be the limit of the average rates of change of f over successively smaller intervals around a .

This is also known as the *derivative of f at a* .



EXAMPLE

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CHANGE

The quadratic

$$s(t) = -4.9t^2 + 9.8t$$

models the position of an object thrown vertically into the air with an initial velocity of 9.8 m/s.



EXAMPLE

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The quadratic

$$s(t) = -4.9t^2 + 9.8t$$

models the position of an object thrown vertically into the air with an initial velocity of 9.8 m/s. What is the instantaneous rate of change at the vertex, where $t = 1$?



EXAMPLE (CONT.)

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Here are some values:

t

$$\frac{f(t) - f(1)}{t - 1}$$



EXAMPLE (CONT.)

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2.1: INSTANTANEOUS
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Here are some values:

t

0

$$\frac{f(t)-f(1)}{t-1}$$

4.9



EXAMPLE (CONT.)

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Here are some values:

t	$\frac{f(t)-f(1)}{t-1}$
0	4.9
0.9	≈ 0.49



EXAMPLE (CONT.)

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Here are some values:

t	$\frac{f(t)-f(1)}{t-1}$
0	4.9
0.9	≈ 0.49
0.99	≈ 0.049



EXAMPLE (CONT.)

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Here are some values:

t	$\frac{f(t)-f(1)}{t-1}$
0	4.9
0.9	≈ 0.49
0.99	≈ 0.049
0.999	≈ 0.0049



EXAMPLE (CONT.)

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Here are some values:

t	$\frac{f(t)-f(1)}{t-1}$
0	4.9
0.9	≈ 0.49
0.99	≈ 0.049
0.999	≈ 0.0049
0.9999	≈ 0.00049



EXAMPLE (CONT.)

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Here are some values:

t	$\frac{f(t)-f(1)}{t-1}$
0	4.9
0.9	≈ 0.49
0.99	≈ 0.049
0.999	≈ 0.0049
0.9999	≈ 0.00049
0.99999	≈ 0.000049



EXAMPLE (CONT.)

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Here are some values:

t	$\frac{f(t)-f(1)}{t-1}$
0	4.9
0.9	≈ 0.49
0.99	≈ 0.049
0.999	≈ 0.0049
0.9999	≈ 0.00049
0.99999	≈ 0.000049
0.999999	≈ 0.0000049



EXAMPLE (CONT.)

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Here are some values:

t	$\frac{f(t)-f(1)}{t-1}$
0	4.9
0.9	≈ 0.49
0.99	≈ 0.049
0.999	≈ 0.0049
0.9999	≈ 0.00049
0.99999	≈ 0.000049
0.999999	≈ 0.0000049

So, we would guess that the instantaneous rate of change is 0 at $t = 1$.



ANIMATION

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