

Rate of Change Problems With Rational Functions

1. The electrical current in a circuit varies with time according to

$$c = \frac{3s^3 - s^2 + 5s}{s^3 + 10},$$

where the current, c , is in amperes, and time s is in

seconds. Find the average rate of change from 0.75 seconds to 1.5 seconds, and find the instantaneous rate of change at 1.5 seconds. Identify any vertical asymptotes.

2. As you get farther from Earth's surface, gravity has less effect on you. For this reason, you actually weigh less at higher altitudes. A person who weighs 55kg can use the function's $W(h) = \frac{6400(55)}{h + 6400}$ to find their weight, W in kgs, at a specific height, h in feet above sea level, above the Earth's surface. Find the average rate of change from heights of 750 ft to 1200 ft above sea level, and find the instantaneous rate of change at 1200 ft above sea level.

5. The average speed of a certain particle in meters per second is given by the equation $S(t) = \frac{2t^2 + 8t + 5}{t + 3}$. Find the average rate of change as time changes from 0.5 seconds to 3.5 seconds, and find the instantaneous rate of change at 3.5 seconds.

6. After you eat something that contains sugar, the pH or acid level in your mouth changes. This can be modeled by the function $L(m) = \frac{-20.4m}{m^2 + 36} + 6.5$, where L is the pH level and m is the number of minutes that have elapsed since eating. Find the average rate of change from 1.5 minutes to 3 minutes, and find the instantaneous rate of change at 3 minutes.

9. Explain why the line $y = x$ is an asymptote for the graph of $y = \frac{x^3}{x^2 + 1}$.

10. Explain why the line $y = -x$ is an asymptote for the graph of $y = \frac{1 - x^2}{x}$.

ANSWERS:

Average Rate of Change	Instantaneous Rate of Change
1. 0.9629	1.08
2. -0.0065	-0.0069
5. 2.3932 2.044	2
6. -0.3733333	-0.2720
9 & 10. Has an oblique asymptote because the degree of the numerator is exactly one greater than that of the denominator. The equation of that asymptote is found through synthetic division (the quotient).	