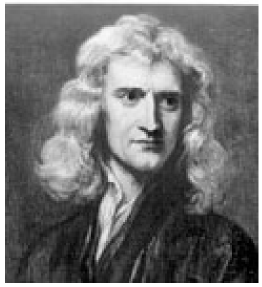
Calculus

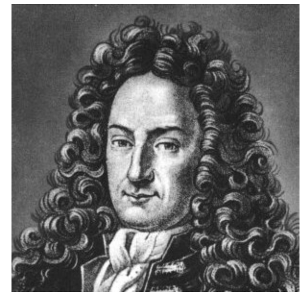
1.1 Can change occur at an instant?

Notes

Write your questions and thoughts here!

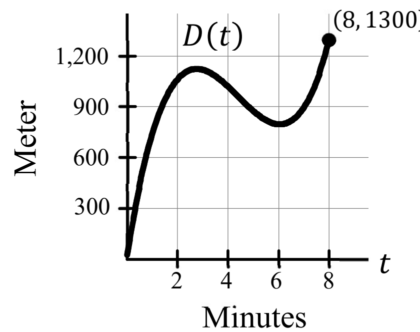
The Father(s) of Calculus





Can Change occur at an instant?

1. Mr. Brust's distance from his house is modeled by the function $D(t)$. While riding his bike to the store, he realizes he dropped his wallet and turns around to find it. After finding his wallet, he finishes his ride to the store.



   a. What is his average speed (rate of change) for his trip to the store if he arrives after 8 minutes?

   b. What was his average rate of change between 2 and 6 minutes?

   c. What was his average rate of change between 2 and 3 minutes?

   Is it possible to know how fast he was going at an instant?

   d. Give an example of how to calculate a rate of change that would give a close estimate to the instantaneous rate of change at $t = 2$.

   e. Give a rough estimate of the instantaneous rate of change at $t = 2$.

2. $b(t)$ represents the buffalo population in the United States where t is measured in years since 1800.

   a. What does $b(90)$ represent?

   b. What does $\frac{b(50)-b(0)}{50-0}$ represent?

   c. What does $\frac{b(32)-b(31.999)}{32-31.999}$ represent?

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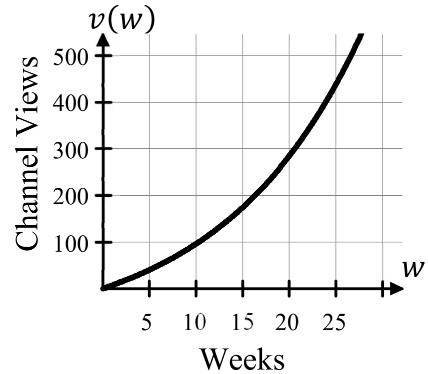
Practice

1. Mr. Kelly has decided to quit his job as a teacher and be a social influencer. The number of views on his new channel is modeled by the function v, where $v(w)$ gives the number of views and w gives the number of weeks since he started the channel for $0 \leq w \leq 26$. The graph of the function v is shown to the right.



   a. Draw a tangent line at $w = 10$.

   b. Give a rough estimate of the instantaneous rate of change at $w = 10$.

   c. Give an example of how to calculate a rate of change that would give a close estimate to the instantaneous rate of change at $w = 5$.

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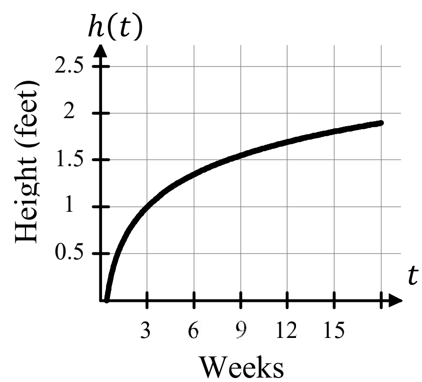
2. The height of a raspberry bush can be modeled by the function h, where $h(t)$ gives the height measured in feet and t gives the number of weeks it was planted for $0 \leq t \leq 12$. The graph of the function h is shown to the right.



   a. Draw a tangent line at $t = 9$.

   b. Give a rough estimate of the instantaneous rate of change at $t =$ 9.

   c. Give an example of how to calculate a rate of change that would give a close estimate to the instantaneous rate of change at $t = 12$.

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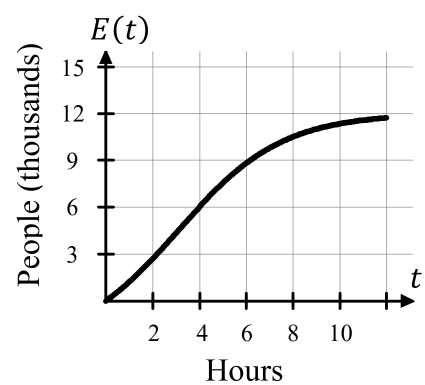
3. The number of people who have entered an amusement park is modeled by the function E, where $E(t)$ gives the number of people in thousands who have entered the park and t gives the number of hours since 10:00 a.m. for $0 \leq t \leq 11$. The graph of the function E is shown to the right.



   a. Draw a tangent line at $t = 3$.

   b. Give a rough estimate of the instantaneous rate of change at $t = 3$.

   c. Give an example of how to calculate a rate of change that would give a close estimate to the instantaneous rate of change at $t = 6$.

4. A basketball player's free throw attempts can be modeled by f, where $f(g)$ is the total number of made free throws during the season and g is the number of games for $0 \leq g \leq 82$.

a. What does $f(50)$ represent?	b. What does $\frac{f(50)-f(0)}{50-0}$ represent?	c. What does $\frac{f(50)-f(49.999)}{50-49.999}$ represent?

5. A monthly electric bill charges for each kilowatt-hour (kWh) used. This can be modeled by k where $k(m)$ is the kWh used for the month and m is the month for $0 \leq m \leq 12$.

a. What does $k(8)$ represent?	b. What does $\frac{k(8)-k(5)}{8-5}$ represent?	c. What does $\frac{k(2)-k(1.999)}{2-1.999}$ represent?

6. In a country, the number of deaths in a year can be modeled by d, where $d(t)$ is the number of deaths and t is the number of years since 1950 for $0 \leq t \leq 50$.

a. What does $d(40)$ represent?	b. What does $\frac{d(20)-d(10)}{20-10}$ represent?	c. What does $\frac{d(49)-d(48.999)}{49-48.999}$ represent?

7. A dam has a "dam release" that releases water. The amount of water released can be modeled by V, where $V(t)$ is the volume of cubic liters of water and t is the seconds since opening the dam release for $0 \leq t \leq 3600$.

a. What does $V(100)$ represent?	b. What does $\frac{V(100)-V(0)}{100-0}$ represent?	c. What does $\frac{V(100)-V(99.999)}{100-99.999}$ represent?