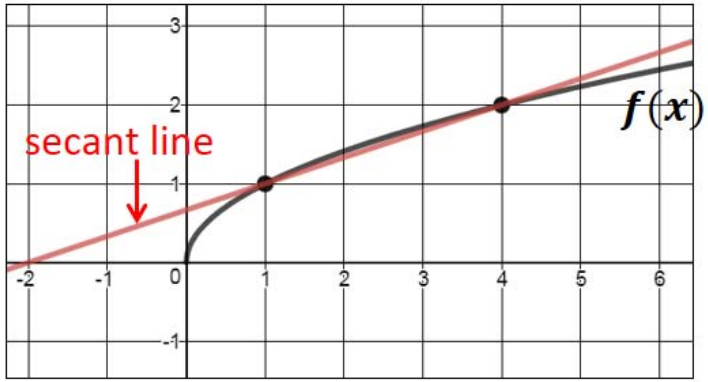
Objective: Find the Average Rate of Change for a Square Root Function

Concept

$$\text{Average Rate of Change} = \frac{\Delta f(x)}{\Delta x}$$

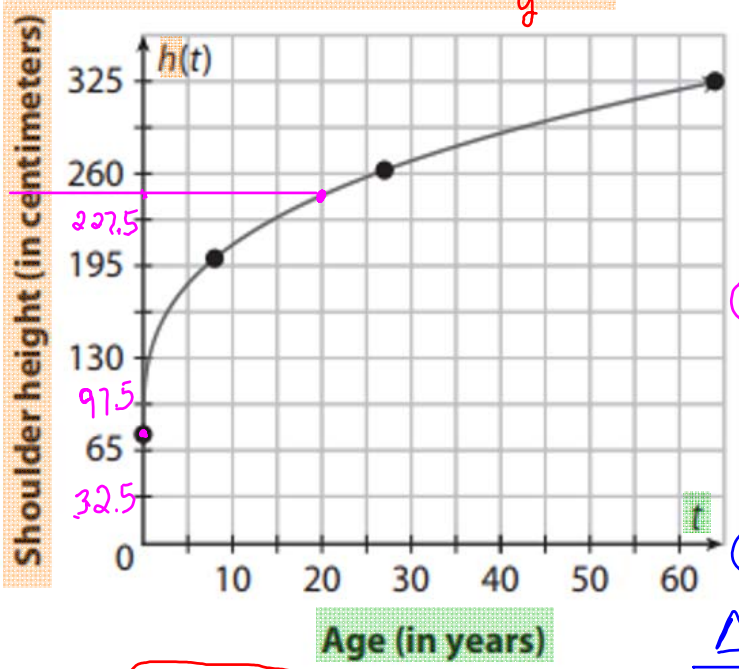
$$\frac{\Delta f(x)}{\Delta x} = \frac{change\ in\ f(x)\ values}{change\ in\ x\ values} = \frac{f(x_2)-f(x_1)}{x_2-x_1} \text{ for the interval } [x_1, x_2]$$

- The **average rate of change** is the average change between y values for each unit of x over a specific interval.
- The **average rate of change** for an interval **corresponds to the slope of the line through the two points at the ends of the interval.** This line is called the **secant line**.



Objective: Find the Average Rate of Change for a Square Root Function

Ex) The shoulder height h, in centimeters, of a particular elephant is modeled by the graph of the square root function below, where the age, t, is in years of the elephant.



Approximate the average change in the elephant's shoulder height per year from birth to 20 years. If necessary, round to three decimal places.

① birth = $t = 0$ yr, $h = 77$ cm
"x" "y"
$t = 20$ yr, $h = 248$ cm

② AROC

$$\frac{\Delta h}{\Delta t} = \frac{248 - 77 \text{ cm}}{20 - 0 \text{ yr}} = \frac{171 \text{ cm}}{20 \text{ yr}}$$

≈ 8.55 cm per yr
cm/yr

③ From birth to 20 years the change in the elephant's shoulder height per year was an average of about 8.55 cm per year.

Objective: Find the Average Rate of Change for a Square Root Function

Ex) An object follows a path according to the function, $d = \sqrt{0.5h - 2}$, where d is the distance the object has traveled in miles after h hours. Calculate the object's average speed from 14 hours to 20 hours. Round your answer to three decimal places.

① $h = 14$ hr, $d = \sqrt{0.5(14) - 2} = \sqrt{5}$ mi

$h = 20$ hr $d = \sqrt{0.5(20) - 2} = \sqrt{8}$ mi

② AROC

$$\frac{\Delta d}{\Delta h} = \frac{\sqrt{8} - \sqrt{5}\ \text{mi}}{20 - 14\ \text{hr}} = \frac{(\sqrt{8} - \sqrt{5})\ \text{mi}}{6\ \text{hr}}$$

$(\sqrt{(8)} - \sqrt{(5)}) \div 6 =$

≈ 0.099 mph or mi/h

③ From 14 hours to 20 hours the object's average speed was about 0.099 mph.

Objective: Find the Average Rate of Change for a Square Root Function

Ex) An object follows a path according to the function, $d = 4(2s)^{\frac{1}{3}} + 6$, where d is the distance the object has traveled in meters after s seconds. Calculate the object's average speed from 7 seconds to 12 seconds. Round your answer to three decimal places.

$d = 4(2s)^{1/3} + 6$ $\quad d = 4 \cdot \sqrt[3]{2s} + 6$

① $s = 7$ sec $\quad d = 4 \cdot \sqrt[3]{2(7)} + 6 = 4\sqrt[3]{14} + 6$ meters

$s = 12$ sec $\quad d = 4\sqrt[3]{2(12)} + 6 = 4\sqrt[3]{24} + 6$ meters

② AROC

$$\frac{\Delta d}{\Delta s} = \frac{4\sqrt[3]{24} + 6 - (4\sqrt[3]{14} + 6) \text{ meters}}{12 - 7 \text{ sec}} = \frac{4\sqrt[3]{24} - 4\sqrt[3]{14} \text{ meters}}{5 \text{ sec}}$$

$-4\sqrt[3]{14} - 6$

$* 4 \cdot 3\sqrt{\ }^{x} (24) - 4 \cdot 3\sqrt{\ }^{x} (14) = \div 5 =$

≈ 0.379 m/s

③ From 7 seconds to 12 seconds the object's average speed was about 0.379 m/s.