E-Learning Solutions

1. $T(x) = x^2 + \ln x + 98$ degree Fahrenheit gives the temperature of an oven x minutes after it's been turned on, $0.3 < x < 15$. Complete the table below.

Solution:

$x < 1$	Slope of secant line from $(1, 99)$ to $(x, T(x))$	$x > 1$	Slope of secant line from $(1, 99)$ to $(x, T(x))$
$x = 0.5$	$\frac{T(1)-T(0.5)}{1-0.5} \approx 2.886$	$x = 1.5$	$\frac{T(1)-T(1.5)}{1-1.5} \approx 3.311$
$x = 0.6$	$\frac{T(1)-T(0.6)}{1-0.6} \approx 2.877$	$x = 1.4$	$\frac{T(1)-T(1.4)}{1-1.4} \approx 3.241$
$x = 0.7$	$\frac{T(1)-T(0.7)}{1-0.7} \approx 2.888$	$x = 1.3$	$\frac{T(1)-T(1.3)}{1-1.3} \approx 3.175$
$x = 0.8$	$\frac{T(1)-T(0.8)}{1-0.8} \approx 2.916$	$x = 1.2$	$\frac{T(1)-T(1.2)}{1-1.2} \approx 3.112$
$x = 0.9$	$\frac{T(1)-T(0.9)}{1-0.9} \approx 2.953$	$x = 1.1$	$\frac{T(1)-T(1.1)}{1-1.1} \approx 3.053$

1a. Using the table above, estimate $T'(1)$, and then write a sentence of interpretation for this.

Solution: We estimate that

$$\begin{aligned} T'(1) &= \lim_{x \to 1} \frac{T(1) - T(x)}{1 - x} \\ &= 3. \end{aligned}$$

Sentence of Interpretation: The temperature of an oven is increasing by 3 degree Fahrenheit per minute, 1 minute after it's been turned on.

1b. Find the percentage rate of change when $x = 1$ and then write a sentence of interpretation for this.

Solution: We calculate the percentage rate of change when $x = 1$ to be

$$\begin{aligned} \frac{T'(1)}{T(1)} \cdot 100\% &= \frac{3}{99} \cdot 100\% \\ &\approx 3.03\%. \end{aligned}$$

Sentence of Interpretation: The temperature of an oven is increasing by 3.03 percent per minute, 1 minute after it's been turned on.