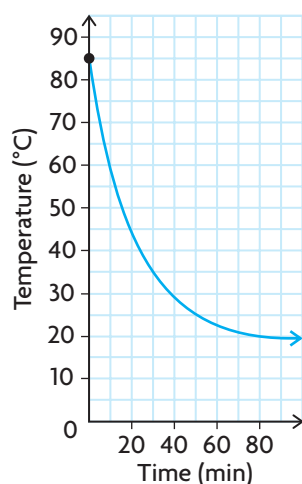


2

Chapter Self-Test



- A speedboat driver is testing a new boat. He begins the test by steadily increasing the boat's speed until he reaches 3 kn (knots) over a period of 1 min. Because he is in a no-wake zone, he stays at this speed for 5 min. After leaving the no-wake zone, he steadily increases the speed of the boat to 25 kn over a period of 2 min. He stays at this speed for 5 min and then increases the speed of the boat to 45 kn over a period of 1 min. After staying at this speed for 5 min, he decelerates the boat at a steady rate over a period of 4 min until he comes to a stop.

 - Draw a graph of the boat's speed versus time. Remember to label your data points.
 - What is the average rate of change in speed from $t = 6$ to $t = 8$ and from $t = 8$ to $t = 13$? How are the two rates different? What does this tell you about the speed of the boat during these two intervals of time?
 - What is the instantaneous rate of change in speed at $t = 7$?
- A cup of hot cocoa left on a desk in a classroom had its temperature measured once every minute. The graph shows the relationship between the temperature of the cocoa, in degrees Celsius, and time, in minutes.

 - Determine the slope of the secant line that passes through the points (5, 70) and (50, 25).
 - What does the answer to part a) mean in this context?
 - Estimate the slope of the tangent line at the point (30, 35).
 - What does the answer to part b) mean in this context?
 - Discuss what happens to the rate at which the cup of cocoa cools over the 90 min period.
- The profit $P(x)$ of a cosmetics company, in thousands of dollars, is given by $P(x) = -5x^2 + 400x - 2550$, where x is the amount spent on advertising in thousands of dollars.

 - Calculate the average rate of change in profit on the interval $8 \leq x \leq 10$.
 - Estimate the instantaneous rate of change in profit when $x = 50$.
 - Discuss the significance of the signs in your answers to parts a) and b).
- Estimate the instantaneous rate of change for each function at each point given. Identify any point that is a maximum/minimum value.

 - $h(p) = 2p^2 + 3p$; $p = -1, -0.75$, and 1
 - $k(x) = -0.75x^2 + 1.5x + 13$; $x = -2, 4$, and 1