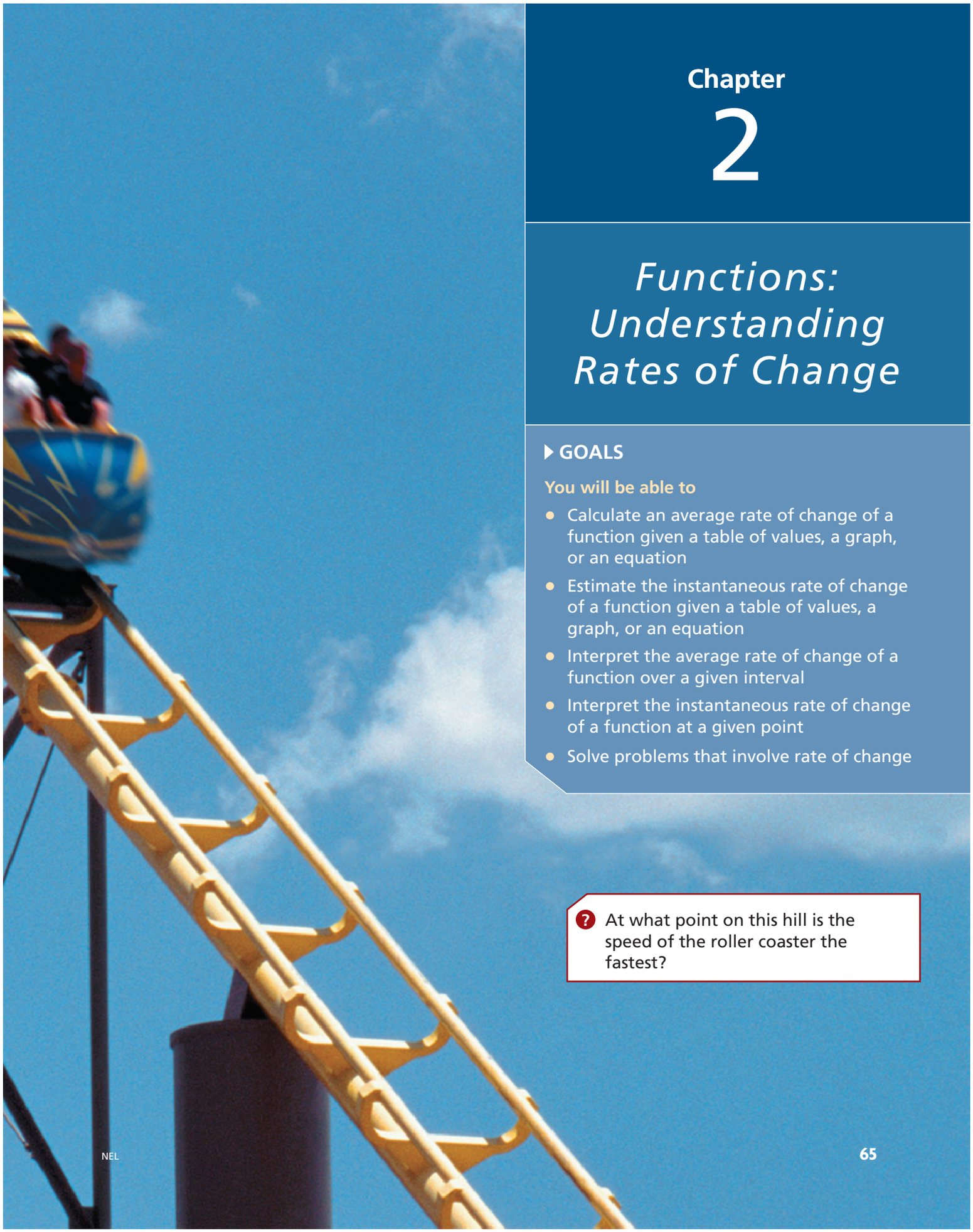


Chapter

2

Functions: Understanding Rates of Change

GOALS

You will be able to

- Calculate an average rate of change of a function given a table of values, a graph, or an equation
- Estimate the instantaneous rate of change of a function given a table of values, a graph, or an equation
- Interpret the average rate of change of a function over a given interval
- Interpret the instantaneous rate of change of a function at a given point
- Solve problems that involve rate of change

? At what point on this hill is the speed of the roller coaster the fastest?

2 Getting Started

Study Aid

- For help, see the Review of Essential Skills found at the Nelson Advanced Functions website.

Question	Appendix
1	R–5
3	R–6
4	R–8
6	R–12

SKILLS AND CONCEPTS You Need

1. Determine the slope of the line through each pair of points.

a) A $(2, 3)$ and B $(5, 7)$ **b)** C $(3, -1)$ and D $(-4, 5)$

2. Calculate the finite differences for each table, identify the type of function that each table represents, and provide a reason for your choice.

a)

x	1	2	3	4	5	6
y	1	−1	−5	−13	−29	−61

b)

x	1	2	3	4	5	6
y	0	11	28	51	80	115

3. Determine the zeros for each of the following functions.

a) $g(x) = 2x^2 - x - 6$ **c)** $j(x) = \sin(x - 45°), 0° \leq x \leq 360°$

b) $h(x) = 2^x - 1$ **d)** $k(x) = 2\cos x, -360° \leq x \leq 0°$

4. Given $y = f(x)$, describe how the graph of $f(x)$ is transformed in each of the following functions.

a) $y = \frac{1}{2}f(x)$ **c)** $y = -3f(x) + 7$

b) $y = 2f(x - 4)$ **d)** $y = 5f(x - 3) - 2$

5. Suppose you invest \$1000 in a savings account that pays 8%/a compounded annually.

a) Write an equation for the amount of money you will have after t years.

b) How much money will you have after three years?

c) Does the amount of money in your account increase at a constant rate each year? Explain.

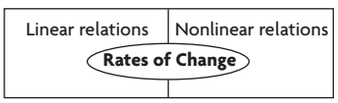
6. The height above the ground of one of the seats of a Ferris wheel, in metres, can be modelled by the function $h(t) = 8 + 7\sin(15°t)$, where t is measured in seconds.

a) What is the maximum and minimum height reached by any seat?

b) How long does one seat on this ride take to rotate back to its starting point?

c) After 30 s, what will the height of the seat be?

7. Create a chart to show what you know about rates of change in **linear** and **nonlinear relations**.



APPLYING What You Know

Safe Driving

It is important for drivers to know how much time they need to come to a safe stop. The time needed to stop depends on the speed of the vehicle.

The following table gives safe stopping distances on dry pavement.

Speed (km/h)	Reaction-Time Distance (m)	Braking Distance (m)	Overall Stopping Distance (m)
0	0.00	0.00	0.00
20	8.33	1.77	10.10
40	16.67	7.09	23.77
60	25.00	15.96	40.96
80	33.33	28.38	61.71
100	41.67	44.35	86.02

? What might be realistic reaction-time distances, braking distances, and overall stopping distances for speeds of 70 km/h and 120 km/h?

A. What type of function best models the reaction-time distances for the given speeds? Explain how you know.

B. Sketch a graph and determine an equation for the type of function you chose in part A, using the data in the table.

C. What type of function best models the braking distances for the given speeds? Explain how you know.

D. Sketch a graph and determine an equation for the type of function you chose in part C, using the data in the table.

E. Do any of the three distances in the table increase at a constant rate? Explain.

F. What other factors, in addition to the speed of the vehicle, may affect the overall stopping distance?

G. Use the graphs and equations you found to predict the reaction times, braking distances, and overall stopping distances, in metres, for speeds of 70 km/h and 120 km/h.