LESSON MAKER PRO

# Closing In

*Estimate what a function approaches.*

**HIGH SCHOOL · C.N.1**

**C.N.1** "Estimate limits from graphs or tables."

NAME _____ DATE _____

## LOOK NEARBY

To estimate a limit, follow the y-values as x gets closer to the target from both sides. If both sides approach the same number, that number is the limit. The value at the target does not have to match the limit.

## WORKED EXAMPLE

Use the table to estimate the limit of f(x) as x approaches 12.

| x | f(x) |
|---|---|
| 11.9 | 17.9 |
| 11.99 | 17.99 |
| 12.01 | 18.01 |
| 12.1 | 18.1 |

1. From the left, f(x) moves toward 18.
2. From the right, f(x) moves toward 18.
3. Both sides approach the same number.

**Answer: 18**

## PRACTICE 4 problems

**1** As x approaches 5, use these (x, f(x)) pairs to estimate the limit: (4.9, 10.9), (4.99, 10.99), (5.01, 11.01).

**ANSWER** _____

**2** As x approaches 1, use these (x, f(x)) pairs to estimate the limit: (0.9, 9.1), (0.99, 9.01), (1.01, 8.99).

**ANSWER** _____

**3** As x approaches -3, use these (x, f(x)) pairs to estimate the limit: (-3.1, 6.1), (-3.01, 6.01), (-2.99, 5.99).

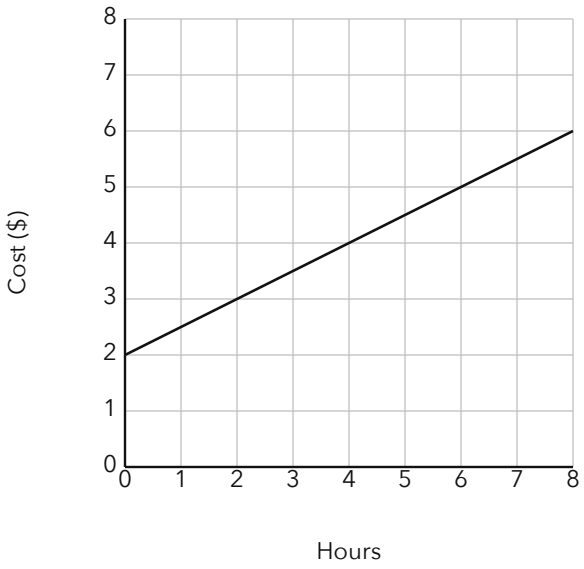
**ANSWER** _____

**4** As x approaches 4, use these (x, f(x)) pairs. Does the limit exist? Why? (3.9, 1.1), (3.99, 1.01), (4.01, 5.01), (4.1, 5.1).

**ANSWER** _____

## APPLY IT Show your work

**1** The graph shows a gaming cafe's cost. Estimate the cost as time approaches 4 hours.




**ANSWER** _____

**2** A phone's battery level drops while a video plays. Use the table to estimate the battery percentage as time approaches 30 minutes.

| Minutes | Battery (%) |
|---|---|
| 29 | 71 |
| 29.9 | 70.1 |
| 30.1 | 69.9 |
| 31 | 69 |

**ANSWER** _____

## CHALLENGE One step up

Estimate the limit of f(x) as x approaches 7. How does it compare with f(7)? Explain.

| x | f(x) |
|---|---|
| 6.9 | 2.9 |
| 6.99 | 2.99 |
| 7 | 10 |
| 7.01 | 3.01 |
| 7.1 | 3.1 |

WORK SPACE AND ANSWER

# Closing In



## PART 1 · PRACTICE

| # | PROBLEM | ANSWER |
|---|---|---|
| 1 | As x approaches 5, use these (x, f(x)) pairs to estimate the limit: (4.9, 10.9), (4.99, 10.99), (5.01, 11.01). | **11** |
| 2 | As x approaches 1, use these (x, f(x)) pairs to estimate the limit: (0.9, 9.1), (0.99, 9.01), (1.01, 8.99). | **9** |
| 3 | As x approaches -3, use these (x, f(x)) pairs to estimate the limit: (-3.1, 6.1), (-3.01, 6.01), (-2.99, 5.99). | **6** |
| 4 | As x approaches 4, use these (x, f(x)) pairs. Does the limit exist? Why? (3.9, 1.1), (3.99, 1.01), (4.01, 5.01), (4.1, 5.1). | **No. The left side approaches 1, but the right side approaches 5.** |

## PART 2 · APPLY IT

1. **$4** Read the graph near 4 hours. The cost approaches $4 from both sides.
2. **70%** The battery percentages approach 70% as time gets closer to 30 minutes from either side.

## CHALLENGE

**The limit is 3, but f(7) = 10. Values on both sides approach 3, even though the value at 7 is 10.**

Accept equivalent wording for the explanations. In problem 4, both one-sided values must be identified to justify why the limit does not exist.