

# Feature Detectives

Read key features from functions, tables, and contexts.

HIGH SCHOOL • HSF-IF.B.4

**CCSS.Math.Content.HSF-IF.B.4** "For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship..."

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## READ THE FEATURES

Use x-values to name where a function rises, falls, is positive, or is negative. Intercepts occur where the output is 0, and a highest or lowest point is a relative maximum or minimum.

## WORKED EXAMPLE

For  $g(x) = |x-19|-28$ , find the minimum, the line of symmetry, and the x-intercepts.

1. The vertex is  $(19, -28)$ , so the minimum is  $-28$ .
2. The graph is symmetric about  $x=19$ .
3. Set the output to 0:  $|x-19|-28=0$ .
4. Solve  $|x-19|=28$ :  $x=-9$  or  $x=47$ .

**Answer: Minimum:  $-28$  at  $x=19$ . Line of symmetry:  $x=19$ . x-intercepts:  $(-9, 0)$  and  $(47, 0)$ .**

## PRACTICE 5 problems

- 1** For  $f(x) = (x+1)(x-6)$ , state the x-intercepts and y-intercept.

ANSWER \_\_\_\_\_

- 2** For  $p(x) = -(x-4)^2 + 8$ , state the relative maximum and where p is increasing and decreasing.

ANSWER \_\_\_\_\_

- 3** For  $q(x) = (x+3)(x-5)$ , state where q is positive and where q is negative.

ANSWER \_\_\_\_\_

- 4** For  $r(x) = -x^4 + 1$ , state the end behavior and the symmetry.

ANSWER \_\_\_\_\_

- 5** A function s repeats every 12 units. If  $s(2) = -4$ , find  $s(26)$ .

ANSWER \_\_\_\_\_

## APPLY IT Show your work

- 1** A basketball's height  $h$ , in feet,  $t$  seconds after a shot is  $h=-(t-1)^2+4$  for  $0 \leq t \leq 3$ . When is the ball rising and falling? What does the maximum mean?

WORK SPACE

ANSWER \_\_\_\_\_

- 2** A video's likes  $L$ , in hundreds, are shown below. Time  $t$  is in hours:  $t$ : 0, 1, 2, 3, 4;  $L$ : 1, 5, 8, 5, 1. When are likes increasing and decreasing? What is the maximum number of likes?

WORK SPACE

ANSWER \_\_\_\_\_

## CHALLENGE One step up

### CHALLENGE

A graph has only  $x$ -intercepts  $(-4,0)$  and  $(2,0)$ , is positive for  $x < -4$  and  $x > 2$ , and has  $y$ -intercept  $(0,-8)$ . Could it be symmetric about the  $y$ -axis? Explain.

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## PART 1 • PRACTICE

| # | PROBLEM                                                                                      | ANSWER                                                                                                                                         |
|---|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | For $f(x)=(x+1)(x-6)$ , state the x-intercepts and y-intercept.                              | <b>x-intercepts: (-1,0) and (6,0). y-intercept: (0,-6).</b>                                                                                    |
| 2 | For $p(x)=-(x-4)^2+8$ , state the relative maximum and where p is increasing and decreasing. | <b>Relative maximum: (4,8). Increasing on <math>x&lt;4</math>. Decreasing on <math>x&gt;4</math>.</b>                                          |
| 3 | For $q(x)=(x+3)(x-5)$ , state where q is positive and where q is negative.                   | <b>Positive for <math>x&lt;-3</math> and <math>x&gt;5</math>. Negative for <math>-3&lt;x&lt;5</math>.</b>                                      |
| 4 | For $r(x)=-x^4+1$ , state the end behavior and the symmetry.                                 | <b>As x approaches positive or negative infinity, <math>r(x)</math> approaches negative infinity. The graph is symmetric about the y-axis.</b> |
| 5 | A function s repeats every 12 units. If $s(2)=-4$ , find $s(26)$ .                           | <b><math>s(26)=-4</math>.</b>                                                                                                                  |

## PART 2 • APPLY IT

- The ball is rising from 0 to 1 second and falling from 1 to 3 seconds. Its maximum height is 4 feet at 1 second.** The vertex is (1,4). The parabola rises to the vertex, then falls.
- Likes are increasing from 0 to 2 hours and decreasing from 2 to 4 hours. The maximum is 800 likes at 2 hours.** Read the values across the table. The largest output is 8 hundreds when  $t=2$ .

## CHALLENGE

**No. Y-axis symmetry would require the reflection of (-4,0), which is (4,0), to also be an x-intercept. The graph has only the two listed x-intercepts.**

Accept interval notation or equivalent inequality wording for increasing, decreasing, positive, and negative intervals. For the basketball context, accept inclusive endpoint wording based on the stated time domain.