The graph of a function is the set of ordered pairs**,** in the coordinate plane, such that is the domain of .

 the directed distance from the -axis the directed distance from the -axis

You can use the graph to estimate function values.

**Sample Problem 1: Use a graph of each function to estimate the indicated function values.** **Then find the values algebraically.**

|  |  |  |
| --- | --- | --- |
| **a.**  |  |  |
| **b.**  |  |  |

**Identifying Intercepts from a Functions Graph**

A point where the graph intersects or meets the or axis is called **an intercept.**

An -intercept occurs where . A -intercept occurs where .

**Sample Problem 2**: Use the graph of each function to approximate its –intercept. Then find the –intercept algebraically.

|  |  |  |  |
| --- | --- | --- | --- |
| **a.**  |  | **b.** |  |
|  |  -intercept occurs where . |  |  -intercept occurs where . |

**Zeros of a Function**

The zeros of function are –values for which

If the graph of a function of has an -intercept at then is a zero of the function.

To find the zeros of a function, set the function equal to zero and solve for the independent variable.

**Sample Problem 3**: **Use the graph of each function to approximate its zeros. Then find the zeros of each function algebraically.**

|  |  |  |  |
| --- | --- | --- | --- |
| **a.** |  | **b.** |  |
|  |  |  |  |
|  |  |  |  |

**Symmetry of Graphs**

There are two possible types of symmetry that graphs of functions can have.

1. **Line symmetry** - graphs can be folded along a line so that the two halves match exactly.

2. **Point symmetry** - graphs can be rotated 180° with respect to a point and appear unchanged.

**Tests for Symmetry**

|  |  |
| --- | --- |
| **Graphical Test** | **Algebraic Test** |
| The graph of a relation is symmetric with respect to the -axis if and only if for every point (, on the graph, the point (, is also on the graph. | Replacing with - produces an equivalent equation. |
| The graph of a relation is symmetric with respect to the -axis if and only if for every point (on the graph, the point (is also on the graph. | Replacing with - produces an equivalent equation. |
| The graph of a relation is symmetric with respect to the origin if and only if for every point ( on the graph, the point (is also on the graph. | Replacing with - and with - produces an equivalent equation. |

**Sample Problem 4**: **Use the graph of each equation to test for symmetry with respect to the -axis, -axis, and the origin.** **Support the answer numerically. Then confirm algebraically.**

|  |  |
| --- | --- |
| **a.** |  |
|  |  | **Graphically****The graph appears to be symmetric with respect to the origin****because for every point** ( **on the graph, there is a point**(**Support Numerically****There is a table of values to support this conjecture.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

**Algebraically****Because is equivalent to , the graph is symmetric with respect to the origin.** |
| **b.** |  |
|  |  | **Graphically****The graph appears to be symmetric with**  respect to the -axis**because for every point** ( **on the graph, there is a point**(**Support Numerically****There is a table of values to support this conjecture.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Algebraically****Because is equivalent to , the graph is symmetric with respect** to the -axis**.** |

**Identify Even and Odd Functions**

If then the function is even, and symmetric to the y-axis.

If then the function is odd, and symmetric to the origin.

**Sample Problem 5**: **Determine whether the following are even, odd, or neither.**

|  |  |  |
| --- | --- | --- |
| **a.** |  |  **The function is even.** |
| **b.** |  |  **The function is odd.** |
| **c.** |  | **The function is neither.** |