

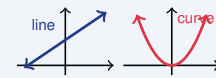
# Linear and Nonlinear Functions

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 18

## Quick Review and Helpful Hints

A *linear* function has a constant rate of change and graphs as a straight line; its equation looks like  $y = mx + b$  (the variable is only to the first power). A *nonlinear* function (like  $y = x^2$  or  $y = \frac{1}{x}$ ) curves and changes its rate.

▶ **Example:** Is  $y = 3x - 2$  linear or nonlinear? **Work:** The variable  $x$  is to the first power and the form is  $y = mx + b$ , so the graph is a straight line.  
 ★ **Answer:** Linear



Linear = line; nonlinear = curve.

### Practice Problems

Tell whether each function is Linear or Nonlinear.

- |                           |       |   |       |
|---------------------------|-------|---|-------|
| 1. $y = 2x + 1$           | _____ | 8. $y = 2^x$                            | _____ |
| 2. $y = x^2$              | _____ | 9. $y = 7 - x$                          | _____ |
| 3. $y = -4x$              | _____ | 10. $y = \sqrt{x}$                      | _____ |
| 4. $y = x^3 + 1$          | _____ | 11. Table $y: 2, 4, 6, 8$ (equal steps) | _____ |
| 5. $y = 5$                | _____ | 12. Table $y: 1, 4, 9, 16$              | _____ |
| 6. $y = \frac{1}{x}$      | _____ | 13. $y = x^2 - 2x$                      | _____ |
| 7. $y = \frac{1}{2}x - 3$ | _____ | 14. $y = -x + 6$                        | _____ |

### Word Problems

15. A car travels at a constant 60 mph. Is distance vs. time linear or nonlinear? \_\_\_\_\_
16. A population doubles every year. Is that growth linear or nonlinear? \_\_\_\_\_
17. A function in the form  $y = mx + b$  always graphs as what kind of shape? \_\_\_\_\_
18. The graph of  $y = x^2$  is a curve. What is that curve called? \_\_\_\_\_



## Answer Keys

- |              |               |                   |
|--------------|---------------|-------------------|
| 1. Linear    | 7. Linear     | 13. Nonlinear     |
| 2. Nonlinear | 8. Nonlinear  | 14. Linear        |
| 3. Linear    | 9. Linear     | 15. Linear        |
| 4. Nonlinear | 10. Nonlinear | 16. Nonlinear     |
| 5. Linear    | 11. Linear    | 17. straight line |
| 6. Nonlinear | 12. Nonlinear | 18. parabola      |

### Step-by-Step Explanations

1. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Form  $y = mx + b$ , first power: linear. So the final answer is Linear.
2. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $x$  is squared: nonlinear. So the final answer is Nonlinear.
3. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $y = -4x$  fits  $y = mx + b$ : linear. So the final answer is Linear.
4. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $x$  is cubed: nonlinear. So the final answer is Nonlinear.
5. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is A constant gives a flat line: linear. So the final answer is Linear.
6. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $x$  is in the denominator: nonlinear. So the final answer is Nonlinear.
7. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is First power,  $y = mx + b$  form: linear. So the final answer is Linear.
8. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $x$  is an exponent: nonlinear. So the final answer is Nonlinear.
9. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $y = 7 - x$  is  $y = -x + 7$ : linear. So the final answer is Linear.
10. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is A square root curves: nonlinear. So the final answer is Nonlinear.
11. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Equal steps mean a constant rate: linear. So the final answer is Linear.
12. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Differences 3, 5, 7 change: nonlinear. So the final answer is Nonlinear.
13. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Contains  $x^2$ : nonlinear. So the final answer is Nonlinear.
14. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Fits  $y = mx + b$ : linear. So the final answer is Linear.
15. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Constant speed gives a straight line: linear. So the final answer is Linear.
16. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Doubling is exponential: nonlinear. So the final answer is Nonlinear.
17. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $y = mx + b$  graphs as a straight line. So the final answer is straight line.
18. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $y = x^2$  graphs as a parabola. So the final answer is parabola.



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