**Worksheet B:** (Topic 1.3) ROC in Linear and Quadratic Functions        Name: Solutions
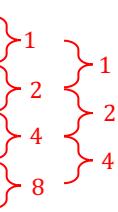
**Directions:** For 1 – 6, selected values for several functions are given in the tables below. For each table of values, determine if the function could be linear, quadratic, or neither.
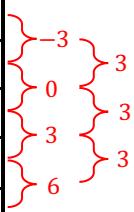
1.

| $x$ | $f(x)$ |
|---|---|
| 1 | 1 |
| 4 | 2 |
| 7 | 4 |
| 10 | 8 |
| 13 | 16 |

Neither because the second differences of $f$ are not constant.

2.
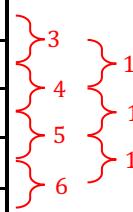
| $x$ | $g(x)$ |
|---|---|
| 1 | $-2$ |
| 2 | $-5$ |
| 3 | $-5$ |
| 4 | $-2$ |
| 5 | 4 |

Quadratic because the second differences of $g$ are constant.

3.
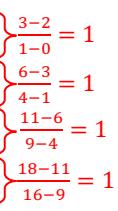
| $x$ | $h(x)$ |
|---|---|
| 0 | 0 |
| 2 | 3 |
| 4 | 7 |
| 6 | 12 |
| 8 | 18 |

Quadratic because the second differences of $h$ are constant.

4.

| $x$ | $k(x)$ |
|---|---|
| 0 | 2 |
| 1 | 3 |
| 4 | 6 |
| 9 | 11 |
| 16 | 18 |

$\frac{3-2}{1-0} = 1$

$\frac{6-3}{4-1} = 1$

$\frac{11-6}{9-4} = 1$

$\frac{18-11}{16-9} = 1$
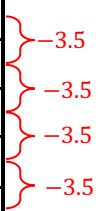
Linear because these average rates of change of $k$ are constant.

5.
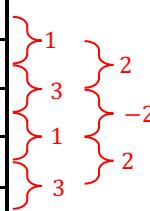
| $x$ | $m(x)$ |
|---|---|
| 1.2 | 12.5 |
| 1.6 | 9 |
| 2.0 | 5.5 |
| 2.4 | 2 |
| 2.8 | $-1.5$ |

Linear because the first differences of $m$ are constant.

6.

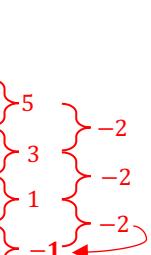| $r$ | $k(r)$ |
|---|---|
| 1 | 2 |
| 3 | 3 |
| 5 | 6 |
| 7 | 7 |
| 9 | 10 |

Neither because the second differences of $k$ are not constant.

**Directions:** For 7 – 9, the tables below give values of several quadratic functions at selected values of $x$. For each function, find the value of the constant $k$ in the table.

7.

| $x$ | $p(x)$ |
|---|---|
| 0 | 0 |
| 2 | 5 |
| 4 | 8 |
| 6 | 9 |
| 8 | $k$ |

Quadratic then the second differences of $p$ are constant. $k = 8$

8.
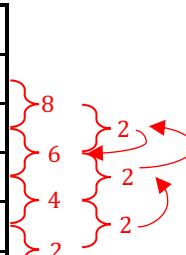
| $x$ | $m(x)$ |
|---|---|
| 1 | 4 |
| 5 | $-1$ |
| 9 | $-4$ |
| 13 | $k$ |
| 17 | $-4$ |

Quadratic then the second differences of $m$ are constant. $k = -5$

9.

| $x$ | $f(x)$ |
|---|---|
| 2.1 | $-2$ |
| 2.5 | $k$ |
| 2.9 | 12 |
| 3.3 | 16 |
| 3.7 | 18 |

Quadratic then the second differences of $f$ are constant. $k = 6$

**Worksheet B:** Topic 1.3        ROC in Linear and Quadratic Functions        Created by Bryan Passwater
Solutions by Ted Gott tedg20776@gmail.com

**Directions:** For 10 – 12, the tables below give values of several linear functions at selected values of $x$. For each function, find the value of the constant $k$ in the table.
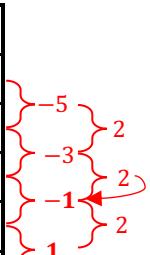
10.

| $x$ | $g(x)$ |
|---|---|
| 1 | $-5$ |
| 3 | $-1$ |
| 5 | $k$ |
| 7 | 7 |

4
4
4

Linear then the first differences of $g$ are constant. $k = 3$

11.

| $x$ | $h(x)$ |
|---|---|
| 0 | 7 |
| 1 | 5 |
| 2 | $k$ |
| 3 | 1 |

$-2$
$-2$
$-2$

Linear then the first differences of $h$ are constant. $k = 3$

12.

| $x$ | $j(x)$ |
|---|---|
| 0 | 1 |
| 2 | $k$ |
| 5 | 16 |
| 7 | 22 |

$\frac{k-1}{2-0} = \frac{k-1}{2}$

$\frac{16-k}{5-2} = \frac{16-k}{3}$

$\frac{22-16}{7-5} = \frac{6}{2} = 3$

Linear then average rates of change of $j$ are constant.

$\frac{k-1}{2} = 3 \Rightarrow k - 1 = 6$

$k = 7$

**Directions:** For 13 – 18, selected values for several functions are shown below. The graph of each function is known to be concave up or concave down. For each problem, use the data in the tables to determine if the given function is concave up or concave down.

13.

| $x$ | $f(x)$ |
|---|---|
| 2 | 1 |
| 2.5 | 3 |
| 3 | 6 |
| 3.5 | 13 |
| 4 | 23 |

$\frac{3-1}{2.5-2} = \frac{2}{0.5} = 4$

$\frac{6-3}{3-2.5} = \frac{3}{0.5} = 6$

$\frac{13-6}{3.5-3} = \frac{7}{0.5} = 14$

$\frac{23-13}{4-3.5} = \frac{10}{0.5} = 20$

concave up because these average rates of change of $f$ are increasing.

14.

| $t$ | $g(t)$ |
|---|---|
| $-4$ | 0 |
| 0 | 8 |
| 4 | 13 |
| 8 | 15 |
| 12 | 16 |

$\frac{8-0}{0-(-4)} = \frac{8}{4} = 2$

$\frac{13-8}{4-0} = \frac{5}{4}$

$\frac{15-13}{8-4} = \frac{2}{4}$

$\frac{16-15}{12-8} = \frac{1}{4}$

concave down because these average rates of change of $g$ are decreasing.

15.

| $x$ | $h(x)$ |
|---|---|
| 0 | 5 |
| 1 | 11 |
| 2 | 14 |
| 3 | 15 |
| 4 | 12 |

$\frac{11-5}{1-0} = 6$

$\frac{14-11}{1} = 3$

$\frac{15-14}{1} = 1$

$\frac{12-15}{1} = -3$

concave down because these average rates of change of $h$ are decreasing.

16.

| $x$ | $k(x)$ |
|---|---|
| 1 | 0 |
| 2 | $-6$ |
| 3 | $-10$ |
| 4 | $-11$ |
| 5 | $-11$ |

$\frac{-6-0}{1} = -6$

$\frac{-10-(-6)}{1} = -4$

$\frac{-11-(-10)}{1} = -1$

$\frac{-11-(-11)}{1} = 0$

concave up because these average rates of change of $k$ are increasing.

17.

| $x$ | $p(x)$ |
|---|---|
| 11 | 18 |
| 15 | 10 |
| 19 | 5 |
| 23 | 3 |
| 27 | 2 |

$\frac{10-18}{15-11} = \frac{-8}{4}$

$\frac{5-10}{19-15} = \frac{-5}{4}$

$\frac{3-5}{23-19} = \frac{-2}{4}$

$\frac{2-3}{27-23} = \frac{-1}{4}$

concave up because these average rates of change of $p$ are increasing.

18.

| $t$ | $j(t)$ |
|---|---|
| 2 | 22 |
| 2.3 | 20 |
| 2.6 | 15 |
| 2.9 | 8 |
| 3.2 | 0 |

$\frac{20-22}{2.3-2} = \frac{-2}{0.3}$

$\frac{15-20}{0.3} = \frac{-5}{0.3}$

$\frac{8-15}{0.3} = \frac{-7}{0.3}$

$\frac{0-8}{0.3} = \frac{-8}{0.3}$

concave down because these average rates of change of $j$ are decreasing.