

2. For  $y = 2x(x + 3)$ ,  $y = (x - 2)^2$ , and  $y = x^2 + 5x + 6$ , the  $y$ -value first decreases and then increases. For the equation  $y = 3x - x^2$  the  $y$ -value first increases and then decreases. In all four equations, the first differences are not constant: for  $y = 2x(x + 3)$ , they increase by 4; for  $y = (x - 2)^2$  and  $y = x^2 + 5x + 6$ , they increase by 2; and for  $y = 3x - x^2$  they decrease by 2.

3. In all four equations, the second differences are constant.

B. 1. a.  $y = x + 2$

$x$	$y$		First Differences		Second Differences
0	2				
1	3	↖	1	↗	0
2	4	↖	1	↗	0
3	5	↖	1	↗	0
4	6	↖	1	↗	0
5	7	↖	1	↗	0

b.  $y = 2x$

$x$	$y$		First Differences		Second Differences
0	0				
1	2	↖	2	↗	0
2	4	↖	2	↗	0
3	6	↖	2	↗	0
4	8	↖	2	↗	0
5	10	↖	2	↗	0

c.  $y = 2^x$

$x$	$y$		First Differences		Second Differences
0	1				
1	2	↖	1	↗	1
2	4	↖	2	↗	2
3	8	↖	4	↗	4
4	16	↖	8	↗	8
5	32	↖	16	↗	

d.  $y = x^2$

$x$	$y$		First Differences		Second Differences
0	1				
1	2	↖	1	↗	2
2	4	↖	3	↗	2
3	9	↖	5	↗	2
4	16	↖	7	↗	2
5	25	↖	9	↗	2

2. In all the tables, for  $x > 0$ , the  $y$ -value increases as the  $x$  value increases. For  $y = x + 2$  and  $y = 2x$ , the change in the  $y$ -value is constant, which means that the  $y$ -value increases at a constant rate. For  $y = 2^x$  and  $y = x^2$ , the  $y$ -value increases at an increasing rate. The second differences for  $y = x^2$  are constant, while the second differences for  $y = 2^x$  increase exponentially.
3. The equations  $y = x + 2$  and  $y = 2x$  fit the general form of linear equations,  $y = mx + b$ . In the table, the constant first differences tell that the equation is linear. The third equation,  $y = 2^x$ , fits the form of an exponential equation,  $y = b^x$ . Since the variable is in the exponent, the base 2 tells the factor by which the  $y$ -value grows. In the table, the growth factor of 2 shows up in the ratio of consecutive  $y$ -values: each difference is twice the previous difference. In  $y = x^2$ , the exponent is 2 and the base is the variable, so the  $y$ -values are the square numbers. In the table we note that first differences are not constant, but second differences are all 2.

