Name _____ Date _____

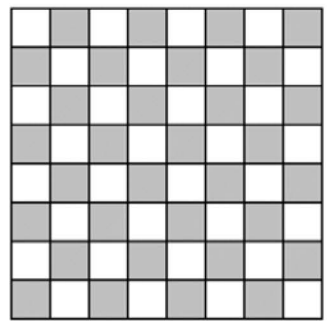
Writing and Evaluating Expressions—Exponents

1. Naomi's allowance is $\$2.00$ per week. If she convinces her parents to double her allowance each week for two months, what will her weekly allowance be at the end of the second month (week 8)?

Week Number	Allowance
1	$\$2.00$
2	
3	
4	
5	
6	
7	
8	
w	

2. Write the expression that describes Naomi's allowance during week w in dollars.

1. A checkerboard has 64 squares on it.



a. If one grain of rice is put on the first square, 2 grains of rice on the second square, 4 grains of rice on the third square, 8 grains of rice on the fourth square, etc. (doubling each time), complete the table to show how many grains of rice are on each square. Write your answers in exponential form on the table below.

Checkerboard Square	Grains of Rice	Checkerboard Square	Grains of Rice	Checkerboard Square	Grains of Rice	Checkerboard Square	Grains of Rice
1		17		33		49	
2		18		34		50	
3		19		35		51	
4		20		36		52	
5		21		37		53	
6		22		38		54	
7		23		39		55	
8		24		40		56	
9		25		41		57	
10		26		42		58	
11		27		43		59	
12		28		44		60	
13		29		45		61	
14		30		46		62	
15		31		47		63	
16		32		48		64	

b. How many grains of rice would be on the last square? Represent your answer in exponential form and standard form. Use the table above to help solve the problem.

c. Would it have been easier to write your answer to part (b) in exponential form or standard form?

2. If an amount of money is invested at an annual interest rate of 6%, it doubles every 12 years. If Alejandra invests $500, how long will it take for her investment to reach $2,000 (assuming she doesn't contribute any additional funds)?

3. The athletics director at Peter's school has created a phone tree that is used to notify team players in the event a game has to be canceled or rescheduled. The phone tree is initiated when the director calls two captains. During the second stage of the phone tree, the captains each call two players. During the third stage of the phone tree, these players each call two other players. The phone tree continues until all players have been notified. If there are 50 players on the teams, how many stages will it take to notify all of the players?

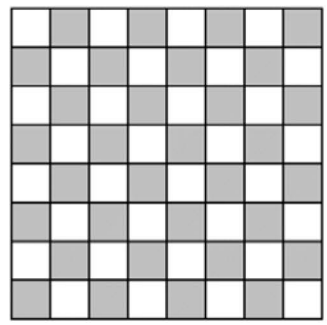
1. Naomi's allowance is $\$2.00$ per week. If she convinces her parents to double her allowance each week for two months, what will her weekly allowance be at the end of the second month (week 8)?

Week Number	Allowance
1	$\$2.00$
2	$\$4.00$
3	$\$8.00$
4	$\$16.00$
5	$\$32.00$
6	$\$64.00$
7	$\$128.00$
8	$\$256.00$
w	$\$2^w$

2. Write the expression that describes Naomi's allowance during week w in dollars.

   $\$2^w$

1. A checkerboard has 64 squares on it.



a. If one grain of rice is put on the first square, 2 grains of rice on the second square, 4 grains of rice on the third square, 8 grains of rice on the fourth square, etc. (doubling each time), complete the table to show how many grains of rice are on each square. Write you answers in exponential form on the table below.

Checkerboard Square	Grains of Rice	Checkerboard Square	Grains of Rice	Checkerboard Square	Grains of Rice	Checkerboard Square	Grains of Rice
1	2^0	17	2^{16}	33	2^{32}	49	2^{48}
2	2^1	18	2^{17}	34	2^{33}	50	2^{49}
3	2^2	19	2^{18}	35	2^{34}	51	2^{50}
4	2^3	20	2^{19}	36	2^{35}	52	2^{51}
5	2^4	21	2^{20}	37	2^{36}	53	2^{52}
6	2^5	22	2^{21}	38	2^{37}	54	2^{53}
7	2^6	23	2^{22}	39	2^{38}	55	2^{54}
8	2^7	24	2^{23}	40	2^{39}	56	2^{55}
9	2^8	25	2^{24}	41	2^{40}	57	2^{56}
10	2^9	26	2^{25}	42	2^{41}	58	2^{57}
11	2^{10}	27	2^{26}	43	2^{42}	59	2^{58}
12	2^{11}	28	2^{27}	44	2^{43}	60	2^{59}
13	2^{12}	29	2^{28}	45	2^{44}	61	2^{60}
14	2^{13}	30	2^{29}	46	2^{45}	62	2^{61}
15	2^{14}	31	2^{30}	47	2^{46}	63	2^{62}
16	2^{15}	32	2^{31}	48	2^{47}	64	2^{63}

b. How many grains of rice would be on the last square? Represent your answer in exponential form and standard form. Use the table above to help solve the problem.

There would be $2^{63} = 9,223,372,036,854,775,808$ grains of rice.

c. Would it have been easier to write your answer to part (b) in exponential form or standard form?

Answers will vary. Exponential form is more concise: 2^{63}. Standard form is longer and more complicated to calculate: $9,223,372,036,854,775,808$. (In word form: nine quintillion, two hundred twenty-three quadrillion, three hundred seventy-two trillion, thirty-six billion, eight hundred fifty-four million, seven hundred seventy-five thousand, eight hundred eight.)

2. If an amount of money is invested at an annual interest rate of 6%, it doubles every 12 years. If Alejandra invests $\$500$, how long will it take for her investment to reach $\$2,000$ (assuming she does not contribute any additional funds)?

   It will take 24 years. After 12 years, Alejandra will have doubled her money and will have $\$1,000$. If she waits an additional 12 years, she will have $\$2,000$.

3. The athletics director at Peter's school has created a phone tree that is used to notify team players in the event a game has to be canceled or rescheduled. The phone tree is initiated when the director calls two captains. During the second stage of the phone tree, the captains each call two players. During the third stage of the phone tree, these players each call two other players. The phone tree continues until all players have been notified. If there are 50 players on the teams, how many stages will it take to notify all of the players?

   It will take five stages. After the first stage, two players have been called, and 48 will not have been called. After the second stage, four more players will have been called, for a total of six; 44 players will remain uncalled. After the third stage, 2^3 players (eight) more will have been called, totaling 14; 36 remain uncalled. After the 4^{th} stage, 2^4 more players (16) will have gotten a call, for a total of 30 players notified. Twenty remain uncalled at this stage. The fifth round of calls will cover all of them because 2^5 includes 32 more players.