

# Exponential Growth and Decay Notes

**Sample Problem 1:** Solve problems involving exponential growth and decay.

1. A certain cell splits into 2 after every hour. How many cells will be there after four hours if there are 17 cells at the start?

Solution:

A.

Time	Calculation	Number of cell N
0	-	17
1	$17(2)$	34
2	$34(2)$	68
3	$68(2)$	136
4	$136(2)$	272

B.

Time	Equation	Number of cell N
0	$17(2)^0$	17
1	$17(2)^1$	34
2	$17(2)^2$	68
3	$17(2)^3$	136
4	$17(2)^4$	272
n	$17(2)^t$	$N_t$

C. From the solution above, the number of cell N, after t hours can be expressed using the equation  $N_t = N_0(2)^t$

$$N_0 = 17$$

$$t = 4$$

$$N_4 = 17(2)^4 = 272$$

# Exponential Growth and Decay Notes

2. Suppose that a TV set depreciate 10% in value each year for the first five years. What is it worth after five years if its original cost was \$1300?

A.

Time	Calculation	Amount
0	-	1300
1	$1300 - (1300 \times 0.1)$	1170
2	$1170 - (1170 \times 0.1)$	1053
3	$1053 - (1053 \times 0.1)$	947.7
4	$947.7 - (947.7 \times 0.1)$	852.93
5	$852.93 - (852.93 \times 0.1)$	767.64

B.

Time	Equation	Amount
0	$1300(1 - 0.1)^0$	1300
1	$1300(1 - 0.1)^1$	1170
2	$1300(1 - 0.1)^2$	1053
3	$1300(1 - 0.1)^3$	947.7
4	$1300(1 - 0.1)^4$	852.93
5	$1300(1 - 0.1)^5$	767.64
n	$1300(1 - 0.1)^t$	$N_t$

C.

Solution:

$N_t = N_0(1 - r)^t$ , Where **N<sub>0</sub>** the original amount **r** is the rate and **t** is the number of years.

$N_0 = 1300$

$r = 10\%$  or  $0.1$

$t = 5$

$$N_5 = 1300(1 - 0.1)^5 = 767.64$$

# Exponential Growth and Decay Notes

3. Lisa deposited \$1000 in a saving account which pays 12% interest compounded annually. How much interest will her money earns in 5 years.

A.

Time	Calculation	Amount
0	-	1000
1	$1000 + (1000 \times 0.12)$	1120
2	$1120 + (1120 \times 0.12)$	1254.4
3	$1254.4 + (1254.4 \times 0.12)$	1404.9
4	$1404.9 + (1404.9 \times 0.12)$	1573.52
5	$1573.52 + (1573.52 \times 0.12)$	1762.34

B.

Time	Equation	Amount
0	$1000(1 + 0.12)^0$	1000
1	$1000(1 + 0.12)^1$	1120
2	$1000(1 + 0.12)^2$	1254.4
3	$1000(1 + 0.12)^3$	1404.9
4	$1000(1 + 0.12)^4$	1573.52
5	$1000(1 + 0.12)^5$	1762.34
t	$1000(1 + 0.12)^t$	$N_t$

Solution:

$N_t = N_0(1 + r)^t$ , where  $N_0$  is the original amount,  $r$  is the rate and  $t$  is the number of years.

$N_0 = \$1000$

$r = 12\%$  or  $0.12$

$t = 5$

$$N_5 = 1000(1 + 0.12)^5 = 1762.34$$

Note:

Terms	Rate	Time
Annually	$r$	$t$
Semi - Annually	$r/2$	$2t$
Quarterly	$r/4$	$4t$
Monthly	$r/12$	$12t$