

Algebra 1 · Exponential Growth and Decay · Worksheet Answer Key

Common Core F-LE.A.1a, F-LE.A.1c, F-LE.A.2, F-LE.A.3, F-IF.C.8b, F-LE.B.5 · mathovore.fr

Each problem has a complete worked solution with the final answer in bold. Compare your method with the steps shown, especially how a percent rate becomes the factor, and check any rounding in the money problems.

Algebra 1 Common Core: F-LE.A.1a · F-LE.A.1c · F-LE.A.2 · F-LE.A.3 · F-IF.C.8b · F-LE.B.5

Problem 1: Evaluate an exponential function

$$f(0) = 3 \cdot 1 = 3, f(1) = 3 \cdot 2 = 6, f(4) = 3 \cdot 16 = 48.$$

Problem 2: Constant factor

The differences are 5, 10, 20 (not equal). The ratios are $10 \div 5 = 2$, $20 \div 10 = 2$, $40 \div 20 = 2$. The function is **exponential with factor 2**.

x	0	1	2	3
y	5	10	20	40

Each y is multiplied by 2.

Problem 3: Linear or exponential tables

- a. Table B: differences $7 - 4 = 3$, $10 - 7 = 3$, $13 - 10 = 3$. **Linear, difference +3.**
b. Table C: ratios $27 \div 81 = \frac{1}{3}$, $9 \div 27 = \frac{1}{3}$, $3 \div 9 = \frac{1}{3}$. **Exponential, factor $\frac{1}{3}$.**

Problem 4: Identify a and b

- a. $a = 7$, $b = 3$: **growth** ($b > 1$).
b. $a = 250$, $b = 0.9$: **decay** ($0 < b < 1$).
c. $a = 0.5$, $b = 4$: **growth**.

Problem 5: Percent rate from the factor

- a. $1.08 - 1 = 0.08$: **8% growth.**
- b. $1 - 0.95 = 0.05$: **5% decay.**
- c. $1.5 - 1 = 0.5$: **50% growth.**
- d. $1 - 0.6 = 0.4$: **40% decay.**

Problem 6: Factor from the percent rate

- a. $b = 1 + 0.12 = 1.12$
- b. $b = 1 - 0.07 = 0.93$
- c. $b = 1 + 1 = 2$
- d. $b = 1 - 0.35 = 0.65$

Problem 7: Equation from a table

At $x = 0$, $y = 3$, so $a = 3$. The ratio is $15 \div 3 = 5$, so $b = 5$. The function is $y = 3(5)^x$. Check: $3(5)^3 = 3 \cdot 125 = 375$.

x	0	1	2	3
y	3	15	75	375



x5 x5 x5

Each y is multiplied by 5.

Problem 8: Decay from a table

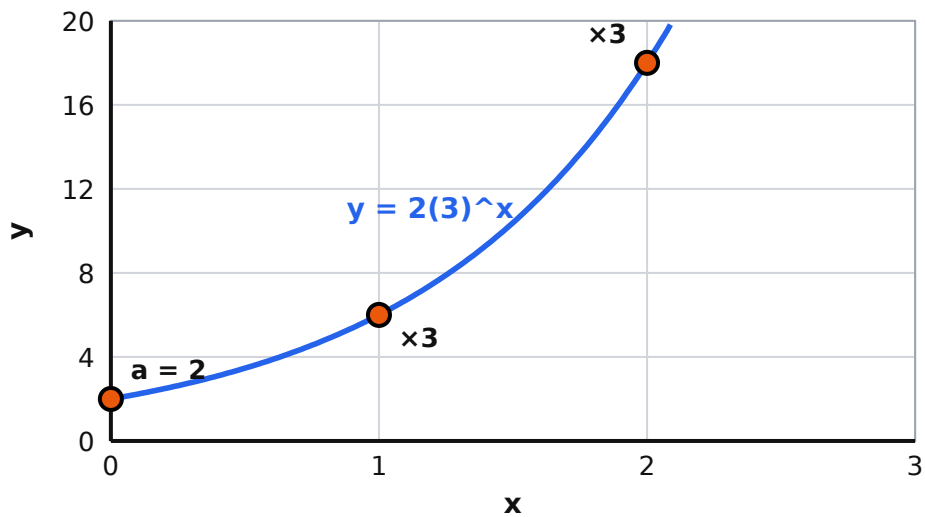
$a = 1000$. $b = 600 \div 1000 = 0.6$. Check: $360 \div 600 = 0.6$ and $216 \div 360 = 0.6$. The function is $y = 1000(0.6)^x$.

Problem 9: Equation from two points

- a. $a = 5$. Then $5b^2 = 45$, so $b^2 = 9$ and $b = 3$ (b is positive). $y = 5(3)^x$.
- b. $a = 96$. Then $96b^3 = 12$, so $b^3 = \frac{1}{8}$ and $b = \frac{1}{2}$. $y = 96\left(\frac{1}{2}\right)^x$.

Problem 10: Equation from a graph

The graph crosses the y -axis at 2, so $a = 2$. From $(0, 2)$ to $(1, 6)$: $6 \div 2 = 3$, so $b = 3$. Check: $2(3)^2 = 18$. The equation is $y = 2(3)^x$.



Starting value 2, factor 3.

Problem 11: Evaluate growth

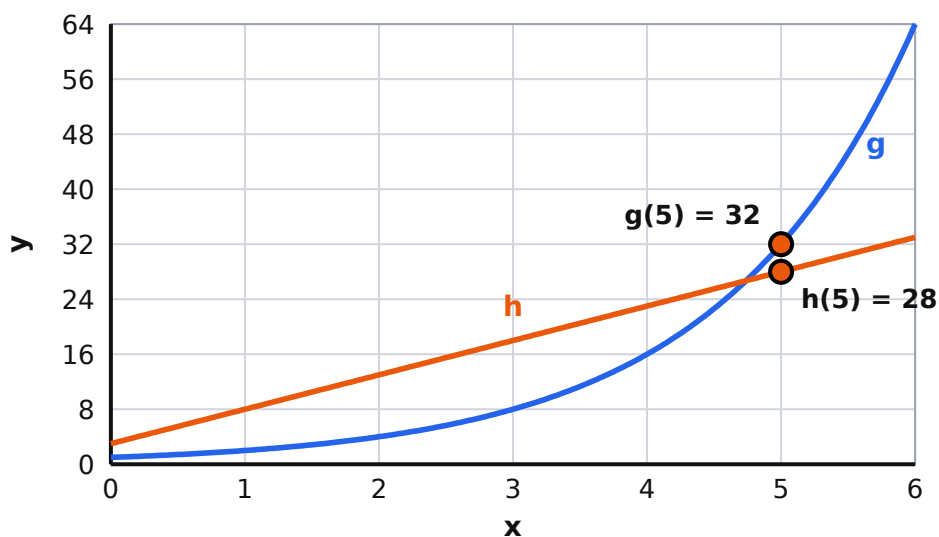
$1.05^3 = 1.157625$. $400 \times 1.157625 = 463.05$. Answer: 463.05.

Problem 12: Evaluate decay

$0.8^4 = 0.4096$. $900 \times 0.4096 = 368.64$. Answer: 368.64.

Problem 13: Exponential versus linear

g : 1, 2, 4, 8, 16, 32. h : 3, 8, 13, 18, 23, 28. The values of g are below h for $x = 0$ to 4 (for example $16 < 23$). At $x = 5$, $32 > 28$. Answer: $x = 5$.



At $x = 5$ the exponential is first above the line.

Problem 14: Interpret the parameters

12,000 is the population in 2020 ($t=0$). The factor 0.97 means the population is 97% of the previous year, a **3% decrease each year**. For 2023, $t=3$:
 $12000(0.97)^3 = 12000 \times 0.912673 = 10952.076 \approx 10,952$ people.

Problem 15: Compound interest, yearly

$A = 2000(1.03)^4$. $1.03^4 = 1.12550881$. $A = 2000 \times 1.12550881 \approx \$2,251.02$.

Problem 16: Compounding twice a year

Yearly: $1000(1.06)^2 = \$1,123.60$. Twice a year: $r/n = 0.03$ and $nt = 4$, so $1000(1.03)^4 = \$1,125.51$.
Difference: $1125.51 - 1123.60 = \$1.91$.

Problem 17: Equivalent forms of an exponential

- a. $12t$ counts months and the factor per month is 1.01: **1% per month**.
- b. $1.01^{12} \approx 1.1268$, so the yearly factor is about **1.1268**, a yearly rate of about **12.7%**.
- c. $300(1.01)^{24} = 300 \times 1.2697 \approx \$380.92$.

Problem 18: Half-life model

$t=20$: $80(0.5)^2 = 80 \text{ times } 0.25 = 20 \text{ extg}$. $t=30$: $80(0.5)^3 = 80 \text{ times } 0.125 = 10 \text{ extg}$. Every 10 years the amount is cut in half, so the half-life is **10 years**.

Problem 19: Video views

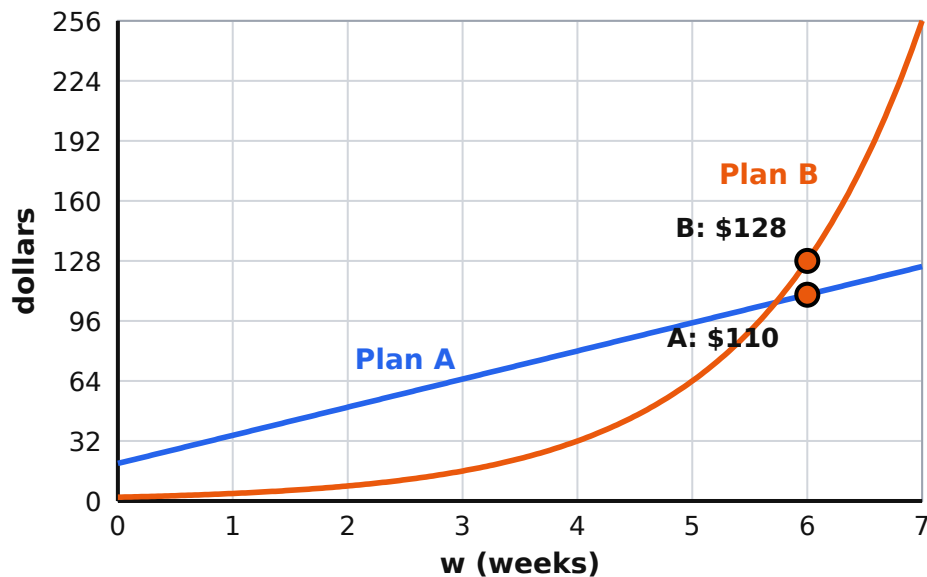
$a=150$ and $b=2$, so $V(d) = 150(2)^d$. $V(7) = 150 \times 128 = 19,200$ views.

Problem 20: Car depreciation

$b=1-0.15=0.85$, so $V(t) = 24000(0.85)^t$. $0.85^3 = 0.614125$. $V(3) = 24000 \times 0.614125 = \$14,739$.

Problem 21: Two savings plans

A: 20, 35, 50, 65, 80, 95, 110, 125. B: 2, 4, 8, 16, 32, 64, 128, 256 for $w=0$ to 7. At $w=5$, $95 > 64$. At $w=6$, $128 > 110$. Plan B first has more in **week 6**, and it stays ahead.



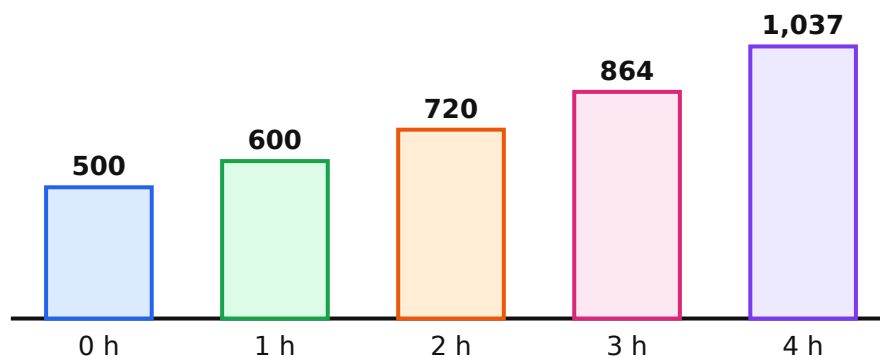
At week 6, Plan B passes Plan A.

Problem 22: Medicine in the body

$b = 0.88$, so $M(h) = 200(0.88)^h$. $M(3) = 200 \times 0.681472 \approx 136.29$ mg. Table:
 $M(4) \approx 119.94$, $M(5) \approx 105.55$, $M(6) \approx 92.88$. Since $105.55 > 100 > 92.88$, the first hour is **hour 6**.

Problem 23: Growing cell culture

$N(t) = 500(1.2)^t$. $N(3) = 1000 > 864$ and $N(4) = 500 \times 2.0736 = 1036.8 > 1000$, so the first hour is **hour 4**. $N(5) = 500 \times 2.48832 = 1244.16 \approx 1,244$ cells.



Cell count by hour.

Problem 24: Interest: simple versus compound

Priya: $P(t) = 800(1.05)^t$. Diego: $D(t) = 800 + 40t$. After 10 years, $P(10) = 800 \times 1.628895 \approx \$1,303.12$ and $D(10) = 800 + 400 = \$1,200$. Priya has **\$103.12 more**. They tie after 1 year (\$840), then the exponential pulls ahead.