

Algebra 2 · Exponential Functions and the Number e · Test Answer Key

Common Core F-IF.C.8b, F-LE.A.4, F-LE.B.5 · mathovore.fr

Worked solutions with a scoring guide for every question. Accept answers that differ in the last decimal because of rounding, award partial credit for a correct setup with an arithmetic slip, and total the score out of 20 points.

Algebra 2 Common Core: F-IF.C.8b · F-LE.A.4 · F-LE.B.5

Question 1: Growth model (2 points)

- a. Initial population **18,000**; growth **4.5% per year**.
- b. $P(8) = 18000(1.045)^8 \approx \mathbf{25,598}$.

Scoring: 1 point for each part.

Question 2: Compound interest (2 points)

- a. $A = 2400\left(1 + \frac{0.032}{12}\right)^{60}$.
- b. The balance is **\$2,815.83**.

Scoring: 1 point for the correct formula with $n = 12$ and $nt = 60$; 1 point for the correct balance.

Question 3: Continuous versus yearly (2 points)

- a. $A = 1800e^{0.045 \cdot 12} = 1800e^{0.54} \approx \mathbf{\$3,088.81}$.
- b. $A = 1800(1.045)^{12} \approx \mathbf{\$3,052.59}$, which is **\$36.23** less (using unrounded values).

Scoring: 1 point for each balance method with the matching difference in part (b).

Question 4: Model from a graph (3 points)

- a. $a = f(0) = 5$ and $b = \frac{15}{5} = 3$. Check: $\frac{45}{15} = 3$.
- b. $f(x) = 5 \cdot 3^x$.
- c. $f(4) = 5 \cdot 81 = \mathbf{405}$.



$f(x) = 5 \cdot 3^x$, with $f(4) = 405$.

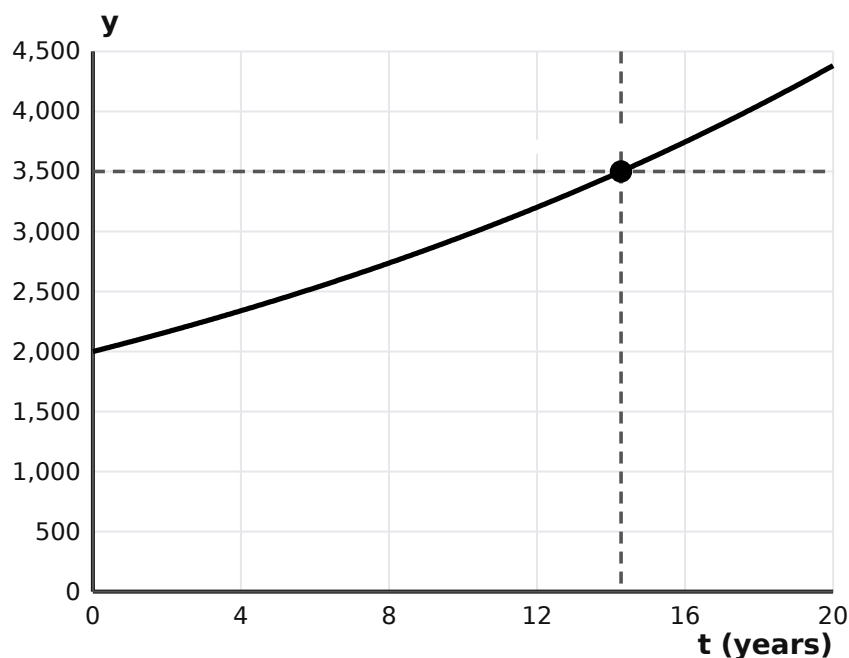
Scoring: 1 point for a and b, 1 point for the equation, 1 point for $f(4) = 405$.

Question 5: Solve for time (3 points)

a. $1.04^t = 1.75$, so $t = \frac{\ln 1.75}{\ln 1.04}$.

b. $t \approx 14.27$.

c. After 14 years $A(14) \approx \$3,463.35$ is below \$3,500, and after 15 years $A(15) \approx \$3,601.89$ is above. The answer is **15 years**.



The curve meets $A = 3,500$ at $t \approx 14.27$.

Scoring: 1 point for the exact logarithm form, 1 point for 14.27, 1 point for checking years 14 and 15.

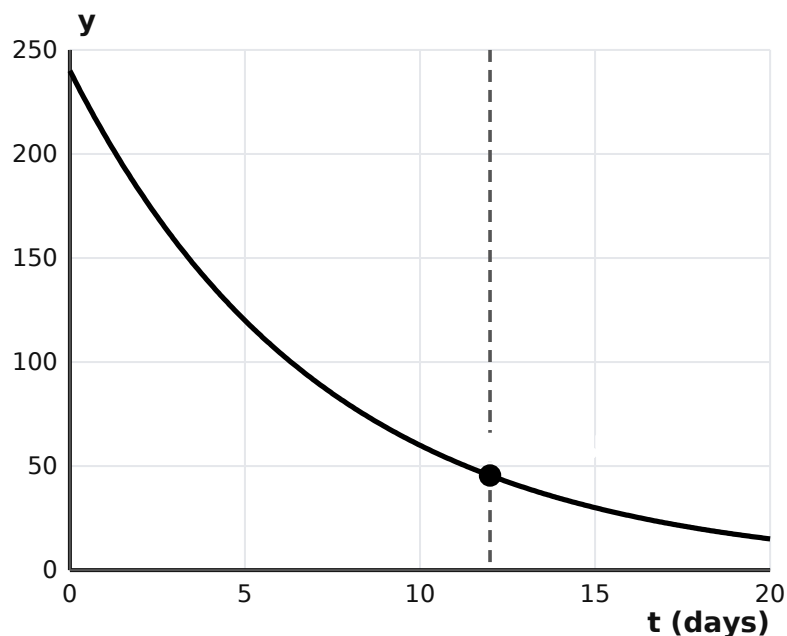
Question 6: Doubling time (2 points)

Solve $1.06^t = 2$: $t = \frac{\ln 2}{\ln 1.06} \approx \mathbf{11.90 \text{ years}}$.

Scoring: 1 point for the equation $1.06^t = 2$ with a logarithm step; 1 point for the correct value.

Question 7: Half-life (3 points)

- a. The mass halves from 240 to 120 in 5 days: **5 days**.
- b. $A(t) = 240\left(\frac{1}{2}\right)^{t/5}$.
- c. $A(12) = 240\left(\frac{1}{2}\right)^{12/5} \approx \mathbf{45.5 \text{ mg}}$.



The point (12, 45.5) on the curve.

Scoring: 1 point for the half-life, 1 point for the model, 1 point for the value.

Question 8: Equivalent forms (3 points)

- a. Since $b = 1.12$, the growth rate is **12% per year**.
- b. $e^k = 1.12$, so $k = \ln 1.12 \approx \mathbf{0.1133}$, giving $f(t) = 500e^{0.1133t}$.
- c. $b_{\text{month}} = 1.12^{1/12} \approx 1.00949$, so the monthly rate is about **0.95%**.

Scoring: 1 point for each part.

Total

20 points