

Using Logs to Solve Exponent Equations

Grade 11 – Algebra 2 math · Test Answer Key · Standards: F-LE.A.4, A-SSE.B.3c

Each answer shows the work and a scoring guide. Give partial credit for a correct setup with an arithmetic slip, and use the total out of 20 to judge readiness.

Standards: F-LE.A.4, A-SSE.B.3c · **Level:** Grade 11 Algebra 2

Question 1 Same-base equation (2 points)

$81 = 3^4$, so $x - 2 = 4$ and **$x = 6$** .

Scoring: 1 point for writing 81 as 3^4 , 1 point for the solution.

Question 2 Exponential equation (2 points)

$x = \ln 50 \div \ln 6 = 3.9120 \div 1.7918 = 2.1833$. **$x \approx 2.18$** .

Scoring: 1 point for the logarithm setup, 1 point for the value.

Question 3 Isolate and solve with e (2 points)

$e^{0.5x} = 7.5$, so $0.5x = \ln 7.5 \approx 2.0149$ and $x \approx 4.030$. **$x \approx 4.03$** .

Scoring: 1 point for isolating, 1 point for the value.

Question 4 Logarithmic equation (2 points)

$2x + 3 = 7^2 = 49$, so $2x = 46$. **$x = 23$** .

Scoring: 1 point for exponential form, 1 point for the solution.

Question 5 Equation with two logarithms (3 points)

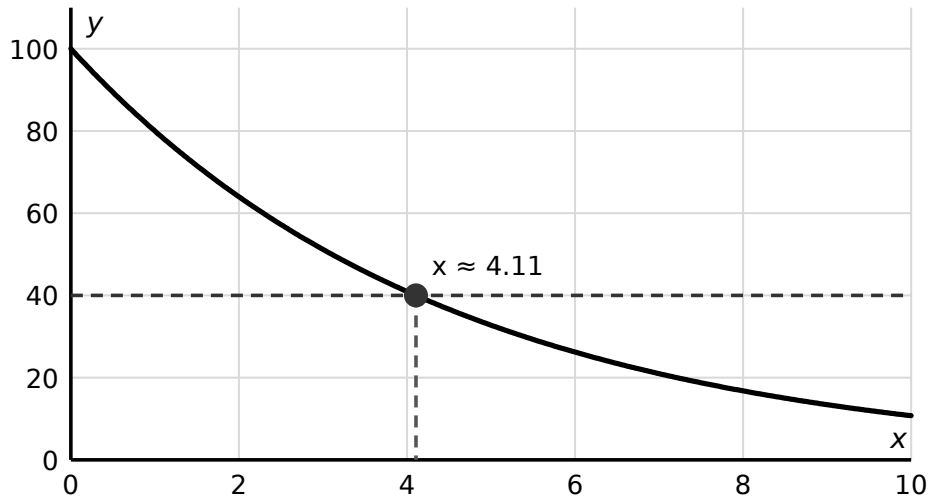
$\log_5(x^2 + 4x) = 1$, so $x^2 + 4x = 5$ and $(x + 5)(x - 1) = 0$. The value -5 makes $\log_5 x$ undefined. **$x = 1$** . Check: $\log_5 1 + \log_5 5 = 0 + 1$.

Scoring: 1 point for combining, 1 point for factoring, 1 point for rejecting -5 .

Question 6 Decay model (3 points)

a. The curve is at 40 a little after 4 hours.

b. $100(0.8)^x = 40$, so $0.8^x = 0.4$ and $x = \ln 0.4 \div \ln 0.8 = 4.106$. **≈ 4.11 hours.**



The curve reaches 40 at about 4.11 hours.

Scoring: 1 point for the estimate, 1 point for the logarithm setup, 1 point for the value.

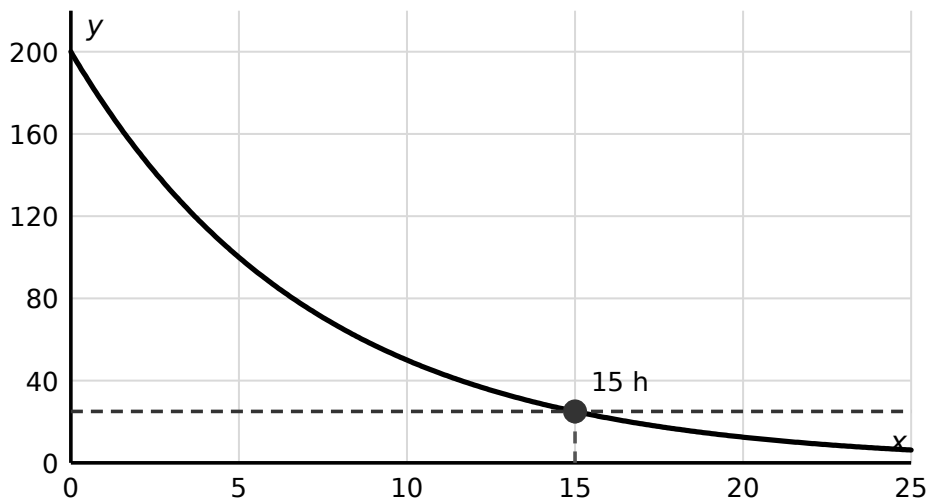
Question 7 Compound interest (2 points)

$2500(1 + 0.038/12)^{12t} = 4000$, so $(1.0031667)^{12t} = 1.6$. Then $12t = \ln 1.6 \div \ln 1.0031667 = 0.4700 \div 0.00316$, so $t \approx 12.388$. $\approx$ **12.4 years**.

Scoring: 1 point for the setup, 1 point for the value.

Question 8 Half-life (2 points)

$200(1/2)^{t/5} = 25$, so $(1/2)^{t/5} = 1/8 = (1/2)^3$. Then $t/5 = 3$. **$t = 15$ hours**.



The amount reaches 25 mg at 15 hours.

Scoring: 1 point for the equation, 1 point for the value.

Question 9 Extraneous solution (2 points)

$x^2 + 9x = 10$, so $(x + 10)(x - 1) = 0$. The value -10 is rejected because $\log(-10)$ is undefined.
 $x = 1$. Check: $\log 1 + \log 10 = 0 + 1 = 1$.

Scoring: 1 point for the solutions of the quadratic, 1 point for the rejection and answer.