

Algebra 1 · Graphs as Solution Sets, Linear-Quadratic Systems and Exponential Expressions · Worksheet Answer Key

Common Core A-REI.D.10, A-REI.C.7, F-IF.C.7e, A-SSE.B.3c · mathovore.fr

Each worked solution shows the substitution or the factoring, the check in both equations, and the final answer in bold. If your intersection points differ, recheck the signs when you move terms to one side and the order of the coordinates.

Algebra 1 Common Core: A-REI.D.10 · A-REI.C.7 · F-IF.C.7e · A-SSE.B.3c

Problem 1: Is the point a solution?

(a) $2(3)-1=5$, which equals the y-value 5. **Yes, it is a solution.**

(b) $2(1)-1=1$, but the y-value is 2. **No, it is not a solution**, so $(1,2)$ is not on the graph.

Problem 2: Points on a parabola

$(-2)^2+3=4+3=7$, so $(-2,7)$ is on the graph.

$3^2+3=12$, not 10, so $(3,10)$ **is not on the graph.**

Problem 3: Find the missing coordinate

$k=4^2-6=10$.

$3=m^2-6$ gives $m^2=9$, so $m=3$ or $m=-3$. Check: $(-3)^2-6=3$. $k=10$; $m=3$ **or** $m=-3$

Problem 4: Intercepts as solutions

With $y=0$: $0=2x-6$, so $x=3$. With $x=0$: $y=-6$. **x-intercept** $(3,0)$, **y-intercept** $(0,-6)$

Problem 5: Points and a graph

A: $-1+4=3$ yes. B: $-3+4=1 \neq 2$ no. C: $-0+4=4$ yes. D: $-(-2)+4=6$ yes. E: $-4+4=0 \neq 1$ no.

A, C and D are solutions; they are the points on the line.

Problem 6: Line and parabola: $y = x^2$ and $y = x + 6$

$x^2 = x + 6$ gives $x^2 - x - 6 = 0$, so $(x-3)(x+2) = 0$ and $x = 3$ or $x = -2$.

$y = 3 + 6 = 9$ and $y = -2 + 6 = 4$. Check: $3^2 = 9$ and $(-2)^2 = 4$. **(3,9) and (-2,4)**

Problem 7: System with a trinomial

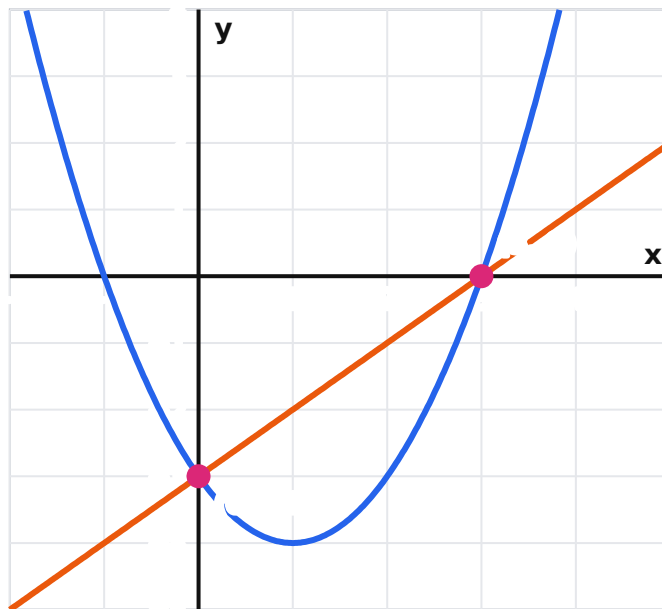
$x^2 + 2x - 3 = x + 3$ gives $x^2 + x - 6 = 0$, so $(x+3)(x-2) = 0$ and $x = -3$ or $x = 2$.

$y = -3 + 3 = 0$ and $y = 2 + 3 = 5$. Check: $9 - 6 - 3 = 0$ and $4 + 4 - 3 = 5$. **(-3,0) and (2,5)**

Problem 8: Read and verify

The graphs meet at $(0, -3)$ and $(3, 0)$.

Algebra: $x^2 - 2x - 3 = x - 3$ gives $x^2 - 3x = 0$, so $x(x-3) = 0$ and $x = 0$ or $x = 3$. Then $y = -3$ and $y = 0$. **(0, -3) and (3, 0)**



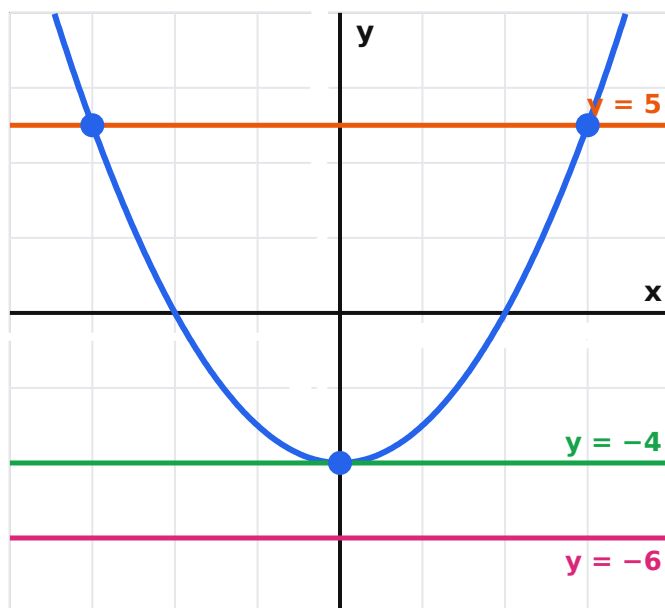
The intersection points are the solutions.

Problem 9: How many solutions?

(a) $x^2 - 4 = 5$ gives $x^2 = 9$, so $x = \pm 3$: 2 solutions, **(3,5) and (-3,5)**.

(b) $x^2 - 4 = -4$ gives $x^2 = 0$: 1 solution, **(0, -4)**.

(c) $x^2 - 4 = -6$ gives $x^2 = -2$, which has no real solution: 0 solutions. **2, 1 and 0 solutions**



The first line cuts the parabola twice, the second touches it once, the third misses it.

Problem 10: A line that touches the parabola

$x^2+2=2x+1$ gives $x^2-2x+1=0$, so $(x-1)^2=0$ and $x=1$ only.

$y=2(1)+1=3$. Check: $1+2=3$. **One solution, (1,3)**

Problem 11: Rearranging before factoring

$x^2-3x=2x-6$ gives $x^2-5x+6=0$, so $(x-2)(x-3)=0$ and $x=2$ or $x=3$.

$y=2(2)-6=-2$ and $y=2(3)-6=0$. Check: $4-6=-2$ and $9-9=0$. **(2,-2) and (3,0)**

Problem 12: Downward parabola

$-x^2+4=-x+2$ gives $0=x^2-x-2$, so $(x-2)(x+1)=0$ and $x=2$ or $x=-1$.

$y=-2+2=0$ and $y=1+2=3$. Check: $-4+4=0$ and $-1+4=3$. **(2,0) and (-1,3)**

Problem 13: Table for an exponential

$2^{-2}=\frac{1}{4}$, $2^{-1}=\frac{1}{2}$, $2^0=1$, $2^1=2$, $2^2=4$, $2^3=8$.

The y-intercept is (0,1). The values get close to 0 on the left but never reach it, so the asymptote is $y=0$.

Problem 14: Features of a growth function

At $x=0$, $y=5 \cdot 1=5$, so the y-intercept is $(0,5)$. Since $5 \cdot 3^x > 0$ for every x , there is **no x-intercept**.

As x gets very large, y gets very large ($y=15$ at $x=1$, $y=45$ at $x=2$). As x gets very small, y approaches 0 ($y=\frac{5}{3}$ at $x=-1$).

Problem 15: Exponential decay

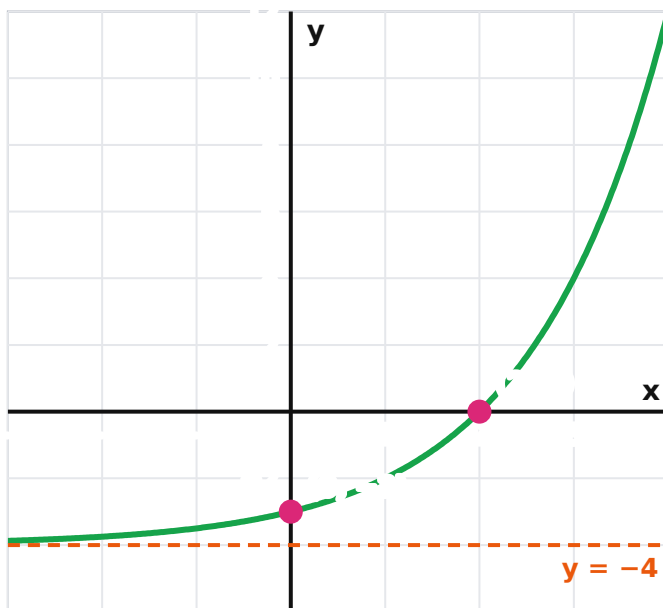
The y-intercept is $(0,64)$. As x gets large, y approaches 0; as x gets very negative, y grows without bound.

$$y(5) = 64 \cdot \frac{1}{32} = 2. \text{ y-intercept } (0,64); y=2$$

Problem 16: A shifted exponential

y-intercept: $2^0 - 4 = -3$, so $(0,-3)$. x-intercept: $2^x - 4 = 0$ gives $2^x = 4$, so $x=2$ and the point is $(2,0)$. The graph approaches $y=-4$ on the left.

$(0,-3)$, $(2,0)$, **asymptote** $y=-4$



Dashed line: horizontal asymptote $y = -4$.

Problem 17: Rewrite with base 2

(a) $8^x = (2^3)^x = 2^{3x}$.

(b) $4^{3x} = (2^2)^{3x} = 2^{6x}$.

(c) $16^{x/2} = (2^4)^{x/2} = 2^{2x}$. 2^{3x} , 2^{6x} , 2^{2x}

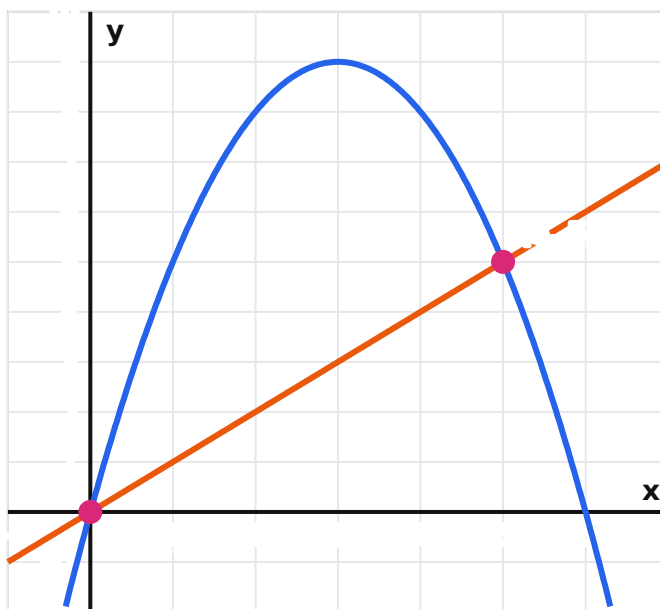
Problem 18: A two-year factor

$1.2^4 = (1.2^2)^{1/2} = 1.44^{1/2}$, so $P(t) = 500(1.44)^{t/2}$. Check: $500(1.2)^2 = 500(1.44) = 720$ and $500(1.44)^1 = 720$. $P(t) = 500(1.44)^{t/2}$; **the 2-week factor is 1.44, a 44% increase**

Problem 19: Ball on a hill

$-x^2 + 6x = x$ gives $-x^2 + 5x = 0$, so $x(5-x) = 0$ and $x = 0$ (the kick) or $x = 5$.

$y = 5$. Check: $-25 + 30 = 5$. **The ball lands at (5,5), 5 feet along and 5 feet up**



The path meets the hill at (0, 0) and (5, 5).

Problem 20: Savings account, monthly rate

$1.06^{1/12} \approx 1.0049$, so $A = (1.0049)^{12t}$. The monthly rate is about **0.49%**.

Check: $1.0049^{12} \approx 1.0603$, close to 1.06 (rounding).

Problem 21: Growth of 15% per year

$1.15^t = (1.15^{1/12})^{12t} \approx (1.0117)^{12t}$, so $N \approx 800(1.0117)^{12t}$. The monthly rate is about **1.17%**.

This is less than $15\% \div 12 = 1.25\%$ because of compounding. Check: $1.0117^{12} \approx 1.1496$, about 1.15.

Problem 22: Car value each quarter

$0.85^t = (0.85^{1/4})^{4t}$ and $0.85^{1/4} \approx 0.9602$, so $V \approx 22000(0.9602)^{4t}$. The factor 0.9602 means the value drops by $1 - 0.9602 = 0.0398$, about **4.0% per quarter**.

Check: $0.9602^4 \approx 0.85$.

Problem 23: Bacteria every 20 minutes

$2^t = (2^{1/3})^{3t}$ and $2^{1/3} \approx 1.26$, so $N \approx 100(1.26)^{3t}$. The culture grows about **26% every 20 minutes**.

Check: $1.26^3 \approx 2.0$.