

Where Graphs Meet

Solve $f(x) = g(x)$ to find shared x -values.

HIGH SCHOOL • HSA-REI.D.11

CCSS.Math.Content.HSA-REI.D.11 "Explain why the x -coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g...."

NAME _____

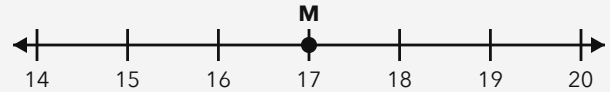
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SHARED POINTS

When $y = f(x)$ and $y = g(x)$ intersect, both rules have the same y -value for the same x -value. Set $f(x) = g(x)$ and solve for x . The solution or solutions are the x -coordinates of the intersection points.

WORKED EXAMPLE

Point M marks the x -coordinate of an intersection of $y = |x - 31|$ and $y = 11x - 173$. Verify the intersection and find its ordered pair.



1. At an intersection, set $|x - 31| = 11x - 173$.
2. Use M: $|17 - 31| = 11(17) - 173$.
3. Both sides equal 14, so $x = 17$.
4. Use either rule to get $y = 14$.

Answer: (17, 14)

PRACTICE 4 problems

- 1** Find the x -coordinates where $y = x^2$ and $y = 10x - 21$ intersect.

ANSWER _____

- 2** Find the x -coordinates where $y = 1/x$ and $y = x$ intersect.

ANSWER _____

- 3** Find the x -coordinate where $y = |x - 18|$ and $y = x - 12$ intersect.

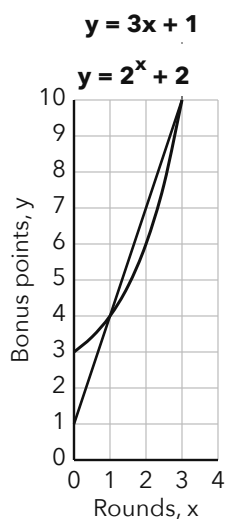
ANSWER _____

- 4** Find the x -coordinate where $y = \log_2(x)$ and $y = 1$ intersect.

ANSWER _____

APPLY IT Show your work

- 1** A game tracks bonus points from two reward rules. The graph shows total bonus points after x rounds. At which rounds do the rules give the same total?



ANSWER _____

- 2** An esports club can split a \$48 event fee among x students, so each student pays $48/x$ dollars. A second event costs \$2 per student. Write and solve an equation to find when the per-student costs match.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Points A and B mark the x-coordinates where $y = \log_2(x)$ and $y = x/2$ intersect. Explain why both marked values solve $\log_2(x) = x/2$, then verify each value by substitution.



WORK SPACE AND ANSWER

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Find the x-coordinates where $y = x^2$ and $y = 10x - 21$ intersect.	$x = 3$ and $x = 7$
2	Find the x-coordinates where $y = 1/x$ and $y = x$ intersect.	$x = -1$ and $x = 1$
3	Find the x-coordinate where $y = x - 18 $ and $y = x - 12$ intersect.	$x = 15$
4	Find the x-coordinate where $y = \log_2(x)$ and $y = 1$ intersect.	$x = 2$

PART 2 • APPLY IT

- Rounds 1 and 3.** Read the x-coordinates of the two graph intersections. The curves meet at $x = 1$ and $x = 3$.
- $48/x = 2$; $x = 24$ students** Set the two per-student costs equal: $48/x = 2$. Multiplying by x gives $48 = 2x$, so $x = 24$.

CHALLENGE

At an intersection, both functions have the same y-value, so the x-coordinate solves the equation. For $x = 2$, $\log_2(2) = 1$ and $2/2 = 1$. For $x = 4$, $\log_2(4) = 2$ and $4/2 = 2$.

Accept equivalent equation-solving work and either order for multiple solutions. For graph questions, accept clearly identified intersection x-values.