

Where Graphs Meet

Solve equal outputs to find intersection points.

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 _____

DATE _____

THE SHARED POINT RULE

An intersection has one x-value and one y-value that work in both equations. Set $f(x)$ equal to $g(x)$ to find the shared x-value, then substitute it into either equation to find y. Check that restricted values, such as a zero denominator, are not used.

WORKED EXAMPLE

Find the intersection of $y = 7x + 5$
and $y = 3x + 17$.

1. Set the y-values equal: $7x + 5 = 3x + 17$.
2. Subtract $3x$ and 5 : $4x = 12$.
3. Divide by 4 : $x = 3$.
4. Substitute $x = 3$ into $y = 7x + 5$: $y = 26$.

Answer: The intersection is (3, 26).

PRACTICE 6 problems

- 1** Find the intersection of $y = 6x - 8$ and $y = 2x + 16$.

ANSWER _____

- 2** Find the intersection points of $y = x^2 - 36$
and $y = 0$.

ANSWER _____

- 3** Find the intersection of $y = 18/x$ and $y = 9$.

ANSWER _____

- 4** Find the intersection points of $y = |x - 8|$ and
 $y = 10$.

ANSWER _____

- 5** Find the intersection of $y = 6^x$ and $y = 36$.

ANSWER _____

- 6** Find the intersection of $y = \log_2(x)$ and $y = 6$.

ANSWER _____

APPLY IT Show your work

- 1** A music streaming service offers two monthly plans. Plan A costs $6x + 20$ dollars, and Plan B costs $2x + 52$ dollars, where x is the number of gigabytes of data used. At how many gigabytes do the plans cost the same, and what is that cost?

WORK SPACE

ANSWER _____

- 2** A gaming club compares two tournament room options. Option A has an average cost per player of $120/x + 8$ dollars, where x is the number of players. Option B costs 20 dollars per player. How many players make the average costs equal, and what is the cost per player?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

The graphs $y = |x - 8|$ and $y = x^2$ intersect. Find both x -coordinates to the nearest tenth. Then explain in one sentence why those x -values make the graphs meet.

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the intersection of $y = 6x - 8$ and $y = 2x + 16$.	(6, 28)
2	Find the intersection points of $y = x^2 - 36$ and $y = 0$.	(-6, 0) and (6, 0)
3	Find the intersection of $y = 18/x$ and $y = 9$.	(2, 9)
4	Find the intersection points of $y = x - 8 $ and $y = 10$.	(-2, 10) and (18, 10)
5	Find the intersection of $y = 6^x$ and $y = 36$.	(2, 36)
6	Find the intersection of $y = \log_2(x)$ and $y = 6$.	(64, 6)

PART 2 · APPLY IT

- At 8 gigabytes, both plans cost \$68.** Set $6x + 20$ equal to $2x + 52$ to get $x = 8$. Substitute 8 into either cost expression to get 68.
- With 10 players, both options cost \$20 per player.** Set $120/x + 8$ equal to 20, giving $120/x = 12$ and $x = 10$. The shared average cost is 20 dollars per player.

CHALLENGE

$x = (-1 - \sqrt{33})/2$ approx -3.4 and $x = (-1 + \sqrt{33})/2$ approx 2.4; the unrounded values work because each makes $|x - 8|$ equal x^2 , so the y-coordinates match.

Accept intersection points in either order. For the challenge, accept the exact x-values, the nearest-tenth values, or both, as long as the explanation states that equal function outputs give the same y-coordinate.