LESSON MAKER PRO

Where Graphs Meet

Find and explain solutions to systems of functions.

HIGH SCHOOL · FA.F.22

FA.F.22 "Graph a system of two functions, f(x) and g(x), on the same Coordinate Plane by hand for simple cases, and with technology for complicated cases. Explain the relationship between the point(s) of intersection and the solution to the system..."

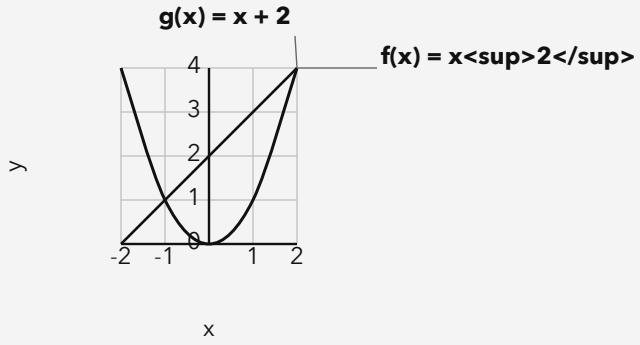
NAME _____ DATE _____

SHARED POINTS

An intersection has the same x-value and y-value on both graphs. To find one with equations, set the functions equal, solve for x, then find y. Each intersection point is a solution to the system.

WORKED EXAMPLE

Find the solutions shown by the graphs.



1. Set the rules equal: $x^2 = x + 2$.
2. Factor: $(x - 2)(x + 1) = 0$.
3. So $x = -1$ or $x = 2$. Substitute to get $y = 1$ or $y = 4$.

Answer: The solutions are (-1, 1) and (2, 4).

PRACTICE 4 problems

1 Find both intersections of $f(x) = x^2 + 3$ and $g(x) = 7$.

ANSWER _____

2 Find both intersections of $f(x) = x^2 + 1$ and $g(x) = -x + 3$.

ANSWER _____

3 Find the intersection of $f(x) = 3x - 1$ and $g(x) = x + 5$.

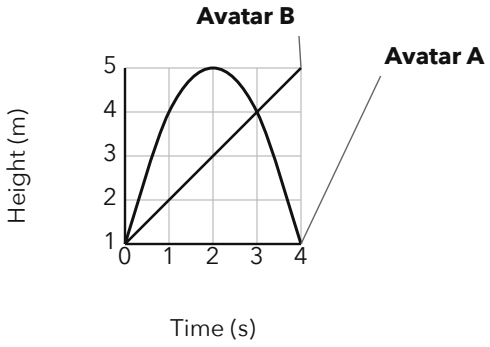
ANSWER _____

4 How many intersections do $f(x) = x^2 + 4$ and $g(x) = 3$ have? Explain.

ANSWER _____

APPLY IT Show your work

1 In a game, the graph shows two avatars' heights over time. When are they at the same height? Give each time and height.



ANSWER _____

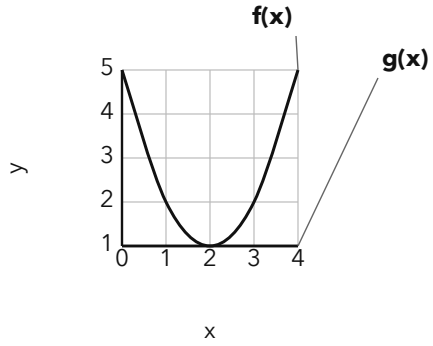
2 At a school fair, two ticket plans predict earnings in dollars for a ticket price of x dollars: $A(x) = -x^2 + 8x$ and $B(x) = 2x + 8$. Which prices give equal earnings, and how much does each plan earn?

WORK SPACE

ANSWER _____

CHALLENGE One step up

How many solutions does this graphed system have? Name the solution and explain why there are no others.



WORK SPACE AND ANSWER

ANSWER KEY

Where Graphs Meet

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find both intersections of $f(x) = x^2 + 3$ and $g(x) = 7$.	**(-2, 7) and (2, 7)**
2	Find both intersections of $f(x) = x^2 + 1$ and $g(x) = -x + 3$.	**(-2, 5) and (1, 2)**
3	Find the intersection of $f(x) = 3x - 1$ and $g(x) = x + 5$.	**(3, 8)**
4	How many intersections do $f(x) = x^2 + 4$ and $g(x) = 3$ have? Explain.	**None. Since x^2 is never negative, f(x) is always at least 4 and cannot equal 3.**

PART 2 · APPLY IT

1. **At 0 seconds, both are 1 meter high. At 3 seconds, both are 4 meters high.** The graphs meet at (0, 1) and (3, 4). Read each point as (time, height).
2. **A $2 ticket gives $12 in earnings for each plan. A $4 ticket gives $16 for each plan.** Set the rules equal: $-x^2 + 8x = 2x + 8$. Factoring gives $(x - 2)(x - 4) = 0$; substitute each price into either rule.

CHALLENGE

One solution: (2, 1). The line touches the parabola at its lowest point and does not meet it anywhere else.

Accept intersection points in either order. For the challenge, accept any explanation that identifies the single point where the graphs meet.