LESSON MAKER PRO

Piecewise Pathways

Choose the rule, graph the pieces, and use context constraints.

HIGH SCHOOL · MA.912.AR.9.10

MA.912.AR.9.10 "Solve and graph mathematical and real-world problems that are modeled with piecewise functions. Interpret key features and determine constraints in terms of the context."

NAME _____ DATE _____

ONE INPUT, ONE RULE

For each x-value, use only the rule whose condition includes that value. To graph a piecewise function, draw each rule only on its stated domain, using an open circle for an excluded endpoint and a closed circle for an included endpoint.

WORKED EXAMPLE

Given f(x) = {2x + 1 if x < 4; 9 if x >= 4}, find f(4).

1. Since 4 >= 4, use f(x) = 9.
2. Substitute: f(4) = 9.

Answer: f(4) = 9

PRACTICE 6 problems

1 Given f(x) = {3x - 5 if x < 6; x + 7 if x >= 6}, find f(6).

ANSWER _____

2 Solve g(x) = 17 for g(x) = {3x + 8 if x <= 3; 17 if x > 3}.

ANSWER _____

3 Graph h(x) = {-x + 11 if x < 5; 6 if x >= 5}. State the open circle and closed circle.

ANSWER _____

4 Find the domain and range of q(x) = {7x if x < 0; 12 if x >= 0}.

ANSWER _____

5 Solve r(x) = 0 for r(x) = {15 - 3x if x < 7; x - 6 if x >= 7}.

ANSWER _____

6 Is p(x) = {x + 10 if x < 8; 3x - 6 if x >= 8} continuous at x = 8? Explain with the values from both rules.

ANSWER _____

APPLY IT Show your work

1 A concert venue charges $7 to park for up to 3 hours. After 3 hours, it charges $5 per additional hour, with partial hours charged proportionally. Parking time x must satisfy 0 < x <= 8. Write a piecewise function C(x) for the cost, find C(6), and graph the function.

WORK SPACE

ANSWER _____

2 A school club sells custom stickers. Each of the first 5 stickers costs $6. Each sticker after 5 costs $3, and the club can order no more than 11 stickers. Let x be the whole-number number of stickers ordered. Write a piecewise function S(x), state the constraints, and find S(7).

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A gaming lounge charges a $5 entry fee that covers a session up to 3 hours. From more than 3 hours through 6 hours, it adds $7 per hour beyond 3. After 6 hours, it adds $6 per hour beyond 6. A session time x must satisfy 0 < x <= 8. Write a piecewise function L(x), graph it, find L(7), and explain why the domain conditions do not overlap.

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ANSWER KEY

Piecewise Pathways

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Given f(x) = {3x - 5 if x < 6; x + 7 if x >= 6}, find f(6).	**f(6) = 13**
2	Solve g(x) = 17 for g(x) = {3x + 8 if x <= 3; 17 if x > 3}.	**x >= 3**
3	Graph h(x) = {-x + 11 if x < 5; 6 if x >= 5}. State the open circle and closed circle.	**Graph y = -x + 11 for x < 5 with an open circle at (5, 6). Graph y = 6 for x >= 5 with a closed circle at (5, 6).**
4	Find the domain and range of q(x) = {7x if x < 0; 12 if x >= 0}.	**Domain: all real numbers. Range: y < 0 or y = 12.**
5	Solve r(x) = 0 for r(x) = {15 - 3x if x < 7; x - 6 if x >= 7}.	**x = 5**
6	Is p(x) = {x + 10 if x < 8; 3x - 6 if x >= 8} continuous at x = 8? Explain with the values from both rules.	**Yes. The first rule gives 8 + 10 = 18, and the second rule gives 3(8) - 6 = 18, so the pieces meet at (8, 18).**

PART 2 · APPLY IT

1. **C(x) = {7 if 0 < x <= 3; 7 + 5(x - 3) if 3 < x <= 8}. C(6) = 22. Graph y = 7 for 0 < x <= 3, then graph y = 7 + 5(x - 3) for 3 < x <= 8. Use a closed point at (3, 7) and an endpoint at (8, 32).** Use the flat fee through 3 hours. For 6 hours, add 5 dollars for each of the 3 hours beyond 3.
2. **S(x) = {6x if 0 < x <= 5; 30 + 3(x - 5) if 5 < x <= 11}. Constraints: x is a whole number and 0 < x <= 11. S(7) = 36.** The first 5 stickers cost 30 dollars. For 7 stickers, add the cost of the 2 stickers beyond 5.

CHALLENGE

L(x) = {5 if 0 < x <= 3; 5 + 7(x - 3) if 3 < x <= 6; 26 + 6(x - 6) if 6 < x <= 8}. L(7) = 32. Graph y = 5 through (3, 5), then graph the line from (3, 5) to (6, 26), then graph the line from (6, 26) to (8, 38). The conditions do not overlap because x = 3 belongs only to the first rule and x = 6 belongs only to the second rule.

Accept equivalent simplified expressions, such as 5x - 8 for the second parking rule. Accept correctly labeled graphs with equivalent endpoint notation, provided open and closed circles match the stated inequalities.