

Piecewise Pathways

Choose the rule, solve the value, and read the situation.

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 _____

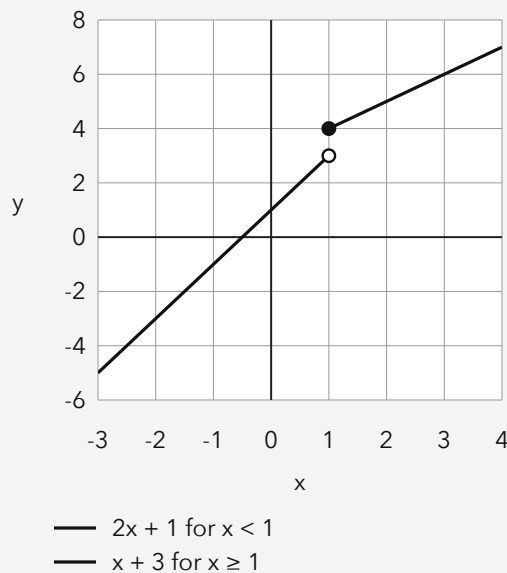
You will need: Pencil; Ruler

CHOOSE THE CORRECT PIECE

At an endpoint, check the inequality sign to see which rule owns the point. To graph each rule, draw only over its stated x -values, using an open circle for $<$ or $>$ and a closed circle for $\leq$ or $\geq$. In a context, restrict x to values that make sense, such as nonnegative time.

WORKED EXAMPLE

Graph $h(x) = \{2x + 1 \text{ if } x < 1; x + 3 \text{ if } x \geq 1\}$. Find $h(0)$ and $h(2)$.

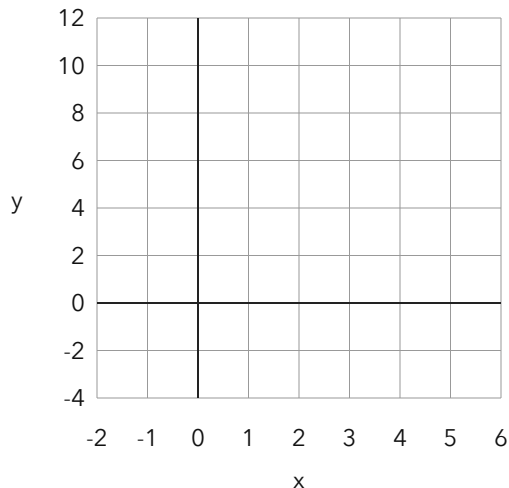


1. Draw each line only over the inputs for its rule.
2. Use an open circle at $(1, 3)$ and a closed circle at $(1, 4)$.
3. At $x = 0$, use the first rule: $h(0) = 1$.
4. At $x = 2$, use the second rule: $h(2) = 5$.

Answer: $h(0) = 1$; $h(2) = 5$. There is a jump at $x = 1$.

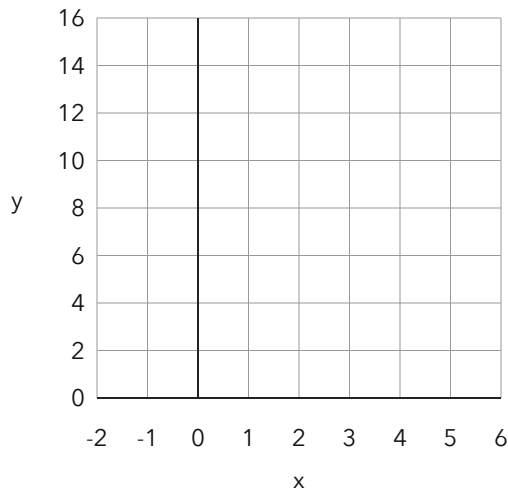
PRACTICE 6 problems

- 1** Graph $f(x) = \{2x + 1 \text{ if } x < 4; x - 3 \text{ if } x \geq 4\}$. Find $f(4)$ and $f(-1)$.



ANSWER _____

- 2** Graph $p(x) = \{-x + 6 \text{ if } x \leq 2; 3x - 2 \text{ if } x > 2\}$. Find $p(2)$ and $p(5)$.



ANSWER _____

- 3** Solve $q(x) = 7$. $q(x) = \{x + 4 \text{ if } x < 3; 2x - 1 \text{ if } x \geq 3\}$

ANSWER _____

- 4** Is r continuous at $x = 2$? Explain briefly. $r(x) = \{x + 1 \text{ if } x < 2; 2x - 1 \text{ if } x \geq 2\}$

ANSWER _____

- 5** A parking garage charges $c(h) = \{5 \text{ if } 0 \leq h \leq 1; 5 + 2(h - 1) \text{ if } h > 1\}$, where h is time in hours and c is cost in dollars. State the domain in context and find $c(3)$.

ANSWER _____

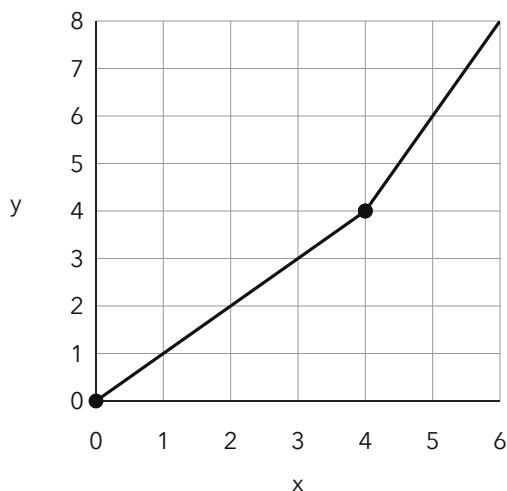
- 6** State the domain and range of s . $s(x) = \{2 \text{ if } x < -1; x + 3 \text{ if } x \geq -1\}$

ANSWER _____

APPLY IT Show your work

1

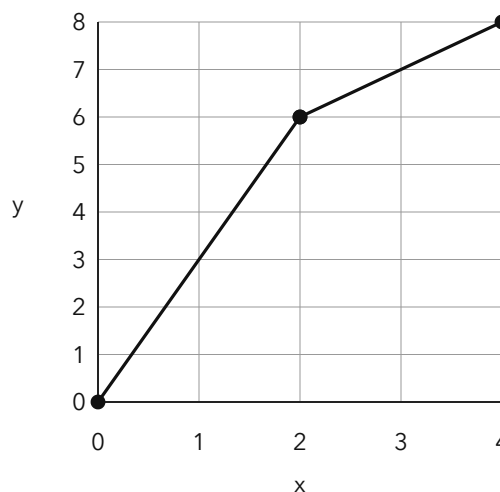
The graph shows total cost y , in dollars, for x gigabytes of music downloads. Find the total cost for 3 GB and 5 GB. What is the cost per additional GB before and after 4 GB? The horizontal axis is x (GB); the vertical axis is y (dollars).



REASONING AND ANSWER

2

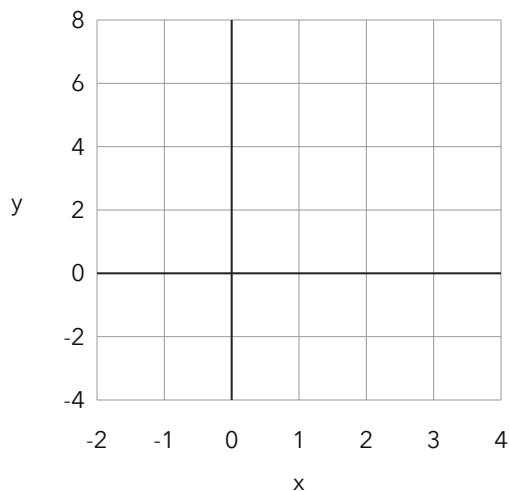
A tutoring platform pays a student tutor for up to 4 hours of online work. The graph shows earnings y in tens of dollars after x hours. How much does the tutor earn after 3 hours? State the hourly pay rate before and after 2 hours, and state the meaningful domain. The horizontal axis is x (hours); the vertical axis is y (tens of dollars).



REASONING AND ANSWER

CHALLENGE One step up

For $b(x) = \{3x + 2 \text{ if } x < 1; x + 4 \text{ if } x \geq 1\}$, solve $b(x) = 7$. Then decide whether b is continuous at $x = 1$ and explain your reasoning. Graph both pieces with correct endpoint inclusion.



WORK SPACE AND ANSWER

PRACTICE 3

$$x = 4$$

PRACTICE 4

Yes. Both pieces approach 3 at $x = 2$; only the second rule defines $r(2) = 3$.

PRACTICE 5

Domain: $h \geq 0$; $c(3) = 9$ dollars

PRACTICE 6

Domain: all real numbers; range: $s(x) \geq 2$

APPLY IT 1

3 GB costs \$3 and 5 GB costs \$6. Each additional GB costs \$1 up to 4 GB and \$2 beyond 4 GB. Total cost is continuous at 4 GB.

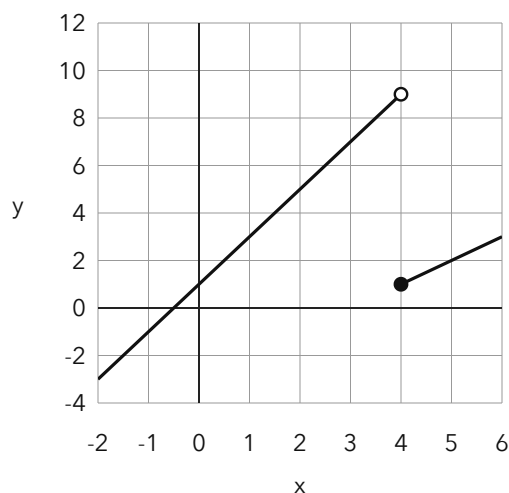
Read $y = 3$ at $x = 3$ and $y = 6$ at $x = 5$. The first graph segment rises 1 dollar per GB, and the second rises 2 dollars per GB.

APPLY IT 2

After 3 hours, the tutor earns \$70. The rate is \$30 per hour from 0 to 2 hours and \$10 per hour after 2 hours. The meaningful domain is $0 \leq x \leq 4$. At $x = 3$, the graph has $y = 7$, which means 7 tens of dollars. The slopes are 3 tens of dollars per hour before 2 hours and 1 ten of dollars per hour after 2 hours.

PRACTICE 1

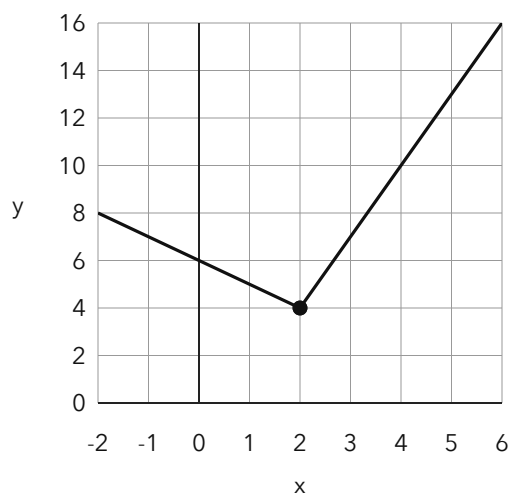
$f(4) = 1$; $f(-1) = -1$. Open circle (4, 9); closed circle (4, 1).



$$\begin{aligned} & 2x + 1 \text{ for } x < 4 \\ & x - 3 \text{ for } x \geq 4 \end{aligned}$$

PRACTICE 2

$p(2) = 4$; $p(5) = 13$. Both pieces meet at (2, 4), which is included by the first rule.



$$\begin{aligned} & -x + 6 \text{ for } x \leq 2 \\ & 3x - 2 \text{ for } x > 2 \end{aligned}$$

CHALLENGE

$x = 3$. b is continuous at $x = 1$ because the left-hand value approaches 5 and the value from the second piece is $b(1) = 5$. The candidate $x = 5/3$ from the first rule is rejected because $5/3$ is not less than 1.

Accept equivalent interval notation for domains and ranges. For continuity explanations, accept statements that the two pieces meet at the same y -value at the boundary. Graphs must respect piece domains and actual open/closed endpoints. If two pieces share the same endpoint and either includes it, the combined function includes that point.

