

AP Precalculus
Function Representations and Average Rates of Change

Function Representations and Average Rates of Change | APPC-COMB-U01-P01-P02

96 problems · Four activity formats

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Topic focus

Across 96 tasks this topic asks for exact average rate, degrees Celsius per day, kilopascals per hour, function decision with justification, value comparison and behavior statement and labeled qualitative graph.

8 PDFs and a README; 107 buyer pages.

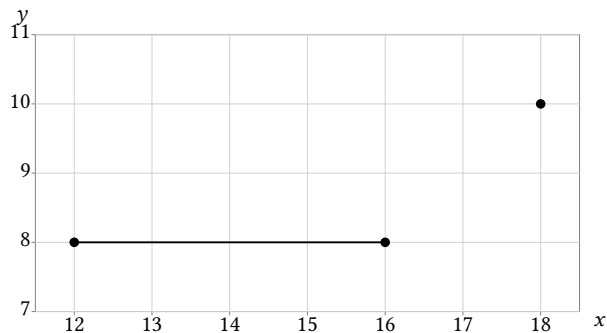
AP Precalculus

Function Representations and Average Rates of Change

Name: _____ Date: _____ Class: _____

Answer each question and record the matching bank letter. Give exact values. A value without its unit is not a complete answer.

An exact graph consists of a line segment from $(12, 8)$ (solid) to $(16, 8)$ (solid); the isolated solid point $(18, 10)$. Find every input satisfying $y = 8$, respecting all endpoint markers.

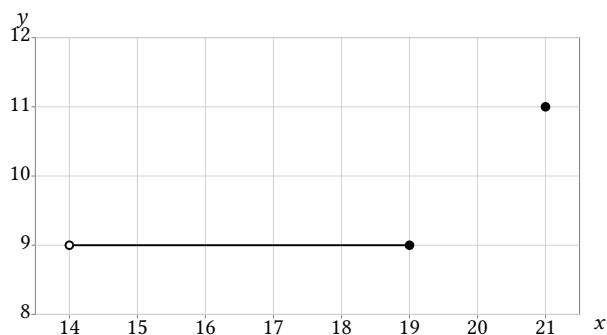


Bank label: _____

For a mixing tank, solution volume is $F(t) = 10 + 3t$ liters after t continuous minutes. Operation may last at most 8 minutes, but capacity is 22 liters. Give the feasible domain and output range.

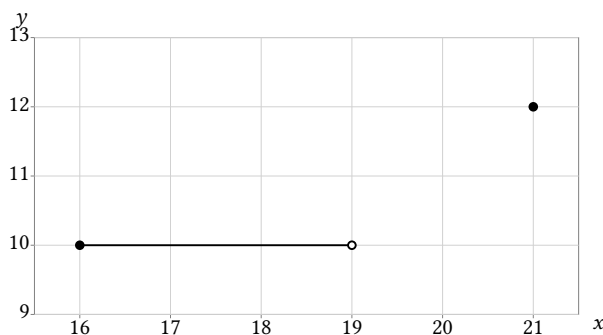
Bank label: _____

An exact graph consists of a line segment from $(14, 9)$ (open) to $(19, 9)$ (solid); the isolated solid point $(21, 11)$. Find every input satisfying $y = 9$, respecting all endpoint markers.



Bank label: _____

An exact graph consists of a line segment from $(16, 10)$ (solid) to $(19, 10)$ (open); the isolated solid point $(21, 12)$. Find every input satisfying $y = 10$, respecting all endpoint markers.



Bank label: _____

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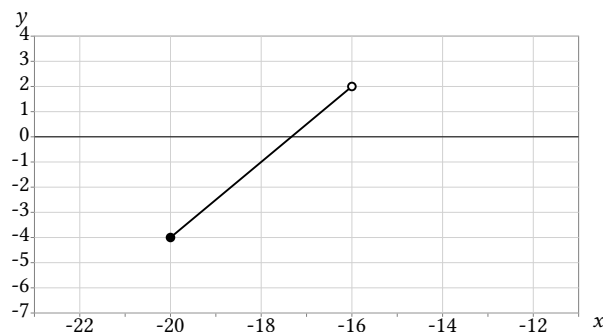
Name: _____ Date: _____ Class: _____

Answer each question and show your reasoning in the workspace. Give exact values rather than decimals unless the question supplies a decimal. A value without its unit is not a complete answer.

A study controls number of concert tickets purchased and records total charge. The model is $f(x) = 4x + 2$, and $f(3) = 14$. Identify the input and output quantities with units, then interpret $f(3) = 14$.

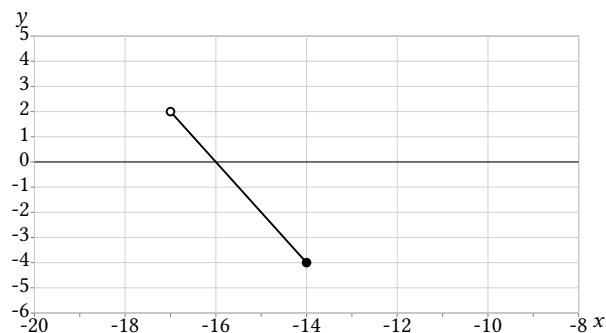
Measure the input in tickets and the total charge in dollars.

An exact graph uses one unit per tick and consists of a line segment from $(-20, -4)$ (solid) to $(-16, 2)$ (open). Determine the domain and range of the plotted relation; do not use the viewing-window edges.



For sealed sample tubes loaded into a rack, rack mass is $F(n) = 7 + 3n$. At most 4 items fit, and n must be a whole number. Give the feasible domain and range.

An exact graph uses one unit per tick and consists of a line segment from $(-17, 2)$ (open) to $(-14, -4)$ (solid). Determine the domain and range of the plotted relation; do not use the viewing-window edges.



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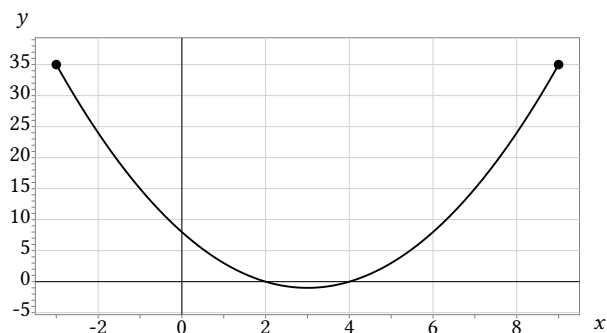
Function Representations and Average Rates of Change

Name: _____ Date: _____ Class: _____

Begin at START. Answer the card, then find the matching final answer at the top of another card. Use the recording sheet for your reasoning. Visit each card once and continue to FINISH.

START

An exact graph consists of the graph of $y = (x - 3)^2 - 1$ for $-3 \leq x \leq 9$, with the left endpoint included and right endpoint included. Find every input satisfying $y = 15$, respecting all endpoint markers.



Your response: _____

Incoming: Rates are $F: 0, T: 5, G: 0$; ranking: $T > F = G$.

A relation is shown by isolated plotted points:

$(29, 18), (30, 23), (32, 18), (34, 25)$. Is the relation a function of the first coordinate? Justify using the input-output condition.

Context/domain: precalculus

29	18
30	23
32	18
34	25

Your response: _____

Incoming: Rates are $F: -1, T: 2, G: 5$; ranking: $G > T > F$.

A finite table gives $x = 3, f(x) = 14$; $x = 6, f(x) = 19$; $x = 9, f(x) = 17$. The function is continuous on the displayed interval, but no interpolation rule is specified. Evaluate the claim: "The maximum output on $[3, 9]$ is 19." State whether it is supported and identify exactly what the evidence does or does not determine.

Context/domain: precalculus

3	14
6	19
9	17

Your response: _____

Incoming: -2

Sketch one continuous qualitative graph of balloon altitude, measured in meters, versus elapsed time using breakpoints $[0, 4, 6, 9, 13]$. In order, the stages are: Stage A: increases while steepening; Stage B: remains constant; Stage C: decreases while flattening; Stage D: increases at a constant rate. Also satisfy this global constraint: the final level is above the initial level. Label both axes. Exact vertical values are not specified, so show only the required direction, pace, and sign information.

Your response: _____

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Evaluate the supplied statement or method. Say whether it is correct, repair it if it is not, and verify the result exactly. Not every prompt contains an error.

A table gives $x = -5, f(x) = 35$; $x = 1, f(x) = ?$; $x = 5, f(x) = 54$. The average rate of change from $x = -5$ to $x = 1$ is 1. The table also claims an average rate of 3 from $x = 1$ to $x = 5$. After recovering the missing endpoint, decide whether all the information is consistent. Find the missing output and show the signed net-change equation. Student work/claim: The missing output is 41, so every supplied condition is satisfied. Identify the first invalid step or inference in the displayed work. Correct it and complete the original task.

Context/domain: precalculus

-5	35
1	_____
5	54

Diagnose the claim: 'A negative average rate means the function decreased throughout the interval.' Construct an exact one-unit-per-tick polyline counterexample on $[-3, 4]$ with endpoints $(-3, 13)$ and $(4, 8)$, and verify both its average rate and contradictory interior behavior. Student work/claim: A negative average rate means the function decreased throughout the interval. Identify the first invalid step or inference in the displayed work. Correct it and complete the original task.

Context/domain: precalculus

-3	13
4	8

Function Representations and Average Rates of Change

Full Worked Solutions - excerpt

Worked example

Problem. Let $f(x) = kx^2 + 2x$ for real k . Its average rate on $[1, 4]$ is 12. Determine k .

Answer. 2

Explanation and check.

The average rate is $k(1 + 4) + 2 = 5k + 2$. Thus $5k + 2 = 12$ and $k = 2$.

Worked example

Problem. For $f(x) = x^3 - x$ and $a > 0$, simplify the average rate on $[-a, a]$. Explain which symmetry is used.

Answer. $a^2 - 1$

Explanation and check.

The odd function has $f(-a) = -f(a)$. The quotient is $2(a^3 - a\frac{1}{2a}) = a^2 - 1$.