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Chapter 01 - Functions

1. Which description best defines a function?
   a. A relation where each input has exactly one output
   b. A relation where each output has exactly one input
   c. A relation where each input has multiple outputs
   d. A set of unrelated numbers

ANSWER: a
RATIONALE: A function assigns exactly one output to each input.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.1.1 - Identify a function's input and output values and any restrictions on them.
KEYWORDS: Understand
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2. Let $f(x) = 2x + 3$. Evaluate $f(2)$.

ANSWER: 7
RATIONALE: Substitute $x = 2$: $f(2) = 2(2) + 3 = 7$.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.1
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.1.2 - Evaluate a function at a given input value.
KEYWORDS: Analyze | Apply
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3. A graph passes the vertical line test. What does this indicate?
   a. It is linear
   b. It is a function
   c. It is constant
   d. It is not a function

ANSWER: b
RATIONALE: Passing the vertical line test means each input corresponds to exactly one output.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.2
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False

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LEARNING OBJECTIVES: PFAP.1.2.2 - Determine whether a relation represents a function based on a graph, equation, or table of values.
KEYWORDS: Analyze | Apply
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4. A student tracks pages read each day and sees the total number of pages increase daily. What is the sign of the rate of change?

a. Negative
b. Zero
c. Positive
d. Undefined

ANSWER: c
RATIONALE: Increasing output over time indicates a positive rate of change.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.5
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.5.3 - Determine whether a function is increasing or decreasing based on its average rate of change on an interval of input values.
KEYWORDS: Analyze | Apply
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5. Find the slope of the line passing through (2, 3) and (6, 11).

ANSWER: 2
RATIONALE: $m = \frac{11-3}{6-2} = \frac{8}{4} = 2.$
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.4
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.4.1 - Find the slope of a line.
KEYWORDS: Analyze | Apply
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6. Let $f(x) = x^2 - 3x$. Evaluate $f(-1)$

ANSWER: 4
RATIONALE: $f(-1) = (-1)^2 - 3(-1) = 1 + 3 = 4$

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POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.1
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.1.2 - Evaluate a function at a given input value.
KEYWORDS: Analyze | Apply
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7. Evaluate $f(3)$ if $f(x) = 2x - 7$.

a. -1
b. -2
c. -3
d. -4

ANSWER: a
RATIONALE: $f(3) = 2(3) - 7 = 6 - 7 = -1$

POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.1.2 - Evaluate a function at a given input value.
KEYWORDS: Analyze | Apply
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8. Which set of ordered pairs represents a function?

a. {(1,2), (1,3)}
b. {(1,2), (2,3), (3,4)}
c. {(1,2), (2,2), (2,3)}
d. {(1,2), (1,2), (2,3)}

ANSWER: b
RATIONALE: Each input must correspond to exactly one output.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.2
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.2.2 - Determine whether a relation represents a function based on a graph, equation, or table of values.
KEYWORDS: Analyze | Apply

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9. A graph fails the vertical line test. What does this imply?
   a. It is a function
   b. It is not a function
   c. It is constant
   d. It is linear

ANSWER: b
RATIONALE: Failing the vertical line test means one input has multiple outputs.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.2
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.2.2 - Determine whether a relation represents a function based on a graph, equation, or table of values.
KEYWORDS: Analyze | Apply
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10. The temperature in a room drops from 75°F to 68°F over time. What is the sign of the rate of change?
ANSWER: Negative
RATIONALE: A decrease in output corresponds to a negative rate of change.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.5
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.5.3 - Determine whether a function is increasing or decreasing based on its average rate of change on an interval of input values.
KEYWORDS: Analyze | Apply
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11. What is the slope of a horizontal line?
   a. 0
   b. Undefined
   c. 1
   d. -1

ANSWER: a
RATIONALE: A horizontal line has no change in y, so slope is 0.
POINTS: 1

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DIFFICULTY: Easy
REFERENCES: Section 1.4
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.4.1 - Find the slope of a line.
KEYWORDS: Understand
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12. What is the slope of a vertical line?
ANSWER: Undefined
RATIONALE: The slope is undefined because division by zero occurs.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.4
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.4.1 - Find the slope of a line.
KEYWORDS: Understand
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13. What does a constant rate of change indicate?
a. Quadratic function
b. Linear function
c. Exponential function
d. Random behavior
ANSWER: b
RATIONALE: Linear functions have constant rates of change.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.6
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.5.3 - Determine whether a function is increasing or decreasing based on its average rate of change on an interval of input values.
KEYWORDS: Understand
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14. Write the equation of a line with slope 3 and y-intercept -2.
ANSWER: $y = 3x - 2$
RATIONALE: Use slope-intercept form $y = mx + b$.

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POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.4
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.4.2 - Write a linear equation in point-slope form and slope-intercept form.
KEYWORDS: Analyze | Apply
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15. What is the domain of $f(x) = \frac{1}{x-4}$?

a. All real numbers
b. All real numbers except 4
c. All real numbers except 0
d. $x > 4$ only

ANSWER: b
RATIONALE: The denominator cannot equal zero, so $x \neq 4$.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.1.1 - Identify a function's input and output values and any restrictions on them.
KEYWORDS: Understand
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16. What is the range of $f(x) = 2x + 5$?

ANSWER: All real numbers
RATIONALE: A non-constant linear function takes all real values.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.3
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.3.1 - Identify key features of a graph, including
KEYWORDS: Understand
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17. A car's distance from a starting point increases steadily over time. What is the sign of the rate of change?
    a. Negative
    b. Zero
    c. Positive
    d. Undefined

ANSWER: c
RATIONALE: Increasing distance implies a positive rate of change.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.5
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.5.3 - Determine whether a function is increasing or decreasing based on its average rate of change on an interval of input values.
KEYWORDS: Analyze | Apply
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18. A tank is being drained, and the water level decreases over time. What is the sign of the rate of change?
ANSWER: Negative
RATIONALE: Decreasing output corresponds to a negative rate of change.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.5
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.5.3 - Determine whether a function is increasing or decreasing based on its average rate of change on an interval of input values.
KEYWORDS: Analyze | Apply
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19. A company's profit remains constant over time. What is the rate of change?
    a. Positive
    b. Negative
    c. Zero
    d. Undefined

ANSWER: c
RATIONALE: No change in output implies a zero rate of change.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.5
QUESTION TYPE: Multiple Choice

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HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.5.3 - Determine whether a function is increasing or decreasing based on its average rate of change on an interval of input values.
KEYWORDS: Analyze | Apply
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20. Find the midpoint between (2, 4) and (6, 8).
ANSWER: (4, 6)
RATIONALE: $\left(\frac{2+6}{2}, \frac{4+8}{2}\right) = (4,6)$

POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.4
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.4.1 - Find the slope of a line.
KEYWORDS: Analyze | Apply
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21. Find the slope between the points (1, 2) and (3, 6).
a. 1
b. 2
c. 3
d. 4
ANSWER: b
RATIONALE: $m = \frac{6-2}{3-1} = \frac{4}{2} = 2$

POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.4
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.4.1 - Find the slope of a line.
KEYWORDS: Analyze | Apply
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22. A company charges a fixed fee plus a constant cost per item sold. Which type of model best represents this situation?
a. Quadratic
b. Linear

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c. Exponential
d. Constant

ANSWER: b
RATIONALE: A fixed fee plus constant rate indicates a linear model.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.6
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.6.1 - Construct a linear model for a contextual scenario.
KEYWORDS: Analyze | Apply
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23. The sequence 2, 5, 10, 17 follows a pattern. Which model best represents this data?
a. Linear
b. Quadratic
c. Exponential
d. Constant

ANSWER: b
RATIONALE: First differences: 3, 5, 7 → constant second differences.
POINTS: 1
DIFFICULTY: Medium
REFERENCES: Section 1.8
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.8.2 - Calculate a second-difference sequence for a function over equal-length input value intervals, and use it to determine whether the function is quadratic.
KEYWORDS: Analyze | Apply
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24. A data set shows outputs increasing by the same amount for equal increases in input. What type of model describes this?
ANSWER: Linear
RATIONALE: Constant first differences indicate a linear pattern.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.8
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.8.1 - Calculate a first-difference sequence for a function over equal-length input value intervals, and use it to determine whether the function is linear.

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KEYWORDS: Analyze | Apply
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25. Let $f(x) = x^2$. Find the average rate of change from x=1 to x=3.

a. 2
b. 3
c. 4
d. 5

ANSWER: c
RATIONALE: $\frac{9-1}{3-1} = \frac{8}{2} = 4$
POINTS: 1
DIFFICULTY: Medium
REFERENCES: Section 1.5
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.5.1 - Calculate the average rate of change of a function given an interval of input values.
KEYWORDS: Analyze | Apply
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26. A graph rises from left to right across its domain. What does this indicate?

a. Decreasing
b. Constant
c. Increasing
d. Undefined

ANSWER: c
RATIONALE: Rising left to right indicates increasing behavior.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.3
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.3.1 - Identify key features of a graph, including
KEYWORDS: Analyze | Apply
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27. Write the equation of a line with slope 2 that passes through (0, 5).

ANSWER: $y = 2x + 5$
RATIONALE: Use slope-intercept form.
POINTS: 1

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DIFFICULTY: Easy
REFERENCES: Section 1.4
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.4.2 - Write a linear equation in point-slope form and slope-intercept form.
KEYWORDS: Analyze | Apply
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28. A business notices revenue decreases as price increases. What is the sign of the rate of change?
    a. Positive
    b. Negative
    c. Zero
    d. Undefined

ANSWER: b
RATIONALE: Decreasing output implies negative rate of change.
POINTS: 1
DIFFICULTY: Medium
REFERENCES: Section 1.5
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.5.3 - Determine whether a function is increasing or decreasing based on its average rate of change on an interval of input values.
KEYWORDS: Analyze | Apply
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29. Determine the domain of $f(x) = \dfrac{1}{x^2 - 9}$

ANSWER: All real numbers except $x = 3$ and $x = -3$
RATIONALE: Denominator cannot be zero.
POINTS: 1
DIFFICULTY: Medium
REFERENCES: Section 1.1
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.1.1 - Identify a function’s input and output values and any restrictions on them.
KEYWORDS: Analyze | Apply
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30. Find the midpoint between (4, 2) and (10, 6).

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a. (6,4)
b. (7,4)
c. (7,5)
d. (8,4)

ANSWER: b
RATIONALE: Midpoint formula: $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)=\left(\frac{4+10}{2}, \frac{2+6}{2}\right)=(7,4)$

POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.4
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.4.1 - Find the slope of a line.
KEYWORDS: Analyze | Apply
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31. Let $f(x)=3x-5$.Evaluate $f(4)$.

a. 5
b. 7
c. 9
d. 11

ANSWER: b
RATIONALE: Substitute $x=4$:$f(4)=3(4)-5=12-5=7$.

POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.1.2 - Evaluate a function at a given input value.
KEYWORDS: Analyze | Apply
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32. Let $f(x)=x^2+2x$.Evaluate $f(-2)$.

ANSWER: 0
RATIONALE: $f(-2)=(-2)^2+2(-2)=4-4=0$.

POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.1
QUESTION TYPE: Subjective Short Answer

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HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.1.2 - Evaluate a function at a given input value.
KEYWORDS: Analyze | Apply
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33. A graph shows a horizontal line across all x-values. What does this indicate about the function?
    a. Increasing
    b. Decreasing
    c. Constant
    d. Not a function

ANSWER: c
RATIONALE: A horizontal line represents a constant function with no change in output.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.3
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.3.1 - Identify key features of a graph, including
KEYWORDS: Analyze | Apply
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34. Find the slope of the line passing through (0, 1) and (4, 9).
ANSWER: 2
RATIONALE: $m = \frac{9-1}{4-0} = \frac{8}{4} = 2$
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.4
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.4.1 - Find the slope of a line.
KEYWORDS: Analyze | Apply
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35. A function increases as x increases. What is the sign of the rate of change?
    a. Negative
    b. Positive
    c. Zero
    d. Undefined

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ANSWER: b
RATIONALE: Increasing functions have positive rates of change.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.5
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.5.3 - Determine whether a function is increasing or decreasing based on its average rate of change on an interval of input values.
KEYWORDS: Analyze | Apply
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36. Let $f(x) = 2x + 1$.Find the average rate of change from $x = 0$ to $x = 5$.

ANSWER: 2
RATIONALE: $\frac{f(5)-f(0)}{5-0} = \frac{11-1}{5} = 2$
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.5
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.5.1 - Calculate the average rate of change of a function given an interval of input values.
KEYWORDS: Analyze | Apply
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37. A data set shows a constant rate of change between successive values. Which model best represents the data?
    a. Linear
    b. Quadratic
    c. Exponential
    d. Cubic

ANSWER: a
RATIONALE: Constant rate of change indicates a linear model.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.8
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.8.1 - Calculate a first-difference sequence for a function over equal-length input value intervals, and use it to determine whether the function is linear.
KEYWORDS: Analyze | Apply

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38. Write the equation of a line with slope -1 and y-intercept 3.
ANSWER: $y = -x + 3$
RATIONALE: Use slope-intercept form $y = mx + b$.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.4
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.4.2 - Write a linear equation in point-slope form and slope-intercept form.
KEYWORDS: Analyze | Apply
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39. What is the domain of $f(x) = \dfrac{1}{x+2}$?

a. All real numbers
b. All real numbers except -2
c. All real numbers except 2
d. $x > -2$ only

ANSWER: b
RATIONALE: The denominator cannot be zero, so $x \neq -2$.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.1.1 - Identify a function's input and output values and any restrictions on them.
KEYWORDS: Analyze | Apply
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40. Find the midpoint between (0, -2) and (8, 6).
ANSWER: (4, 2)
RATIONALE: $\left(\dfrac{0+8}{2}, \dfrac{-2+6}{2}\right) = (4,2)$
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.4

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QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.4.1 - Find the slope of a line.
KEYWORDS: Analyze | Apply
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41. Let $f(x) = 4x - 1$.Evaluate $f(3)$.

a. 9
b. 10
c. 11
d. 12

ANSWER: c
RATIONALE: $f(3) = 12 - 1 = 11$
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.1.2 - Evaluate a function at a given input value.
KEYWORDS: Analyze | Apply
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42. Let $f(x) = x^2 - 4$.Evaluate $f(2)$.

ANSWER: 0
RATIONALE: $f(2) = 4 - 4 = 0$
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.1
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.1.2 - Evaluate a function at a given input value.
KEYWORDS: Analyze | Apply
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43. A graph shows a line decreasing from left to right. What does this indicate?

a. Increasing
b. Decreasing
c. Constant

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d. Undefined

ANSWER: b
RATIONALE: A decreasing graph falls from left to right.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.3
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.3.1 - Identify key features of a graph, including
KEYWORDS: Analyze | Apply
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44. Find the slope of the line passing through (2, 5) and (6, 13).
ANSWER: 2
RATIONALE: $(13-5)/(6-2)=8/4=2$
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.4
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.4.1 - Find the slope of a line.
KEYWORDS: Analyze | Apply
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45. A function has a rate of change equal to zero. What does this indicate?
a. Increasing
b. Decreasing
c. Constant
d. Undefined

ANSWER: c
RATIONALE: Zero rate of change means no change in output.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.5
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.5.3 - Determine whether a function is increasing or decreasing based on its average rate of change on an interval of input values.
KEYWORDS: Analyze | Apply
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46. Let $f(x) = x + 6$.Find the average rate of change from $x = 2$ to $x = 8$.

ANSWER: 1
RATIONALE: $(14-8)/6 = 1$
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.5
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.5.1 - Calculate the average rate of change of a function given an interval of input values.
KEYWORDS: Analyze | Apply
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47. A data set shows increasing first differences. Which model best fits?
a. Linear
b. Quadratic
c. Exponential
d. Constant

ANSWER: b
RATIONALE: Increasing first differences imply quadratic behavior.
POINTS: 1
DIFFICULTY: Medium
REFERENCES: Section 1.8
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.8.2 - Calculate a second-difference sequence for a function over equal-length input value intervals, and use it to determine whether the function is quadratic.
KEYWORDS: Analyze | Apply
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48. Write the equation of a line with slope 5 and y-intercept -4.
ANSWER: $y = 5x - 4$
RATIONALE: Use $y = mx + b$
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.4
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic

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LEARNING OBJECTIVES: PFAP.1.4.2 - Write a linear equation in point-slope form and slope-intercept form.
KEYWORDS: Analyze | Apply
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49. What is the domain of $f(x) = \frac{1}{x^2 - 1}$?

a. All real numbers
b. All real numbers except 1
c. All real numbers except -1
d. All real numbers except -1 and 1

ANSWER: d
RATIONALE: Denominator cannot be zero.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.1.1 - Identify a function's input and output values and any restrictions on them.
KEYWORDS: Analyze | Apply
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50. Find the midpoint between (-2, 4) and (6, 0).
ANSWER: (2, 2)
RATIONALE: Midpoint formula.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.4
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.4.1 - Find the slope of a line.
KEYWORDS: Analyze | Apply
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51. A data set shows the following values:

x: 1, 2, 3, 4
y: 3, 6, 11, 18

Which model best fits the data?

a. Linear
b. Quadratic

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c. Exponential
d. Constant

ANSWER: b
RATIONALE: First differences are 3, 5, 7, which increase by a constant amount, so second differences are constant, indicating a quadratic model.
POINTS: 1
DIFFICULTY: Medium
REFERENCES: Section 1.8
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.8.2 - Calculate a second-difference sequence for a function over equal-length input value intervals, and use it to determine whether the function is quadratic.
KEYWORDS: Evaluate
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52. Calculate the average rate of change of $f(x) = x^2$ on the interval [1,3].

ANSWER: 4
RATIONALE: $\frac{f(3)-f(1)}{3-1} = \frac{9-1}{2} = \frac{8}{2} = 4$
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.5
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.5.1 - Calculate the average rate of change of a function given an interval of input values.
KEYWORDS: Analyze | Apply
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53. A student claims that the function $f(x) = 2x + 5$ is decreasing because the y-intercept is positive. Is the student correct? Explain.

ANSWER: No; the function is increasing because the slope is positive.
RATIONALE: The sign of the slope determines whether a function increases or decreases, not the y-intercept.
POINTS: 1
DIFFICULTY: Medium
REFERENCES: Section 1.6
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic

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LEARNING OBJECTIVES: PFAP.1.4.2 - Write a linear equation in point-slope form and slope-intercept form.
KEYWORDS: Evaluate
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54. Two functions are described:

Function A has a constant rate of change.
Function B has a changing rate of change.

Which function is best modeled by a quadratic function?

a. Function A
b. Function B
c. Both
d. Neither

ANSWER: b
RATIONALE: Quadratic functions have changing rates of change, while linear functions have constant rates of change.
POINTS: 1
DIFFICULTY: Medium
REFERENCES: Section 1.5
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.5.3 - Determine whether a function is increasing or decreasing based on its average rate of change on an interval of input values.
KEYWORDS: Evaluate
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55. A graph passes the vertical line test but has repeated y-values. A student concludes it is not a function. Is this correct? Explain.
ANSWER: No; a function can have repeated outputs as long as each input has only one output.
RATIONALE: The vertical line test checks for multiple outputs per input, not repeated outputs overall.
POINTS: 1
DIFFICULTY: Medium
REFERENCES: Section 1.2
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.2.2 - Determine whether a relation represents a function based on a graph, equation, or table of values.
KEYWORDS: Evaluate
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56. A data set shows constant first differences. A student models the data using a quadratic function. What is the best

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critique?

a. The student is correct
b. The student should use a linear model
c. The student should use an exponential model
d. There is not enough information

ANSWER: b
RATIONALE: Constant first differences indicate a linear pattern, not quadratic.
POINTS: 1
DIFFICULTY: Medium
REFERENCES: Section 1.8
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.8.1 - Calculate a first-difference sequence for a function over equal-length input value intervals, and use it to determine whether the function is linear.
KEYWORDS: Evaluate
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57. Two models are proposed for a data set:

Model A: Linear
Model B: Quadratic

The data shows increasing first differences. Which model is more appropriate? Explain.

ANSWER: Quadratic; increasing first differences indicate a changing rate of change.

RATIONALE: Linear models require constant first differences, while quadratic models show changing first differences.
POINTS: 1
DIFFICULTY: Medium
REFERENCES: Section 1.8
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.8.2 - Calculate a second-difference sequence for a function over equal-length input value intervals, and use it to determine whether the function is quadratic.
KEYWORDS: Evaluate
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58. A function has an average rate of change of 0 over an interval. Which conclusion is best?

a. The function is increasing
b. The function is decreasing
c. The function has equal values at the endpoints

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d. The function is constant over the interval

ANSWER: c
RATIONALE: A zero average rate of change means the outputs at the endpoints are equal, not necessarily constant throughout the interval.
POINTS: 1
DIFFICULTY: Medium
REFERENCES: Section 1.5
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.5.1 - Calculate the average rate of change of a function given an interval of input values.
KEYWORDS: Evaluate
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59. A student states that all linear functions have a range of all real numbers. Is this always true? Explain.
ANSWER: No; a constant linear function has a single output value, so its range is not all real numbers.
RATIONALE: Only non-constant linear functions have range equal to all real numbers.
POINTS: 1
DIFFICULTY: Medium
REFERENCES: Section 1.6
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.6.1 - Construct a linear model for a contextual scenario.
KEYWORDS: Evaluate
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60. Which statement best explains why a vertical line is not a function?

a. It has no slope
b. It has more than one y-value for a single x-value
c. It is undefined
d. It is constant

ANSWER: b
RATIONALE: A vertical line assigns multiple outputs to a single input, violating the definition of a function.
POINTS: 1
DIFFICULTY: Easy
REFERENCES: Section 1.2
QUESTION TYPE: Multiple Choice
HAS VARIABLES: False
LEARNING OBJECTIVES: PFAP.1.2.2 - Determine whether a relation represents a function based on a graph, equation, or table of values.

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KEYWORDS: Evaluate
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61. A data set is modeled using a linear function, but the rate of change is not constant. What is the best conclusion?
ANSWER: The linear model is not appropriate because the rate of change is not constant.
RATIONALE: Linear models require a constant rate of change, so a changing rate indicates a different model is needed.
POINTS: 1
DIFFICULTY: Medium
REFERENCES: Section 1.6
QUESTION TYPE: Subjective Short Answer
HAS VARIABLES: False
STUDENT ENTRY MODE: Basic
LEARNING OBJECTIVES: PFAP.1.9.3 - Justify whether a linear regression model is appropriate based on its residual plot.
KEYWORDS: Evaluate
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