LESSON MAKER PRO

Graph Shape Detective

Predict a graph, then check it with exact values.

HIGH SCHOOL · A3.G.40

A3.G.40 "Predict the shapes of graphs of exponential, logarithmic, rational, and piece-wise functions, and verify the prediction with and without technology."

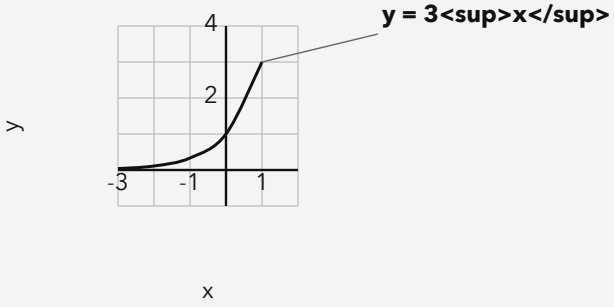
NAME _____ DATE _____

PREDICT, THEN VERIFY

A function's rule can help you predict whether its graph rises, falls, turns, or approaches a line called an asymptote. Check your prediction by finding exact values from the rule and comparing them with points on the graph.

WORKED EXAMPLE

For $y = 3^x$, predict whether the graph rises or falls as x increases. Use the graph to check your prediction and identify its horizontal asymptote.

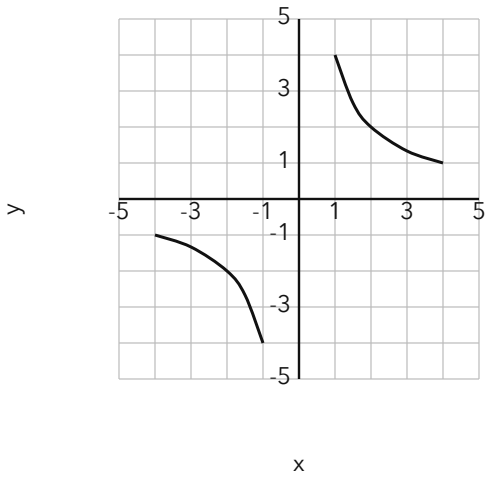


1. Predict a rise because each increase of 1 in x multiplies y by 3.
2. Check the graph: it passes through (0, 1) and (1, 3), so y rises.
3. To the left, the graph gets closer to the x-axis but stays above it.

Answer: The graph rises as x increases. Its horizontal asymptote is y = 0.

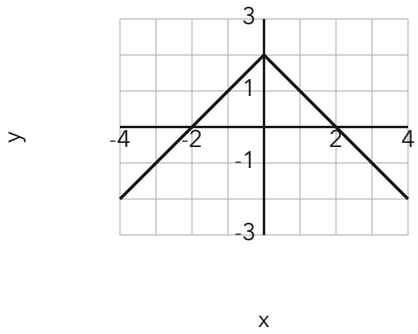
PRACTICE 6 problems

1 Look at the graph. What vertical line does it approach? As x approaches 0 from the left, does y rise or fall without bound?



ANSWER _____

2 Look at the piecewise graph. What is its highest point? Check that it is higher than the plotted values at x = -1 and x = 1.



ANSWER _____

3 Predict whether $y = (1/2)^x$ rises or falls as x increases. Verify by finding y when x = 0 and x = 1.

ANSWER _____

4 Predict whether $y = \log_5(x)$ rises or falls as x increases. Verify by finding y when x = 1 and x = 5.

ANSWER _____

5 For y = 6/(x - 2) + 1, predict the vertical and horizontal asymptotes. Check the horizontal asymptote by finding y when x = 8 and x = 14.

ANSWER _____

6 A piecewise function follows y = x + 1 when x < 2 and y = x - 2 when x ≥ 2. Predict where its graph jumps and how far it jumps. Check both rules at the change.

ANSWER _____

APPLY IT Show your work

1 A student shares a video with 7 friends. The number of views doubles each hour, starting at 7 views when t = 0. Predict whether the graph of views against time rises or falls. Check by finding the views at t = 2 and t = 3.

WORK SPACE

ANSWER _____

2 A club pays $48 to make custom stickers, plus $4 per member for supplies. If x members split the total cost equally, each member pays $C(x) = 48/x + 4$ dollars. Predict whether the graph of cost per member rises or falls as the number of members grows. Check with x = 6 and x = 12.

WORK SPACE

ANSWER _____

CHALLENGE One step up

The graph of $g(x) = \log_2(x - 1) + 2$ is shifted from the graph of $y = \log_2(x)$. Predict its vertical asymptote and two points on its graph. Verify both points by substitution.

WORK SPACE AND ANSWER

ANSWER KEY

Graph Shape Detective

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Look at the graph. What vertical line does it approach? As x approaches 0 from the left, does y rise or fall without bound?	**The vertical asymptote is x = 0. As x approaches 0 from the left, y falls without bound.**
2	Look at the piecewise graph. What is its highest point? Check that it is higher than the plotted values at x = -1 and x = 1.	**The highest point is (0, 2). At x = -1 and x = 1, y = 1, which is lower than 2.**
3	Predict whether $y = (1/2)^x$ rises or falls as x increases. Verify by finding y when x = 0 and x = 1.	**It falls. When x = 0, y = 1; when x = 1, y = 1/2.**
4	Predict whether $y = \log_5(x)$ rises or falls as x increases. Verify by finding y when x = 1 and x = 5.	**It rises. When x = 1, y = 0; when x = 5, y = 1.**
5	For y = 6/(x - 2) + 1, predict the vertical and horizontal asymptotes. Check the horizontal asymptote by finding y when x = 8 and x = 14.	**The asymptotes are x = 2 and y = 1. At x = 8, y = 2; at x = 14, y = 3/2, which is closer to 1.**
6	A piecewise function follows y = x + 1 when x < 2 and y = x - 2 when x ≥ 2. Predict where its graph jumps and how far it jumps. Check both rules at the change.	**The graph jumps down 3 units at x = 2. The first rule approaches 3 there, but the second rule gives y = 0 at x = 2.**

PART 2 · APPLY IT

1. **The graph rises. There are 28 views at t = 2 and 56 views at t = 3.** Use $V(t) = 7 \cdot 2^t$. Substitution gives V(2) = 28 and V(3) = 56, confirming the rise.
2. **The graph falls. The cost is $12 per member for 6 members and $8 per member for 12 members.** Substitute into C(x): C(6) = 48/6 + 4 = 12 and C(12) = 48/12 + 4 = 8. The cost per member falls as the group grows.

CHALLENGE

The vertical asymptote is x = 1. Two points are (2, 2) and (5, 4): $g(2) = \log_2(1) + 2 = 2$, and $g(5) = \log_2(4) + 2 = 4$.

For graph descriptions, accept equivalent wording such as "decreases" for "falls." In the challenge, accept any two correctly verified points in the domain x > 1.