

Log Graph Detectives

Find the features that shape each logarithmic graph.

HIGH SCHOOL • MA.912.AR.5.8

MA.912.AR.5.8 "Given a table, equation or written description of a logarithmic function, graph that function and determine its key features."

NAME _____

DATE _____

KEY FEATURES FIRST

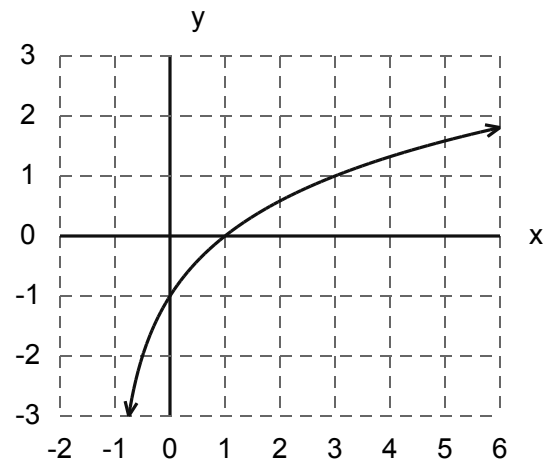
$\log_b(u)=v$ means $b^v=u$, with $b>0$, b not 1 and $u>0$. Use powers of the base to plot points, then draw a smooth curve that approaches its vertical asymptote without touching it. State domain/range, intercepts, increasing/decreasing and sign intervals, and end behavior. R denotes all real numbers; a graph window does not restrict the domain.

WORKED EXAMPLE

Graph $y=\log_2(x+1)-1$. State the asymptote, domain, range and intercepts.

1. Require $x+1>0$, so the domain is $x>-1$ and asymptote $x=-1$.
2. Plot $(0,-1),(1,0),(3,1)$. Continue smoothly with arrows.
3. Every real output is possible; the curve never reaches $x=-1$.

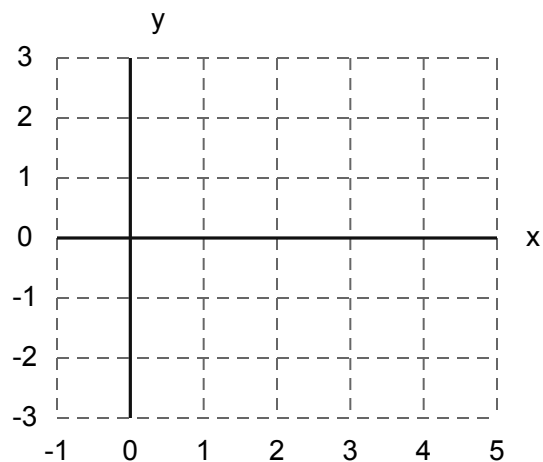
Answer: Asymptote $x=-1$; D: $x>-1$; range R ; intercepts $(1,0),(0,-1)$.



PRACTICE 4 problems

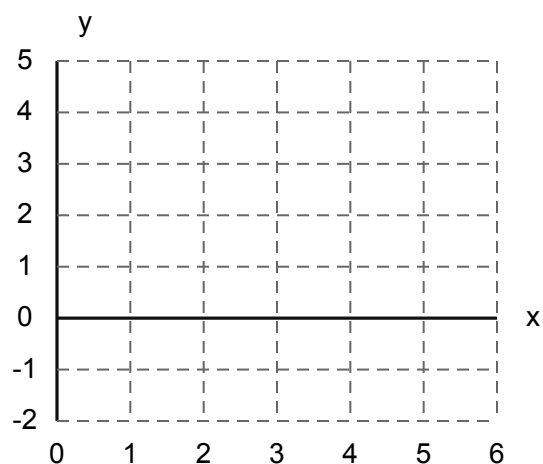
- 1** Graph $y = \log_2(x)$. Give its domain, range, asymptote, intercepts and whether it increases or decreases.

ANSWER _____



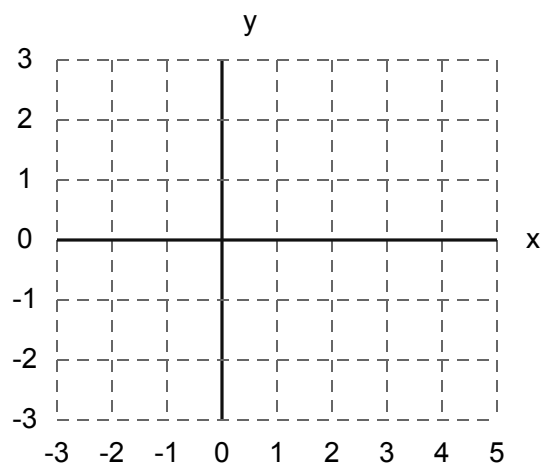
- 2** Graph $y = -\log_2(x-1)+2$. State its domain, range, asymptote and end behavior.

ANSWER _____



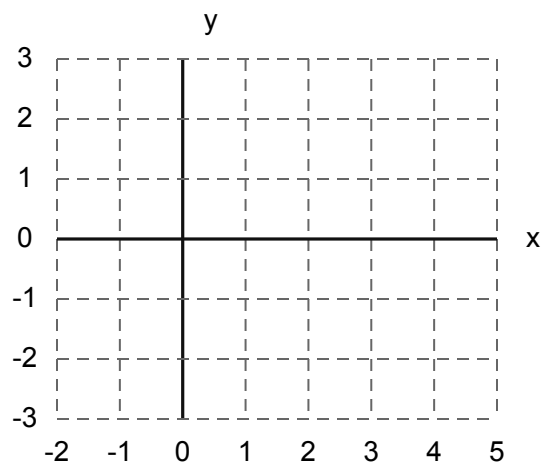
- 3** A table follows $y = \log_2(x-h)$: $x = -1.5, -1, 0, 2$ and $y = -1, 0, 1, 2$. Find h and graph the function. State its asymptote and intercepts.

ANSWER _____



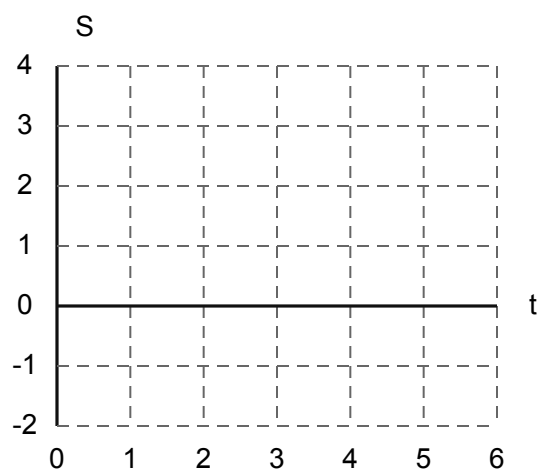
- 4 Graph $y = \log_2(4-x)$. State the domain, asymptote, x/y-intercepts and whether it increases or decreases.

ANSWER _____



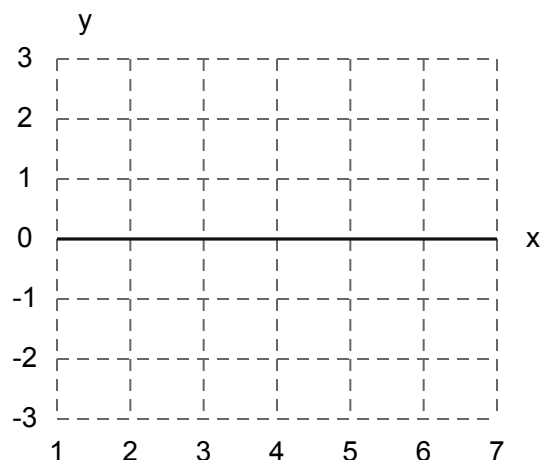
APPLY IT Show your work

- 1 An app defines score $S = \log_2(t) + 1$ for any time $t > 0$ minutes; negative scores are allowed. Graph it. Give the asymptote and the time when $S = 3$.



2

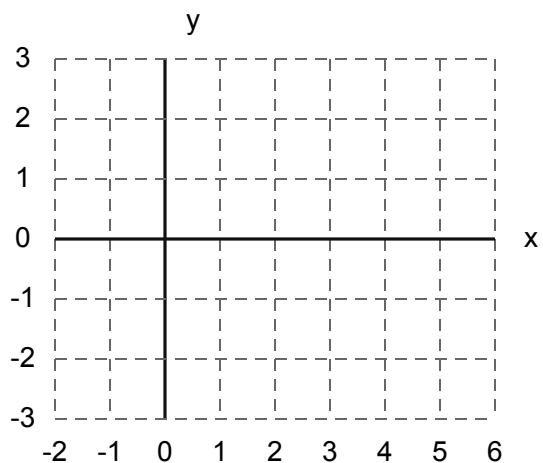
A curve has rule $y = \log_b(x-2)$, $b > 1$, and passes through $(3,0)$, $(4,1)$, $(6,2)$. Find b and graph it. Where is y positive or negative?



CHALLENGE One step up

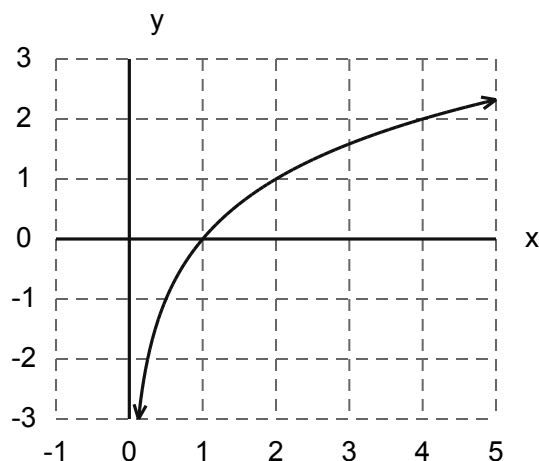
Graph $y = \log_{1/2}(x+1)$. State domain/range, intercepts, monotonic and sign intervals, and behavior near the asymptote and at the right end.

WORK SPACE AND ANSWER



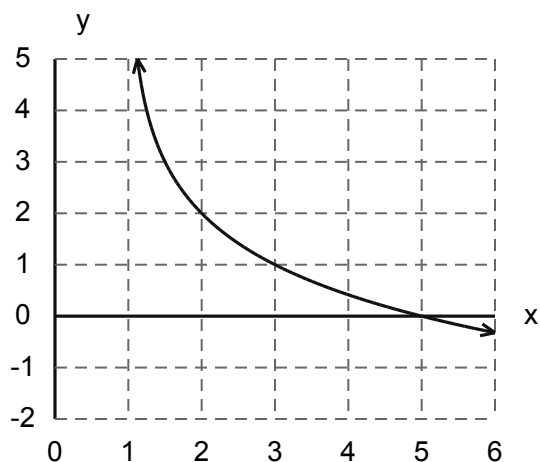
PRACTICE 1

D: $x > 0$; **range** $\mathbb{R}$; **asymptote** $x = 0$; **x-intercept** $(1, 0)$; **no y-intercept**; **increasing**.



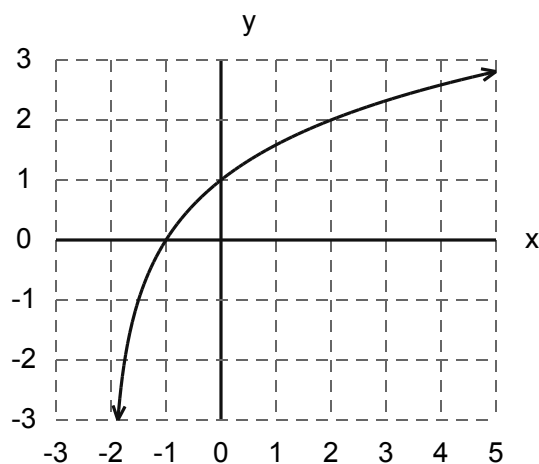
PRACTICE 2

D: $x > 1$; **range** $\mathbb{R}$; **asymptote** $x = 1$. As x approaches 1 from the right, y rises without bound; as x grows, y falls without bound.



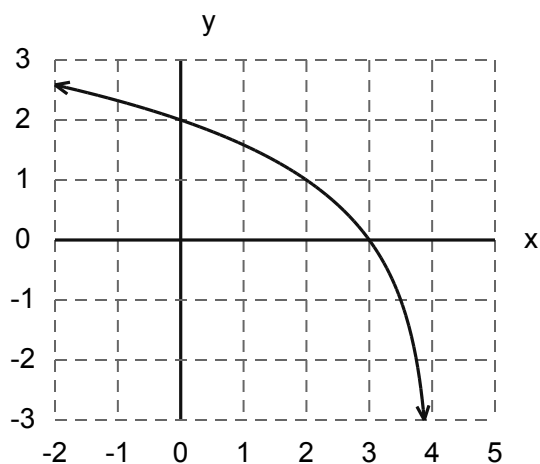
PRACTICE 3

h $= -2$; **$y = \log_2(x+2)$** ; **asymptote** $x = -2$; **intercepts** $(-1, 0), (0, 1)$.



PRACTICE 4

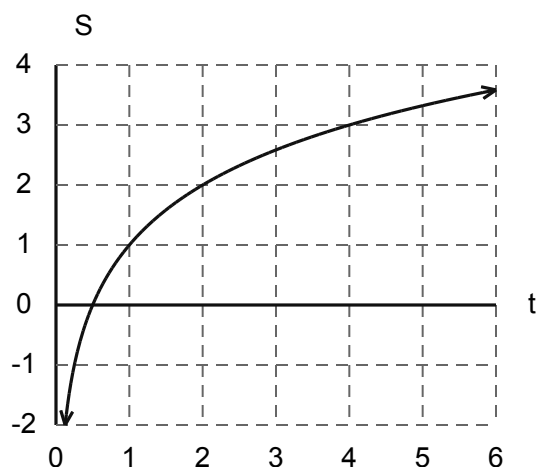
D: $x < 4$; **asymptote** $x = 4$; **intercepts** $(3, 0), (0, 2)$; **decreasing**.



APPLY IT 1

Asymptote $t=0$; $S=3$ at $t=4$ minutes. Domain $t>0$; range R .

$\log_2(t)=2$ means $t=2^2=4$.

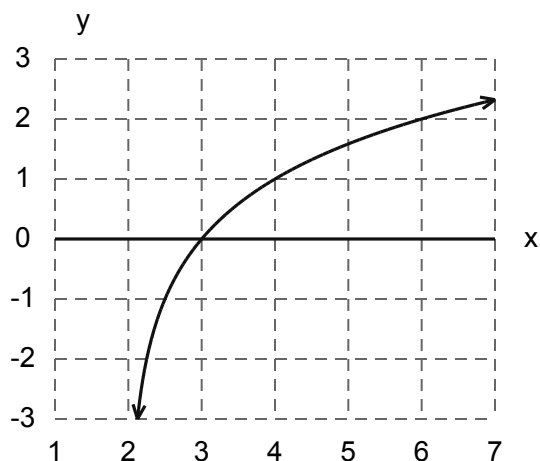


APPLY IT 2

$b=2$; positive $x>3$; negative $2<x<3$; zero at $x=3$.

Domain $x>2$, asymptote $x=2$.

At $(4,1)$, $\log_b(2)=1$, so $b=2$.



CHALLENGE

D: $x>-1$; range R ; both intercepts $(0,0)$. Decreasing; positive $-1<x<0$, negative $x>0$. As x approaches -1 from the right, y rises without bound; as x grows, y falls without bound.

Require smooth logarithmic curves with continuation arrows, correct open domains and no contact with the asymptote. A grid line coinciding with the asymptote is not part of the curve. $\log_b$ denotes base b . Accept equivalent logarithmic expressions; a change of base can change a coefficient without changing the function.

