Graphing Logarithmic Functions: Asymptotes, Domain, and Key Points

Original tasks 1, 2, 3 / complete keys

Task 1

Graph y = log_3(x - 2). State the domain, asymptote, x-intercept, and two key points.

Answer: Domain x > 2; asymptote x = 2; x-intercept (3, 0); key points (5, 1) and (11, 2).

Reason: The argument x - 2 must be positive, so x > 2 and the asymptote is x = 2. Set log_3(x - 2) = 0, so x - 2 = 1 and x = 3. For x - 2 = 3, x = 5 and y = 1. For x - 2 = 9, x = 11 and y = 2.

Check: Substitute (5, 1): log_3(3) = 1. Confirm no plotted x-value is 2 or less.

Task 2

Graph y = log_2(x + 1) - 2. State the domain, asymptote, x-intercept, and two key points.

Answer: Domain x > -1; asymptote x = -1; x-intercept (3, 0); key points (1, -1) and (7, 1).

Reason: Here h = -1, so x + 1 > 0 gives x > -1 and the asymptote is x = -1. Solve log_2(x + 1) - 2 = 0, so log_2(x + 1) = 2, x + 1 = 4, x = 3. For x + 1 = 2, x = 1 and y = 1 - 2 = -1. For x + 1 = 8, x = 7 and y = 3 - 2 = 1.

Check: Substitute (7, 1): log_2(8) - 2 = 3 - 2 = 1. Confirm all x-values exceed -1.

Task 3

Graph y = log_5(x - 4) + 1. State the domain, asymptote, x-intercept, and two key points.

Answer: Domain x > 4; asymptote x = 4; x-intercept (4.2, 0); key points (9, 2) and (29, 3).

Reason: The domain is x > 4 and the asymptote is x = 4. Solve log_5(x - 4) + 1 = 0, so log_5(x - 4) = -1, x - 4 = 1/5, x = 4.2. For x - 4 = 5, x = 9 and y = 1 + 1 = 2. For x - 4 = 25, x = 29 and y = 2 + 1 = 3.

Check: Substitute (9, 2): log_5(5) + 1 = 1 + 1 = 2. Confirm the intercept 4.2 is greater than 4.

Graphing Logarithmic Functions: Asymptotes, Domain, and Key Points

Original tasks 4 / complete keys

Task 4

Graph y = log_2(x - 3) + 2. State the domain, asymptote, whether an x-intercept exists, and two key points.

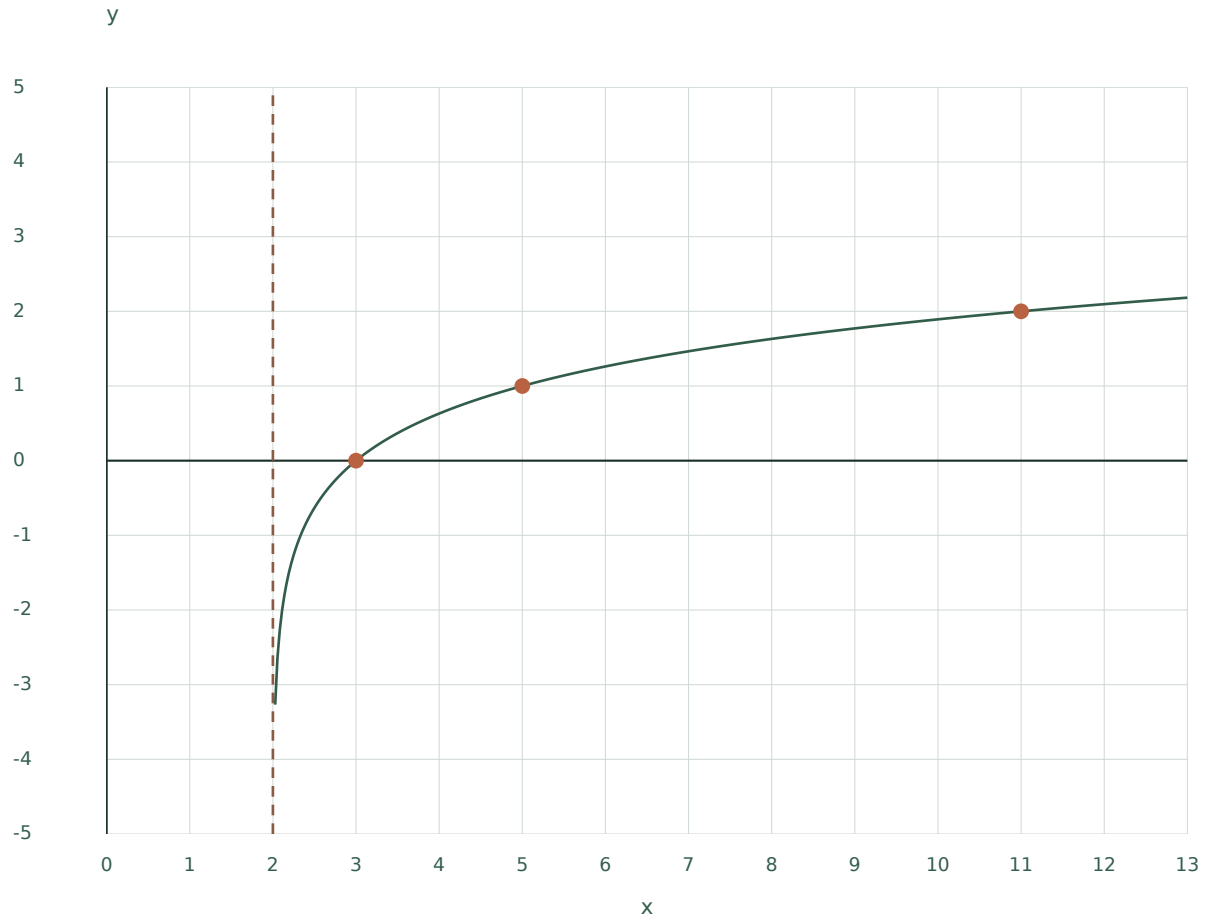
Answer: Domain x > 3; asymptote x = 3; an x-intercept exists at (3.25, 0) because log_2(x - 3) + 2 = 0 gives log_2(x - 3) = -2, so x - 3 = 1/4 and x = 3.25. Key points (4, 2) and (5, 3).

Reason: The domain is x > 3 and the asymptote is x = 3. Solving log_2(x - 3) + 2 = 0 gives log_2(x - 3) = -2, x - 3 = 1/4, x = 3.25, so an intercept does exist at (3.25, 0). For x - 3 = 1, x = 4 and y = 0 + 2 = 2. For x - 3 = 2, x = 5 and y = 1 + 2 = 3.

Check: Substitute (4, 2): log_2(1) + 2 = 0 + 2 = 2. Confirm 3.25 > 3 and that the curve stays above the asymptote's x-value.

Graphing Logarithmic Functions: Asymptotes, Domain, and Key Points

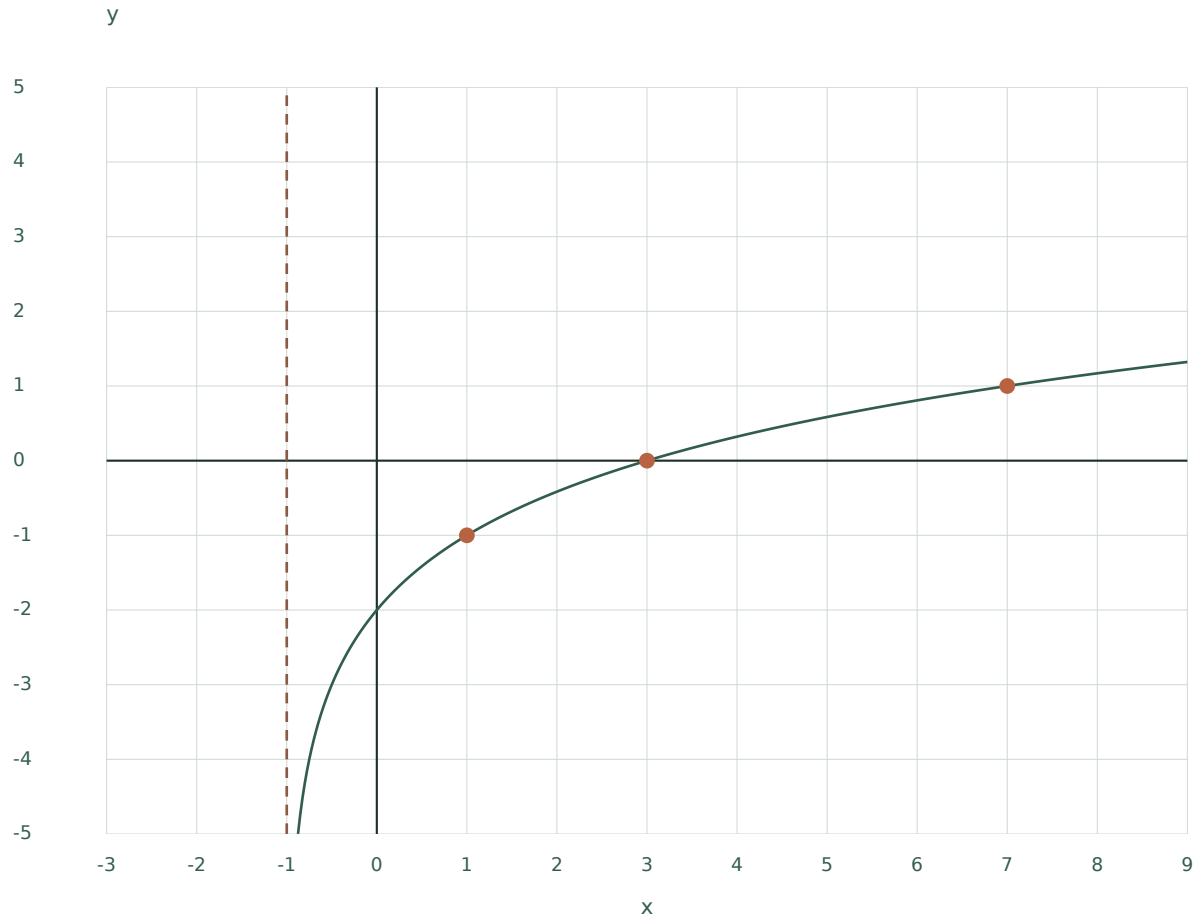
Task 1 / graph key



Dashed brown line is the vertical asymptote x=2. The function is plotted only for x>2. Red marks are the literal source intercept and key points.

Graphing Logarithmic Functions: Asymptotes, Domain, and Key Points

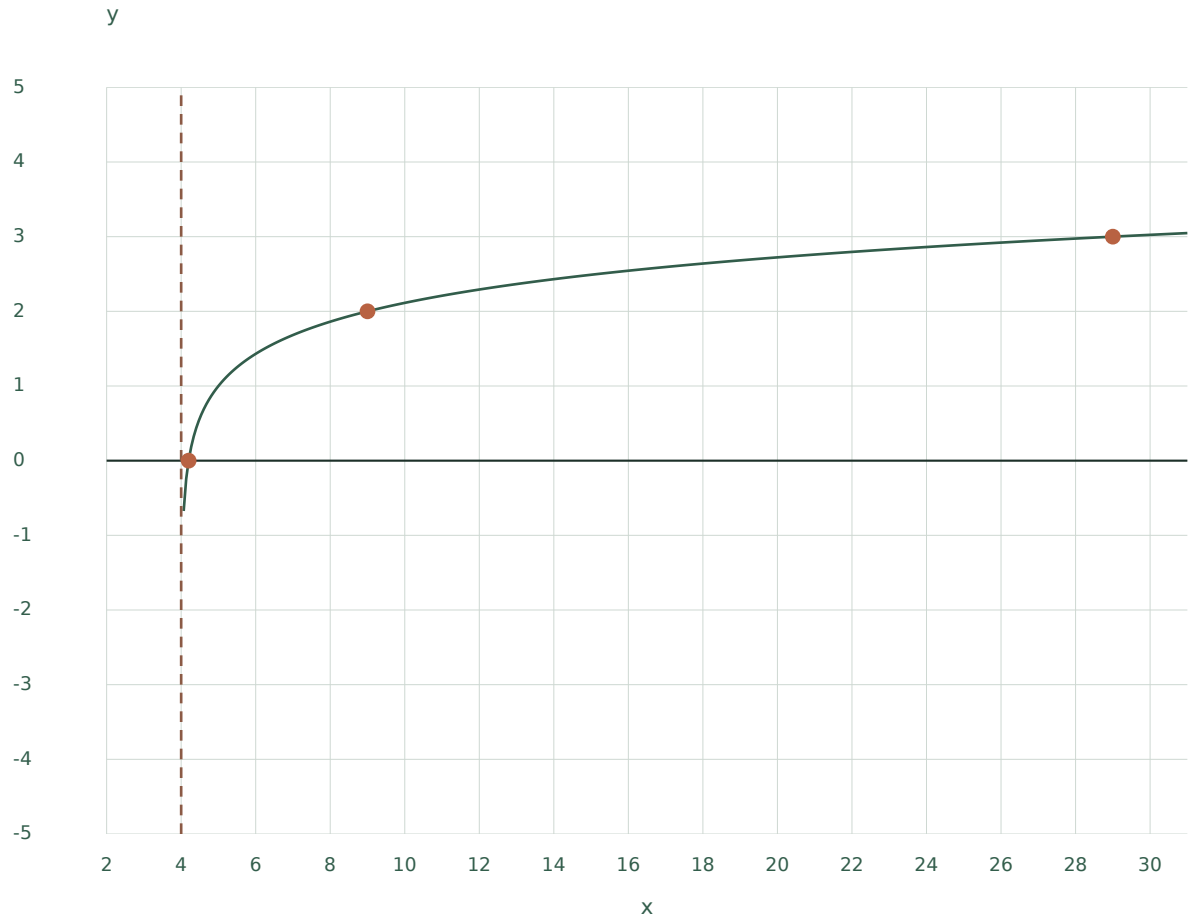
Task 2 / graph key



Dashed brown line is the vertical asymptote x=-1. The function is plotted only for x>-1. Red marks are the literal source intercept and key points.

Graphing Logarithmic Functions: Asymptotes, Domain, and Key Points

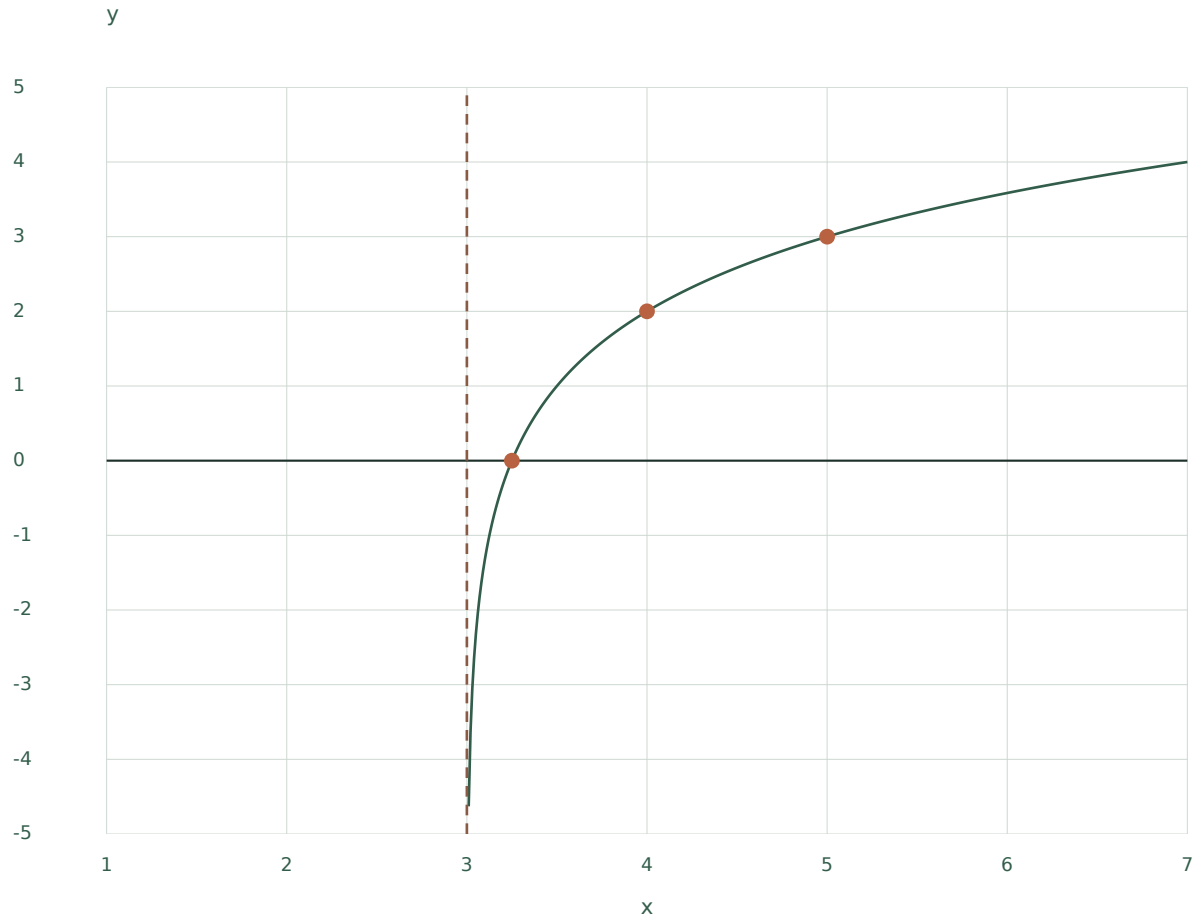
Task 3 / graph key



Dashed brown line is the vertical asymptote x=4. The function is plotted only for x>4. Red marks are the literal source intercept and key points.

Graphing Logarithmic Functions: Asymptotes, Domain, and Key Points

Task 4 / graph key



Dashed brown line is the vertical asymptote x=3. The function is plotted only for x>3. Red marks are the literal source intercept and key points.

Graphing Logarithmic Functions: Asymptotes, Domain, and Key Points

Source rubric / reflection

- [ ] Asymptote drawn as a dashed vertical line and labeled with its equation.
- [ ] Domain stated correctly as an inequality.
- [ ] x-intercept found by solving the equation, not estimated only from the graph.
- [ ] At least three key points plotted with correct ordered pairs.
- [ ] Curve is smooth, increasing for $b > 1$, and never touches the asymptote.
- [ ] Check step shows substitution of one point into the equation.
- [ ] Valid alternative plotting conventions are accepted if the asymptote, domain, intercept, and key points are correct and clearly labeled.

Reflection: What did you check, what did you change, and what will you try next?