

AP Calculus AB - Infinite Limits and Asymptotes - Test Answer Key

Common Core AP CALC AB 1.13, AP CALC AB 1.14, AP CALC AB 1.15 · maths-pdf.fr/en/

Use this answer key to score the asymptotes test out of 20 points. Each solution shows the work and a scoring guide that says how the points are awarded. Give partial credit for a correct setup, a correct derivative or integral, and a correct final statement with units where they apply.

AP Calculus AB · Common Core State Standards: **AP CALC AB 1.13, AP CALC AB 1.14, AP CALC AB 1.15**

Question 1 - One-sided infinite limits [2 pts]

From the right, $x-5 > 0$ is small, so $\frac{-2}{x-5} \rightarrow -\infty$. From the left, $x-5 < 0$, so the quotient goes to ∞ .

Final answer: $-\infty$ from the right; ∞ from the left.

Scoring: 1 point for each one-sided limit.

Question 2 - Vertical asymptotes [2 pts]

$\frac{x-1}{(x-1)(x+1)} = \frac{1}{x+1}$. The vertical asymptote is $x = -1$, and there is a hole at $x = 1$ (at $(1, \frac{1}{2})$).

Scoring: 1 point for the asymptote; 1 point for identifying the hole.

Question 3 - Limits at infinity [3 pts]

- a. $\frac{7}{2}$
- b. 0
- c. ∞

Reasons: (a) equal degrees give the ratio of leading coefficients; (b) denominator degree is larger; (c) numerator degree is larger.

Scoring: 1 point per limit.

Question 4 - Both directions [2 pts]

For large $|x|$, $\sqrt{x^2+1} \approx |x|$. As $x \rightarrow \infty$ the quotient approaches 2; as $x \rightarrow -\infty$ it approaches -2 .

Final answer: 2 and -2 .

Scoring: 1 point for each limit.

Question 5 - Reading asymptotes [3 pts]

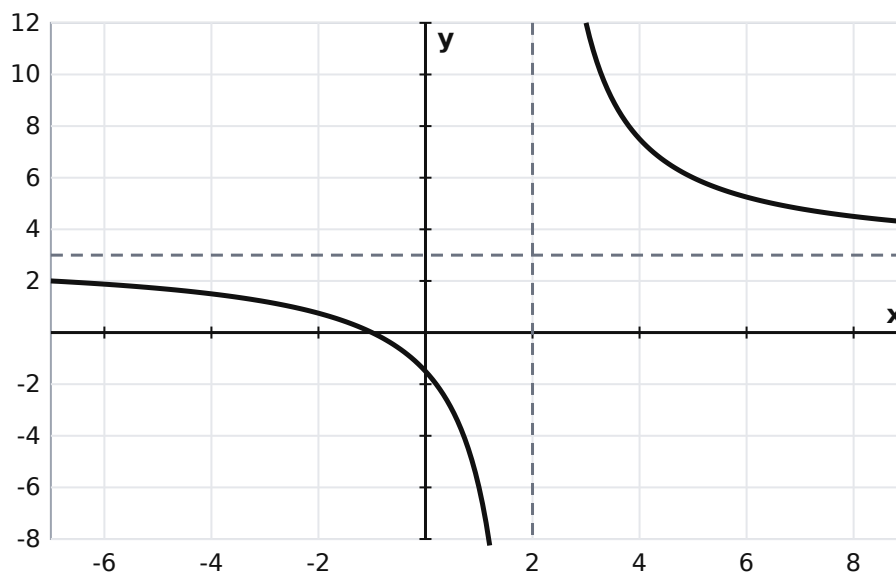
- a. ∞ : the outputs grow without bound on both sides.
- b. 1 and 1.
- c. $x = -2$ (vertical) and $y = 1$ (horizontal).

Scoring: 1 point per part.

Question 6 - All asymptotes [3 pts]

Vertical asymptote: $x = 2$ (numerator $9 \neq 0$). Horizontal asymptote: $\frac{3}{1} = 3$, so $y = 3$.

x-intercept: $3x + 3 = 0$ gives $(-1, 0)$. y-intercept: $r(0) = \frac{3}{-2} = -1.5$, so $(0, -1.5)$.



The graph of $r(x) = 3(x + 1)/(x - 2)$.

Scoring: 1 point for each asymptote; 1 point for both intercepts.

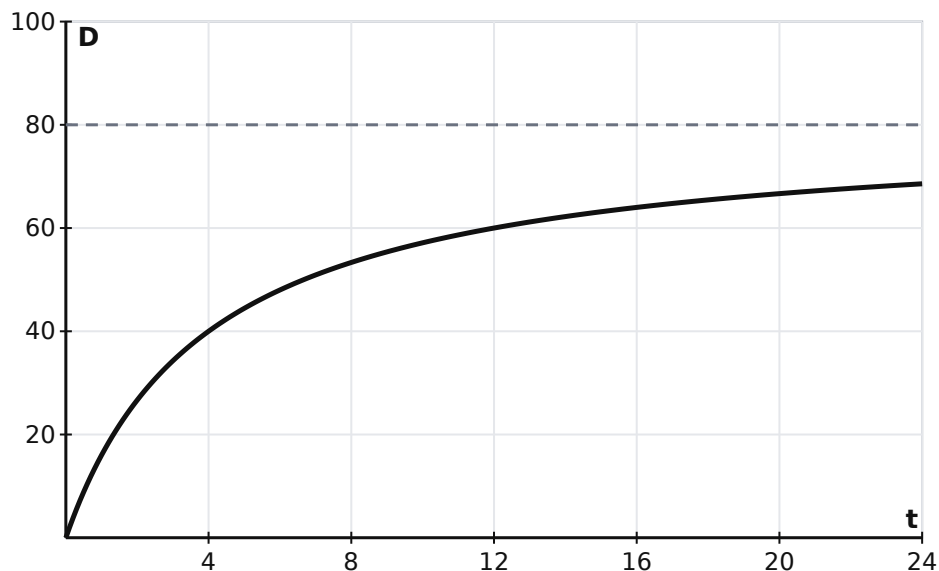
Question 7 - Average cost [2 pts]

- a. $\frac{90+90}{30} = 6$, so **\\$6** per loaf.
b. $A(n) = 3 + \frac{90}{n} \rightarrow 3$: the average cost approaches **\\$3** per loaf, the cost of making one more loaf.

Scoring: 1 point per part.

Question 8 - Leveling off [3 pts]

- a. $\frac{320}{8} = 40$ rpm.
b. 80: equal degrees give $\frac{80}{1}$.
c. The fan speed approaches 80 rpm but the model never exceeds it; the line $D = 80$ is a horizontal asymptote.



Distance a drone travels, approaching a limit.

Scoring: 1 point per part.

Total

20 points