

Solutions

3.1 Radical Equations and Extraneous Solutions

3.1.1. Solve $\sqrt{x+1} = 3$.

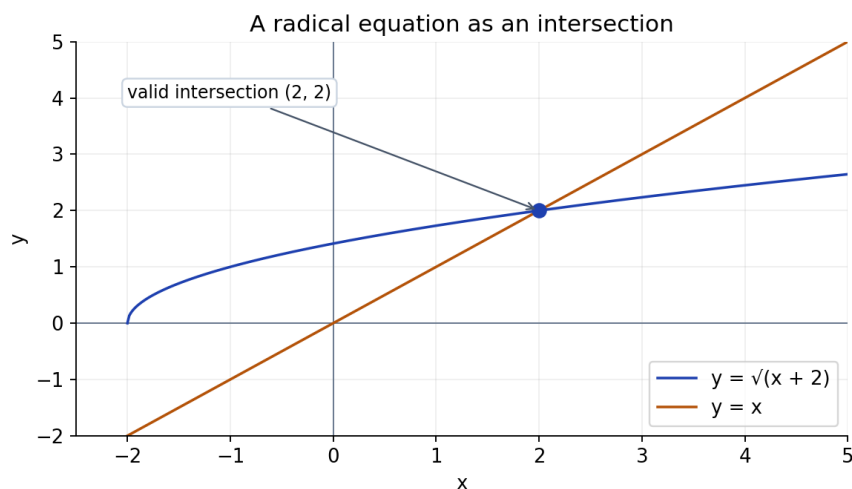
Solution. $x + 1 = 9$, hence $x = 8$, which checks.

3.1.2. Solve $\sqrt{x} = x - 2$.

Solution. Require $x \geq 2$. Squaring gives $x^2 - 5x + 4 = 0$, so candidates are 1 and 4. Only $x = 4$ satisfies the original.

3.1.3. Use the graphs of $y = \sqrt{x+2}$ and $y = x$ to solve $\sqrt{x+2} = x$.

Solution. Squaring gives $(x-2)(x+1) = 0$. The radical is nonnegative, so $x = -1$ fails. The valid intersection is $(2, 2)$.



The intersection is $(2, 2)$; the squared-equation candidate -1 is extraneous.

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3.2 Asymptotes and Holes

3.2.1. Simplify $(x^2 - 4)/(x - 2)$ and state the hole.

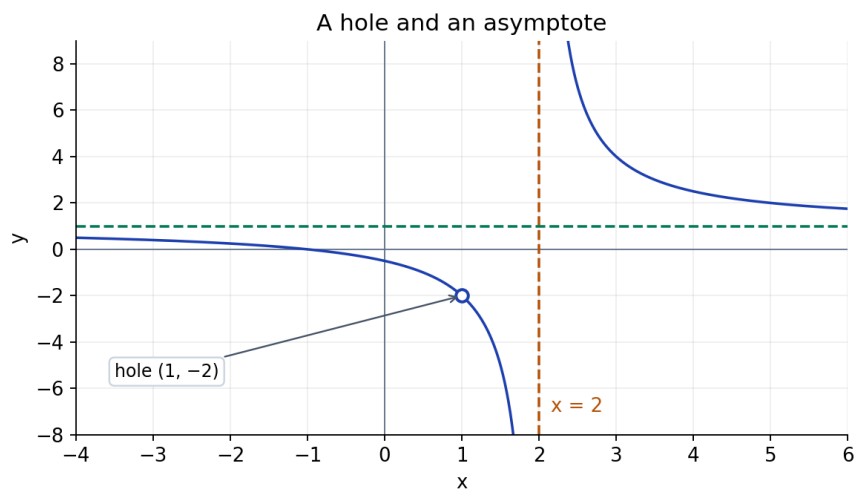
Solution. The reduced expression is $x + 2$, with $x \neq 2$. The hole is $(2, 4)$.

3.2.2. Find the excluded input and vertical asymptote of $1/(x + 3)$.

Solution. $x = -3$ is excluded and is a vertical asymptote.

3.2.3. For the graphed function $f(x) = (x^2 - 1)/((x - 1)(x - 2))$, state the hole and vertical asymptote.

Solution. Reducing gives $(x + 1)/(x - 2)$, with $x \neq 1, 2$. The hole is $(1, -2)$ and the vertical asymptote is $x = 2$.



The hole is $(1, -2)$; the vertical asymptote is $x = 2$.

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3.3 End Behavior of Rational Functions

3.3.1. Find the horizontal asymptote of $(2x + 1)/(x^2 + 4)$.

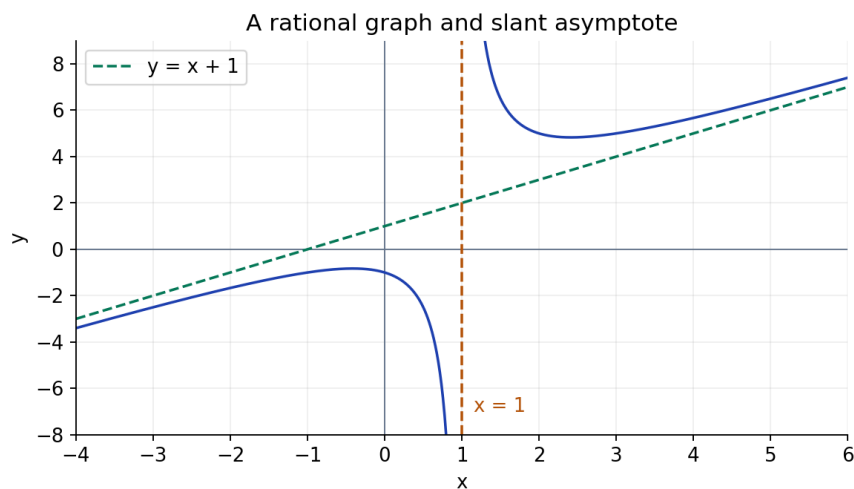
Solution. The numerator degree is smaller, so the horizontal asymptote is $y = 0$.

3.3.2. Find the horizontal asymptote of $(5x^3 - 1)/(2x^3 + x)$.

Solution. Equal degrees give $y = 5/2$.

3.3.3. Use the graph of $y = (x^2 + 1)/(x - 1)$ to identify its slant and vertical asymptotes.

Solution. Division gives $y = x + 1 + 2/(x - 1)$. The slant asymptote is $y = x + 1$; the vertical asymptote is $x = 1$.



The asymptotes are $x = 1$ and $y = x + 1$.