4.6   1,3

Asymptotes: 19, 22, 32, 37, 38

1. $f(x) =$ graph (c). $f'(x) =$ graph (d). $f''(x) =$ graph (b)

   graph (a) is the unrelated function $g(x)$.

3. $f(x) =$ graph (c) $g(x) =$ graph (b) $h(x) =$ graph (d). $k(x) =$ graph (a)

19. $f(x) = \dfrac{x^2 - 4}{x+1}$

   • vertical asymptote $x = -1$ (denominator goes to 0, numerator is finite)
   • oblique asymptote $y = x - 1$ (two-sided)

$$f(x) = \frac{x^2-4}{x+1} = \frac{(x^2+x)+(-x-4)}{x+1} = x - \frac{x+4}{x+1} = x - 1 - \underbrace{\frac{3}{x+1}}_{0 \text{ as } x \to \pm\infty}$$

22. $f(x) = \dfrac{x^2-1}{x^2} = 1 - \dfrac{1}{x^2}$

   • vertical asymptote $x = 0$
   • horizontal asymptote $y = 1$

32. $f(x) = e^{-x} \sin(x)$. $(x \geq 0)$.

   • horizontal asymptote $y = 0$.

37. $f(x) = \dfrac{1}{\sqrt{4-x^2}}$

   vertical asymptotes $x = 2$ and $x = -2$

38. $f(x) = \dfrac{x}{\sqrt{x^2+1}}$

   $\lim\limits_{x \to +\infty} \dfrac{x}{\sqrt{x^2+1}} = \lim\limits_{x \to +\infty} \dfrac{x}{x\sqrt{1+\frac{1}{x^2}}} = 1$

   $\lim\limits_{x \to -\infty} \dfrac{x}{\sqrt{x^2+1}} = \lim\limits_{x \to -\infty} \dfrac{x}{|x|\sqrt{1+\frac{1}{x^2}}} = -1$

   horizontal asymptotes $y = 1$.
                           $y = -1$.