101. Calculate the following limits:

    (a) $\lim\limits_{x\to\infty} \dfrac{3x^3 - 2x + 1}{6x^3 + x^2 + x + 19}$

    (b) $\lim\limits_{x\to\infty} \dfrac{3x^2 - 2x + 1}{6x^3 + x^2 + x + 19}$

    (c) $\lim\limits_{x\to 0} \left(\dfrac{8x - 1}{x - x^2} + \dfrac{1}{x} \right)$

    (d) $\lim\limits_{n\to\infty} \left(\sqrt{9n^2 + 5n} - 3n \right)$

    (e) $\lim\limits_{n\to\infty} (4^n + 1)^{1/4}$

    (f) $\lim\limits_{n\to\infty} (4^n + n)^{1/n}$

    (g) $\lim\limits_{x\to 7} \dfrac{x^2 - 4x - 21}{x^2 - 11x + 28}$

    (h) $\lim\limits_{x\to 0} \dfrac{x^3 - 8x^2 + 3x + 5}{x^9 - 6x^5 + x^4 - 12x + 1}$

102. Suppose $\lim\limits_{x\to 10^-} f(x) = 2$.

    (a) If the graph of f has a hole at $x = 10$, is it possible to know the value of $\lim\limits_{x\to 10^+} f(x)$ from only this information?

    (b) If the graph of f has a hole at $x = 10$, is it possible to know the value of $f(2)$ from only this information?

    (c) If the graph of f has a jump at $x = 10$, is it possible to know the value of $\lim\limits_{x\to 10^+} f(x)$ from only this information?

    (d) If the graph of f has a vertical asymptote at $x = 10$, is it possible to know the value of $\lim\limits_{x\to 10^+} f(x)$ from only this information?

    (e) If the graph of f has a vertical asymptote at $x = 10$, is it possible to know the value of $\lim\limits_{x\to 10^+} |f(x)|$ from only this information?

103. Match the functions with their graphs:
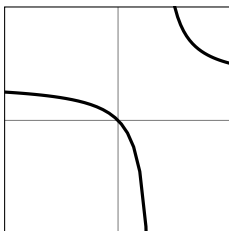
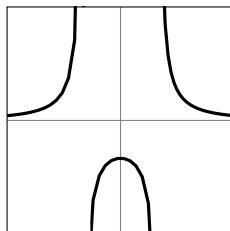   (a) $\dfrac{1}{x^2 - 1}$ (c) $\dfrac{x - 1}{x^2 - 1}$ (b) $\dfrac{x^3}{x - 1}$ (d) $\dfrac{x}{x - 1}$
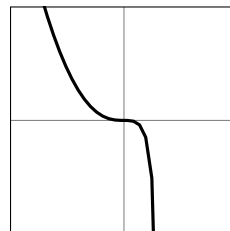
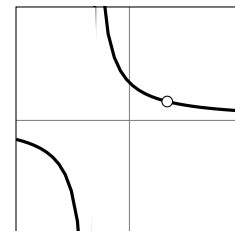   (I)   (II)   (III)   (IV)

104. At $x = 9$, does the function

$$f(x) = \begin{cases} 2x - 1 & \text{if } x \le 1, \\ \log_3(x) & \text{if } 1 < x < 9, \\ \sqrt{x} & \text{if } x \ge 9 \end{cases}$$

have a jump, hole, vertical asymptote, or none of these?

105. For which value(s) of the parameter a does the function
$$f(x) = \frac{x^2 - a}{x^2 + a}$$
have a vertical asymptote at $x = 2$?

106. For which value(s) of the parameter a is the function from Task 105 continuous?

107. Which limit expression below gives the derivative of x^3 at the point $x = 2$?

(A) $\lim\limits_{x \to 2} \dfrac{x^3 - 8}{x}$

(B) $\lim\limits_{h \to 0} \dfrac{h^3 - 8}{h}$

(C) $\lim\limits_{h \to 0} \dfrac{(2 + h)^3 - 8}{h}$

(D) $\lim\limits_{h \to 0} \dfrac{(2 + h)^3 - h^3}{h}$

108. (a) Find $\left(x^{10} + 100x + 1000\right)'$.

(b) Find $D\left[9x + \sqrt{9x}\right]$.

(c) Find $\dfrac{d}{dx}\left[(2x + 3)^2\right]$.

(d) Find $\dfrac{dy}{dx}$ for $y = \dfrac{x + 12}{2x}$.

109. Calculate $f'(2)$ for the function $f(x) = x^4 + 4x$.

110. Find the *slope* of the tangent line to $y = x^4 + 4x$ at the point $(2, 24)$.

111. Give an *equation* for the tangent line to $y = x^4 + 4x$ through the point $(2, 24)$.

112. Give an equation for the tangent line to $y = \dfrac{1}{\sqrt{x}}$ at $x = 4$.