1. 1D-1

   (a) function continuie at x = 0.

   $$\lim_{x \to 0} \frac{4}{x-1} = -4$$

   (b) function continuie at x = 2.

   $$\lim_{x \to 2} \frac{4x}{x+1} = \frac{8}{3}$$

   (c) function not continuie at x = 2. undefined.

   (d) function not continuie at x = 2. going to $-\infty$

   (e) function not continuie at x = 2. going to $+\infty$

   (f)

   $$\lim_{x \to +\infty} \frac{4x^2}{x-2} = +\infty$$

   (g)

   $$\lim_{x \to +\infty} \frac{4x^2}{x-2} - 4x = \lim_{x \to +\infty} \frac{4x^2 - 4x^2 + 8x}{x-2}$$
   $$= \lim_{x \to +\infty} \frac{8}{1 - \frac{2}{x}}$$
   $$= 8$$

   (h)

   $$\lim_{x \to +\infty} \frac{x^2 + 2x + 3}{3x^2 - 2x + 4} = \lim_{x \to +\infty} \frac{(1 + \frac{2}{x} + \frac{3}{x^2})}{3 - \frac{2}{x} + \frac{4}{x^2}}$$
   $$= \frac{1}{3}$$

   (i)

   $$\lim_{x \to 2} \frac{x-2}{x^2 - 4} = \lim_{x \to 2} \frac{x-2}{(x-2)(x+2)}$$
   $$= \lim_{x \to 2} \frac{1}{x+2}$$
   $$= \frac{1}{4}$$

2. 1D-2

   (a) $\lim_{x \to 0+} \sqrt{x} = 0$, $\lim_{x \to 0-} \sqrt{x}$ is undefined

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3. 1D-3

   (a) infinite discontinuity at $x = -2$
   (b) infinite discontinuity at $x = 0 + k\pi$
   (c) infinite discontinuity at x =0
   (d) removable discontinuity at x =0
   (e) jump discontinuity at x = 0
   (f) removable discontinuity at x = 0

4. 1D-5

   (a) if f(x) continuous then $\lim_{x \to 1} f(x) = f(1)$

   $$\lim_{x \to 1-} x^2 = 1$$

   $$\lim_{x \to 1+} ax + b = a$$

   $$\lim_{x \to 1-} = \lim_{x \to 1+}$$
   $$1 = a$$

   $f(1) = b$, $b = 1$ too. and $a = 1, b = 1$

   (b)

   $$f'(x) = \begin{cases} a, x >= 1 \\ 2x, x < 1. \end{cases}$$

   if f'(x) continuous then $\lim_{x \to 1} f'(x) = f'(1)$

   $$\lim_{x \to 1-} 2x = 2$$

   $$\lim_{x \to 1+} a = a$$

   so a = 2, $f'(1) = \lim_{x \to 1} f'(1)$

5. 1D-6

   (a) $f(x)$ is continuous at $x = 0$

   $$\lim_{x \to 0} f(x) = f(0)$$
   $$\lim_{x \to 0-} f(x) = \lim_{x \to 0+} f(x)$$

   $$b = 1a = 4$$

(b) $f(x)$ is continuous at $x = 1$

$$\lim_{x \to 1} f(x) = f(1)$$
$$\lim_{x \to 1-} f(x) = \lim_{x \to 1+} f(x)$$
$$f'(1) = C$$

$$a + b = 6$$
$$b = 0$$
$$a = 6$$