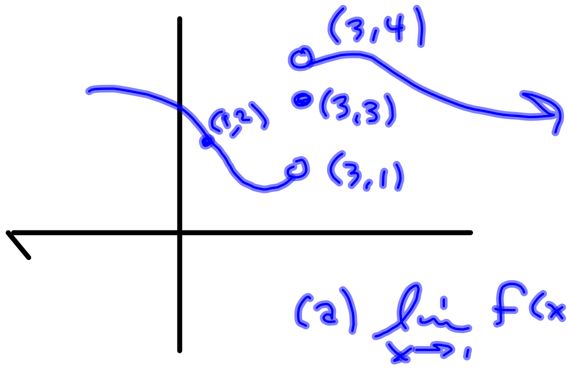
§1.3 #51

§1.5 # 5 How to show




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

(b) $\lim_{x\to 3^-} f(x) = 1$

(c) $\lim_{x\to 3^+} f(x) = 4$

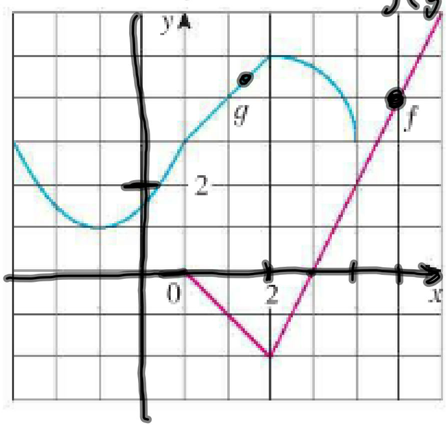
(d) $\lim_{x\to 3} f(x)$ $\nexists$ b/c left- & right-hand limits disagree.

(e) $f(3) = 3$

**51.** Use the given graphs of $f$ and $g$ to evaluate each expression, or explain why it is undefined.

(a) $f(g(2))$ (b) $g(f(0))$ (c) $(f \circ g)(0)$

(d) $(g \circ f)(6)$ (e) $(g \circ g)(-2)$ (f) $(f \circ f)(4)$




$g(g(-2)) = g(1.5) = 4.5$ (approx)

$f(g(2))$

$= f(5) = 4$

§1.6 # 18

$$\lim_{h \to 0} \frac{(2+h)^3 - 8}{h}$$

$$\begin{array}{ccccccccc} & & & & 1 & & & & \\ & & & 1 & & 1 & & & \\ & & 1 & & 2 & & 1 & & \\ & 1 & & 3 & & 3 & & 1 & \\ 1 & & 4 & & 6 & & 4 & & 1 \end{array}$$

$(a+b)^2 = 1a^2 + 2ab + b^2$

$$\frac{(2+h)^3 - 8}{h} = \frac{2^3 + 3(2)^2(h) + 3(2)(h)^2 + h^3 - 8}{h}$$

$$= \frac{8 + 12h + 6h^2 + h^3 - 8}{h} = \frac{12h + 6h^2 + h^3}{h} = \frac{h(12 + 6h + h^2)}{h}$$

$$= 12 + 6h + h^2 \xrightarrow{h \to 0} \boxed{12}$$

The slope of $f(x) = x^3$ @ $x = 2$

$(a+b)^3 = 1a^3b^0 + 3a^2b^1 + 3ab^2 + 1b^3$

$$x^n - 1 = (x-1)(x^{n-1} + x^{n-2} + \dots + x + 1)$$

$$x^7 - 1 = (x-1)(x^6 + x^5 + \dots + x + 1)$$

$$x^2 - 1 = (x-1)(x+1)$$

$$x^3 - 1 = (x-1)(x^2 + x + 1)$$

$$x^3 - y^3 = (x-y)(x^2 + xy + y^2)$$

$f(x) = x^3$

$f'(x) = 3x^2$

$f'(2) = 12$

$x = 2+h,\ y = 2$

$$\frac{(2+h)^3 - 8}{h} = \frac{(2+h)^3 - 2^3}{h} = \frac{\big((2+h) - 2\big)\big((2+h)^2 + (2+h)(2) + 2^2\big)}{h}$$

$$= \frac{h\,(4 + 4h + h^2 + 4 + 2h + 4)}{h}$$

$$= 12 + 4h + h^2 \xrightarrow{h \to 0} \boxed{12}$$

$$|x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{if } x < 0 \end{cases}$$

§1.7

$\lim_{x \to 3} f(x) = 7$ means I can make $f(x)$ $\underbrace{\text{arbitrarily close to } y=7}_{|f(x)-7| < \varepsilon \text{ for any small } \# \varepsilon.}$ whenever

$\underbrace{x \text{ is close to } x=3 \ \boxed{\text{without letting } x=3}}_{0 < |x-3| < \delta \text{ for some small } \# \delta}$

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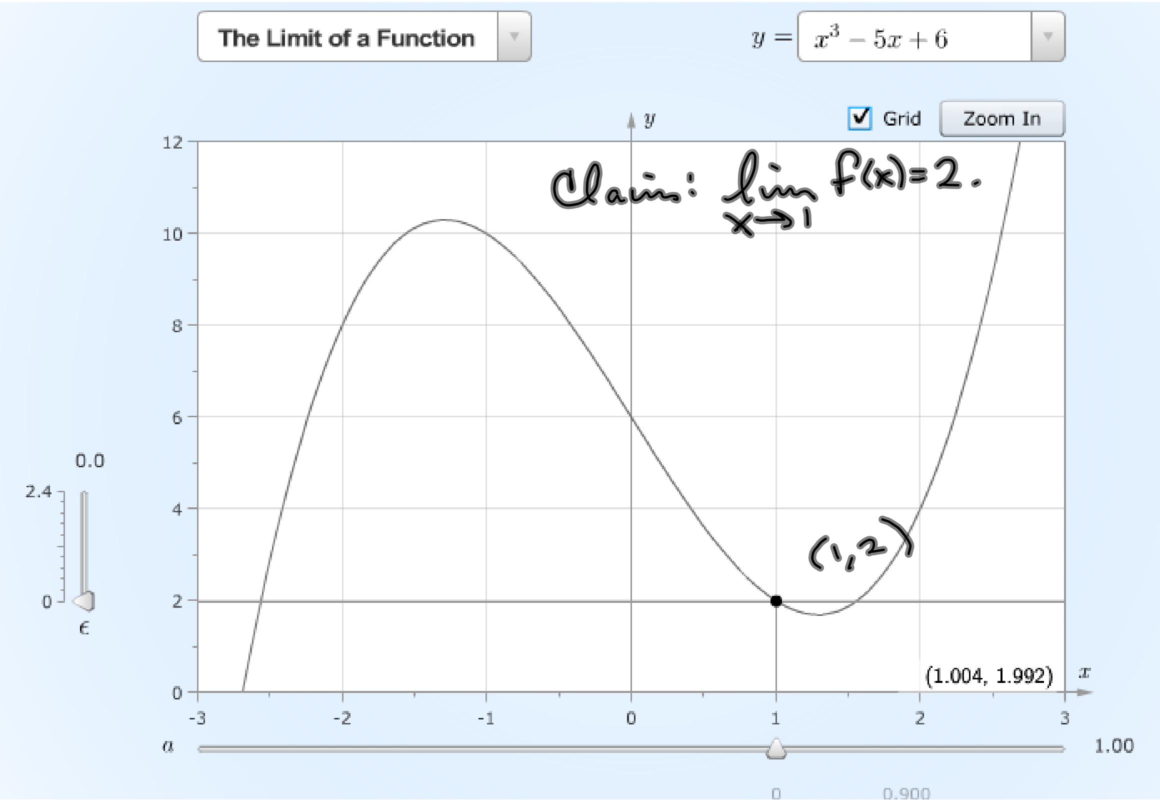


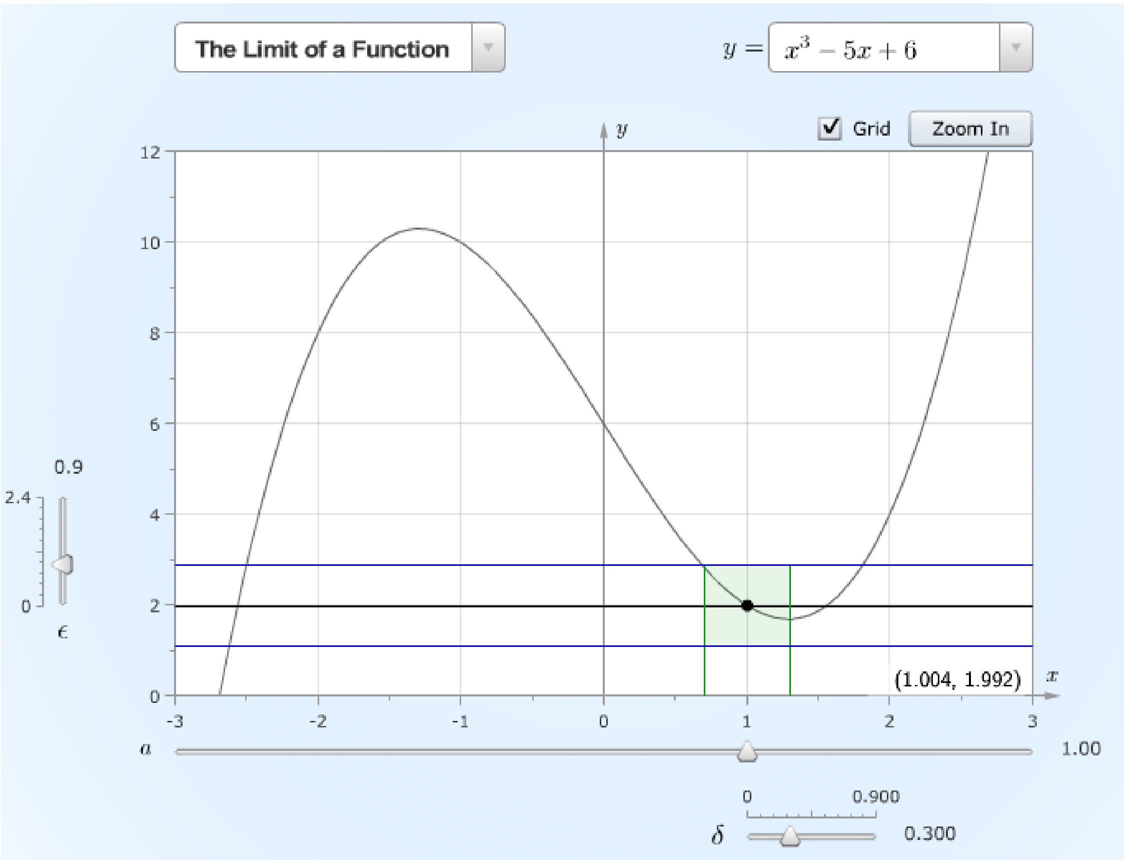

It looks like if $\varepsilon = 0.9$ is

It looks like if $\varepsilon = 0.9$ is given, then $\delta = 0.3$ will guarantee that

$$|f(x) - 2| < \varepsilon$$

whenever

$$0 < |x - 1| < \delta$$



§1.7 #s 1, 11*, 17, 18, 29, 32, 37

* $\varepsilon = 5\,cm^2$. Find $\delta$

§1.8 #s 1, 3, 4, 7, 13, 17, 19, 21, 41, 64

§2.1 #s 1, 3, 5, 7, 8, 11, 12, 13, 33, 35

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