2.2

use the methods shown in exercises 23-38 to evaluate #5.
#6 is mostly limit for the other Calculus sequence.

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12) $\lim_{t\to -1}(5t^2-3t+2) = 5(-1)^2-3(-1)+2 = 5(1)+3+2 = \underline{\underline{10}}$

---

14) $\lim_{x\to 4}(3x-9)^4 = (3(4)-9)^4 = (12-9)^4 = (3)^4 = \underline{\underline{81}}$

---

20) a) $g(t) = \dfrac{t^2-3t-4}{t+1}$ $\quad t+1=0$, $t=-1$ $\quad$ domain: $(-\infty,-1)\cup(-1,\infty)$

b) $\lim_{t\to 3} g(t) = \lim_{t\to 3}\left(\dfrac{t^2-3t-4}{t+1}\right) = \dfrac{(3)^2-3(3)-4}{(3)+1} = \dfrac{9-9-4}{4} = \dfrac{-4}{4} = \underline{\underline{-1}}$

c) $\lim_{t\to -1} g(t) = \lim_{t\to -1}\left(\dfrac{t^2-3t-4}{t+1}\right) = \lim_{t\to -1}\left(\dfrac{(t+1)(t-4)}{t+1}\right) = \lim_{t\to -1}(t-4) = (-1)-4 = \underline{\underline{-5}}$

---

22) a) $R(x) = \dfrac{x^2-2x-8}{x^2-16}$

$x^2-16=0$
$(x+4)(x-4)=0$
$x+4=0 \mid x-4=0$
$x=-4 \mid x=4$

domain: $(-\infty,-4)\cup(-4,4)\cup(4,\infty)$

b) $\lim_{x\to 2} R(x) = \lim_{x\to 2}\left(\dfrac{x^2-2x-8}{x^2-16}\right) = \dfrac{(2)^2-2(2)-8}{(2)^2-16} = \dfrac{4-4-8}{4-16} = \dfrac{-8}{-12} = \underline{\underline{\dfrac{2}{3}}}$

c) $\lim_{x\to 4} R(x) = \lim_{x\to 4}\left(\dfrac{x^2-2x-8}{x^2-16}\right) = \lim_{x\to 4}\left(\dfrac{(x+2)(x-4)}{(x+4)(x-4)}\right) = \lim_{x\to 4}\left(\dfrac{x+2}{x+4}\right) = \dfrac{(4)+2}{(4)+4}$

$= \dfrac{6}{8} = \underline{\underline{\dfrac{3}{4}}}$

24) $\lim\limits_{x \to -2} (4x^2+x) = 4(-2)^2+(-2) = 4(4)-2 = 16-2 = \underline{\underline{14}}$

---

26) $\lim\limits_{w \to 5} \dfrac{3w^2+1}{w} = \dfrac{3(5)^2+1}{(5)} = \dfrac{3(25)+1}{5} = \dfrac{75+1}{5} = \underline{\underline{\dfrac{76}{5}}}$

---

28) $\lim\limits_{x \to 4} \dfrac{x^2-4x}{x^2-3x-4} = \lim\limits_{x \to 4} \dfrac{x(x-4)}{(x+1)(x-4)} = \lim\limits_{x \to 4} \dfrac{x}{x+1} = \dfrac{(4)}{(4)+1} = \underline{\underline{\dfrac{4}{5}}}$

---

30) $\lim\limits_{x \to -4} \dfrac{x^2+5x+4}{x^2+3x-4} = \lim\limits_{x \to -4} \dfrac{(x+4)(x+1)}{(x+4)(x-1)} = \lim\limits_{x \to -4} \dfrac{x+1}{x-1} = \dfrac{(-4)+1}{(-4)-1} = \dfrac{-3}{-5} = \underline{\underline{\dfrac{3}{5}}}$

---

32) $\lim\limits_{x \to -1} \dfrac{x^2+2x+1}{x^4-1} = \lim\limits_{x \to -1} \dfrac{(x+1)(x+1)}{(x^2+1)(x^2-1)} = \lim\limits_{x \to -1} \dfrac{(x+1)(x+1)}{(x^2+1)(x+1)(x-1)}$

$= \lim\limits_{x \to -1} \dfrac{x+1}{(x^2+1)(x-1)} = \dfrac{(-1)+1}{((-1)^2+1)((-1)-1)} = \dfrac{0}{(2)(-2)} = \dfrac{0}{-4} = \underline{\underline{0}}$

---

34) $\lim\limits_{h \to 0} \dfrac{\sqrt{1+h}-1}{\boxed{h}} = \lim\limits_{h \to 0} \left(\dfrac{\sqrt{1+h}-1}{\boxed{h}}\right)\left(\dfrac{\sqrt{1+h}+1}{\sqrt{1+h}+1}\right)$

$= \lim\limits_{h \to 0} \left(\dfrac{(1+h)-(1)^2}{\boxed{h}(\sqrt{1+h}+1)}\right) = \lim\limits_{h \to 0} \dfrac{h}{\boxed{h}(\sqrt{1+h}+1)}$

$= \lim\limits_{h \to 0} \dfrac{1}{\sqrt{1+h}+1} = \dfrac{1}{\sqrt{1+(0)}+1} = \dfrac{1}{\sqrt{1}+1}$

$= \dfrac{1}{1+1} = \underline{\underline{\dfrac{1}{2}}}$

$b > 0$

36) $$\lim_{x \to 0} \frac{\sqrt{x^2+b^2}-b}{\boxed{x^2}} = \lim_{x\to 0}\left(\frac{\sqrt{x^2+b^2}-b}{\boxed{x^2}}\right)\left(\frac{\sqrt{x^2+b^2}+b}{\sqrt{x^2+b^2}+b}\right)$$

$$= \lim_{x\to 0}\frac{(x^2+b^2)-(b)^2}{\boxed{x^2}\left(\sqrt{x^2+b^2}+b\right)} = \lim_{x\to 0}\frac{x^2}{\boxed{x^2}\left(\sqrt{x^2+b^2}+b\right)}$$

$$= \lim_{x\to 0}\frac{1}{\sqrt{x^2+b^2}+b} = \frac{1}{\sqrt{(0)^2+b^2}+b} = \frac{1}{\sqrt{b^2}+b} = \frac{1}{b+b} = \underline{\underline{\frac{1}{2b}}}$$

---

38) $\infty - \infty$

$$\lim_{t\to 0}\left(\frac{1}{t}-\frac{1}{t^2+t}\right) = \lim_{t\to 0}\left(\frac{1}{t}-\frac{1}{t(t+1)}\right) \qquad LCD = t(t+1)$$

$$= \lim_{t\to 0}\frac{1(t+1)-1}{t(t+1)} = \lim_{t\to 0}\frac{t}{t(t+1)} = \lim_{t\to 0}\frac{1}{t+1} = \frac{1}{(0)+1} = \frac{1}{1} = \underline{\underline{1}}$$

---

44) a) $\lim_{x\to 0} f(x) = \underline{\underline{3}}$ b) $\lim_{x\to 3^-} f(x) = \underline{\underline{4}}$

c) $\lim_{x\to 3^+} f(x) = \underline{\underline{2}}$ d) $4 = \lim_{x\to 3^-} f(x) \neq \lim_{x\to 3^+} f(x) = 2$

$\lim_{x\to 3} f(x)$: D.N.E. "does not exist"

e) $f(3) = \underline{\underline{3}}$

---

48) $$f(t) = \begin{cases} t^2 & \text{if } t<0 \\ e^t & \text{if } t \geq 0 \end{cases}$$

a) i) $\lim_{t\to -1} f(t) = \lim_{t\to -1} t^2 = (-1)^2 = \underline{\underline{1}}$

ii) $\lim_{t\to 0^-} f(t) = \lim_{t\to 0^-} t^2 = (0^-)^2 = 0^- = \underline{\underline{0}}$

48) continued

iii) $\lim_{t \to 0^+} f(t) = \lim_{t \to 0^+} e^t = e^{(0^+)} = e^{(0)} = \underline{\underline{1}}$

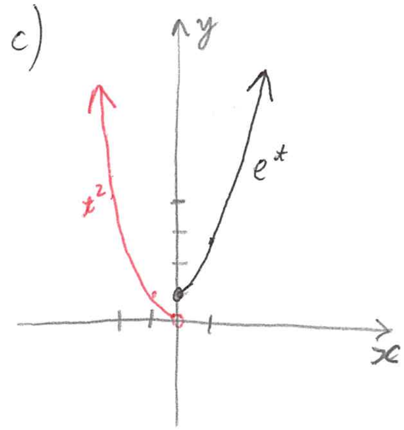
iv) $\lim_{t \to 0} f(t)$: DNE because $0 = \lim_{t \to 0^-} f(t) \neq \lim_{t \to 0^+} f(t)$

v) $\lim_{t \to 2} f(t) = \lim_{t \to 2} e^t = e^{(2)} = \underline{\underline{e^2}}$

b) f is not continuous at $t = 0$ because

$$\lim_{t \to 0^-} f(t) \neq f(0) = \lim_{t \to 0^+} f(t)$$

c)



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50) $F(x) = \dfrac{x^2 - 1}{|x-1|}$

a) i) $\lim_{x \to 1^+} F(x) = \lim_{x \to 1^+} \dfrac{x^2-1}{|x-1|} = \lim_{x \to 1^+} \dfrac{x^2-1}{+(x-1)} = \lim_{x \to 1^+} \dfrac{(x+1)(x-1)}{(x-1)} = \lim_{x \to 1^+} (x+1)$

$= ((1^+) + 1) = \underline{\underline{2}}$

ii) $\lim_{x \to 1^-} F(x) = \lim_{x \to 1^-} \dfrac{x^2-1}{|x-1|} = \lim_{x \to 1^-} \dfrac{x^2-1}{-(x-1)} = \lim_{x \to 1^-} \dfrac{(x+1)(x-1)}{(-1)(x-1)} = \lim_{x \to 1^-} \dfrac{(x+1)}{(-1)} =$

$= \dfrac{((1^-)+1)}{(-1)} = \dfrac{2}{-1} = \underline{\underline{-2}}$

b) $\lim_{x \to 1} F(x)$ DNE

because

$-2 = \lim_{x \to 1^-} F(x) \neq \lim_{x \to 1^+} F(x) = 2$

c)