(1) Given that $f(x) = 6x - 2x^2$, find: (a) $f(-3)$; (b) $f(2)$; (c) $f(0)$; (d) $f(1+\sqrt{2})$; (e) $f(-3a)$; (f) $f(2+t)$

(2) Given that $g(x) = 3 + 2x - x^2$, find: (a) $g(-1)$; (b) $g(3)$; (c) $g(0)$; (d) $g(-\sqrt{2})$; (e) $g(2a)$; (f) $g(1-t)$

(3) Given that $f(x) = \dfrac{2-x}{3x}$, find: (a) $f(10)$; (b) $f(-6)$; (c) $f(-\frac{1}{2})$; (d) $f(2\pi)$; (e) $f(5a)$; (f) $f(2+3t)$

(4) Given that $g(x) = \dfrac{3x}{1-x}$, find: (a) $g(4)$; (b) $g(-1)$; (c) $g(\frac{1}{3})$; (d) $g(e^2)$; (e) $g(-2a)$; (f) $g(1-2t)$

(5) Given that $m(x) = \begin{cases} x^3 - 2x & \text{if} \quad x \leqslant 1 \\ 3x + 1 & \text{if} \quad x > 1 \end{cases}$, find:

(a) $m(-3)$; (b) $m(4)$; (c) $m(0)$; (d) $m(1)$; (e) $m(1.5)$; (f) $m(t^2+2)$

(6) Given that $f(x) = \begin{cases} 1 - x^2 & \text{if} \quad x < -1 \\ \sqrt{x+2} & \text{if} \quad x \geqslant -1 \end{cases}$, find:

(a) $f(2)$; (b) $f(-4)$; (c) $f(0)$; (d) $f(-1)$; (e) $f(-3.2)$; (f) $f(3t^2)$

(7) Given that $s(x) = \begin{cases} \frac{2}{\sqrt{x}} & \text{if} \quad x > 2 \\ 2 - x & \text{if} \quad x \leqslant 2 \end{cases}$, find:

(a) $s(1)$; (b) $s(9)$; (c) $s(0)$; (d) $s(-5)$; (e) $s(-1.8)$; (f) $s(4t^2+3)$

(8) Given that $g(x) = \begin{cases} x^2 - 3x & \text{if} \quad x \geqslant -2 \\ 1 - x^3 & \text{if} \quad x < -2 \end{cases}$, find:

(a) $g(-4)$; (b) $g(1)$; (c) $g(0)$; (d) $g(4)$; (e) $g(2.1)$; (f) $g(t^2)$

(9) Given that $p(x) = \dfrac{(x-2)(3-x)}{2x}$, find: (a) $p(-2)$; (b) $p(3)$; (c) $p(\frac{1}{3})$; (d) $p(1)$; (e) $p(-a)$; (f) $p(\frac{1}{a})$

(10) Given that $h(x) = \dfrac{x+1}{(x-2)(x+2)}$, find: (a) $h(1)$; (b) $h(0)$; (c) $h(\frac{1}{4})$; (d) $h(-3)$; (e) $h(2a)$; (f) $h(1-a)$

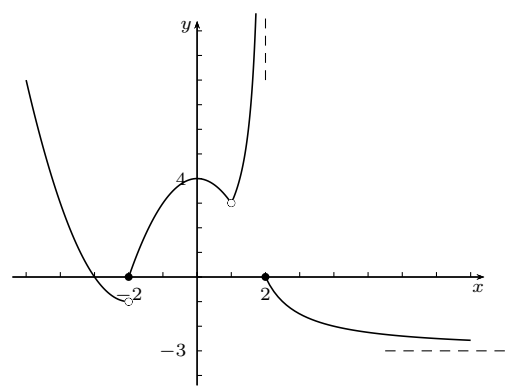
(11) Given the following graph of $f(x)$, find:

(a) $\lim\limits_{x \to -\infty} f(x)$ (b) $\lim\limits_{x \to -2^-} f(x)$

(c) $\lim\limits_{x \to 1} f(x)$ (d) $\lim\limits_{x \to 2^+} f(x)$

(e) $\lim\limits_{x \to 2^-} f(x)$ (f) $\lim\limits_{x \to 2} f(x)$

(g) $\lim\limits_{x \to +\infty} f(x)$



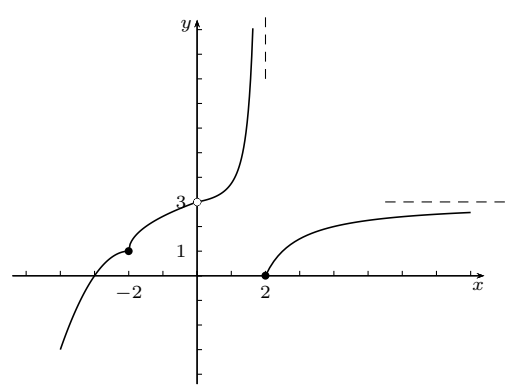
(12) Given the following graph of $f(x)$, find:

(a) $\lim\limits_{x \to -\infty} f(x)$ (b) $\lim\limits_{x \to -2} f(x)$

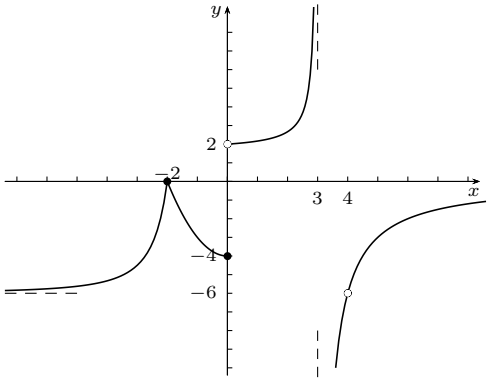
(c) $\lim\limits_{x \to 0} f(x)$ (d) $\lim\limits_{x \to 2^-} f(x)$

(e) $\lim\limits_{x \to 2^+} f(x)$ (f) $\lim\limits_{x \to 2} f(x)$

(g) $\lim\limits_{x \to +\infty} f(x)$



(13) Given the following graph of $f(x)$, find:



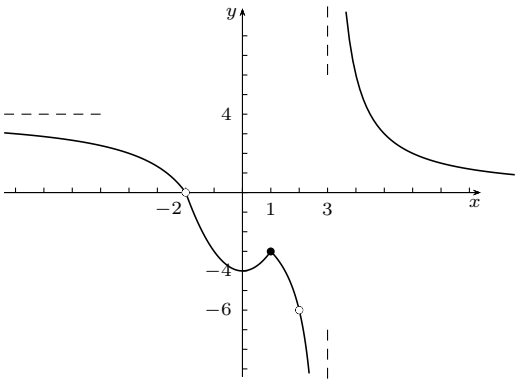
(a) $\lim_{x\to-\infty} f(x)$ (b) $\lim_{x\to-2} f(x)$

(c) $\lim_{x\to0^-} f(x)$ (d) $\lim_{x\to0^+} f(x)$

(e) $\lim_{x\to3^+} f(x)$ (f) $\lim_{x\to3^-} f(x)$

(g) $\lim_{x\to+\infty} f(x)$

(14) Given the following graph of $f(x)$, find:



(a) $\lim_{x\to-\infty} f(x)$ (b) $\lim_{x\to0} f(x)$

(c) $\lim_{x\to1} f(x)$ (d) $\lim_{x\to3^-} f(x)$

(e) $\lim_{x\to3^+} f(x)$ (f) $\lim_{x\to2} f(x)$

(g) $\lim_{x\to+\infty} f(x)$

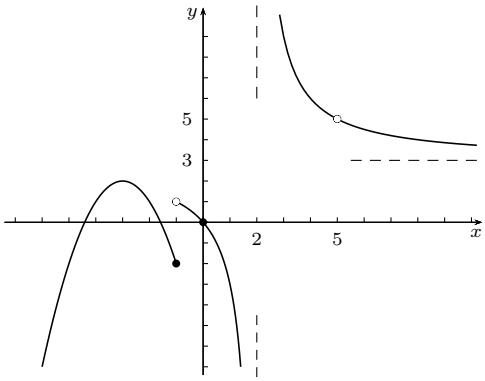
(15) Given the following graph of $f(x)$, find:

(a) $\lim_{x\to-\infty} f(x)$ (b) $\lim_{x\to-1^+} f(x)$

(c) $\lim_{x\to5} f(x)$ (d) $\lim_{x\to2^-} f(x)$

(e) $\lim_{x\to2^+} f(x)$ (f) $\lim_{x\to-3} f(x)$

(g) $\lim_{x\to+\infty} f(x)$



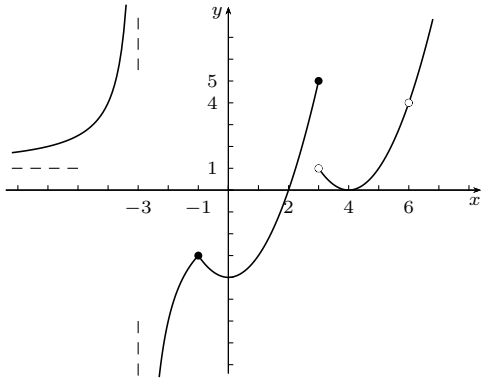
(16) Given the following graph of $f(x)$, find:

(a) $\lim_{x\to-\infty} f(x)$ (b) $\lim_{x\to-1} f(x)$

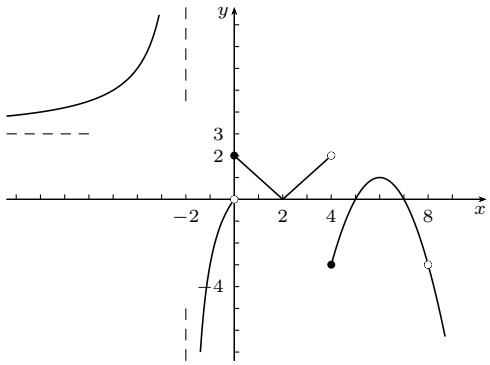
(c) $\lim_{x\to1} f(x)$ (d) $\lim_{x\to3^-} f(x)$

(e) $\lim_{x\to3^+} f(x)$ (f) $\lim_{x\to6} f(x)$

(g) $\lim_{x\to+\infty} f(x)$



(17) Given the following graph of $f(x)$, find:



(a) $\lim\limits_{x\to-\infty} f(x)$ (b) $\lim\limits_{x\to-2^-} f(x)$

(c) $\lim\limits_{x\to0} f(x)$ (d) $\lim\limits_{x\to2} f(x)$

(e) $\lim\limits_{x\to4^+} f(x)$ (f) $\lim\limits_{x\to8} f(x)$

(g) $\lim\limits_{x\to+\infty} f(x)$

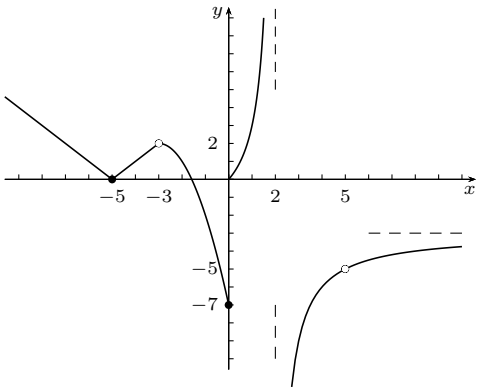
(18) Given the following graph of $f(x)$, find:

(a) $\lim\limits_{x\to-\infty} f(x)$ (b) $\lim\limits_{x\to-3} f(x)$

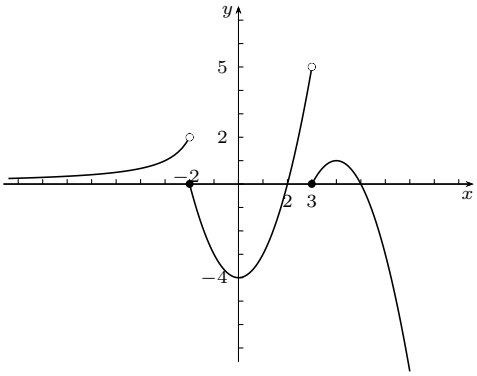
(c) $\lim\limits_{x\to0} f(x)$ (d) $\lim\limits_{x\to2^-} f(x)$

(e) $\lim\limits_{x\to2^+} f(x)$ (f) $\lim\limits_{x\to2} f(x)$

(g) $\lim\limits_{x\to+\infty} f(x)$



(19) Given the following graph of $f(x)$, find:



(a) $\lim\limits_{x\to-\infty} f(x)$ (b) $\lim\limits_{x\to-2^-} f(x)$

(c) $\lim\limits_{x\to-2^+} f(x)$ (d) $\lim\limits_{x\to3^-} f(x)$

(e) $\lim\limits_{x\to2} f(x)$ (f) $\lim\limits_{x\to0} f(x)$

(g) $\lim\limits_{x\to+\infty} f(x)$

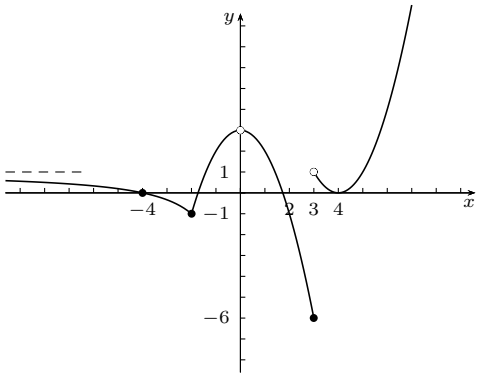
(20) Given the following graph of $f(x)$, find:

(a) $\lim\limits_{x\to-\infty} f(x)$ (b) $\lim\limits_{x\to-2} f(x)$

(c) $\lim\limits_{x\to0} f(x)$ (d) $\lim\limits_{x\to3^-} f(x)$

(e) $\lim\limits_{x\to3^+} f(x)$ (f) $\lim\limits_{x\to3} f(x)$

(g) $\lim\limits_{x\to+\infty} f(x)$



Evaluate the following limits:

(21) $\lim\limits_{z\to 3} \dfrac{z^2 - z - 6}{3z - z^2}$

(22) $\lim\limits_{x\to -4} \dfrac{1 - \sqrt{x+5}}{x+4}$

(23) $\lim\limits_{x\to -\infty} \dfrac{4 - x + 6x^2}{2x^2 - 3x + 4}$

(24) $\lim\limits_{x\to 1} \dfrac{\frac{1}{x+2} + \frac{1}{x-4}}{x-1}$

(25) $\lim\limits_{z\to 1} \dfrac{z^2 - 3z + 2}{z - z^2}$

(26) $\lim\limits_{x\to 3} \dfrac{4 - \sqrt{x+13}}{x-3}$

(27) $\lim\limits_{x\to +\infty} \dfrac{2 + 2x - 4x^2}{2x^2 + x + 5}$

(28) $\lim\limits_{x\to -2} \dfrac{\frac{1}{x+3} + \frac{1}{x+1}}{x+2}$

(29) $\lim\limits_{x\to 1^+} \dfrac{3 - x}{x-1}$

(30) $\lim\limits_{x\to 4} \dfrac{x-4}{\sqrt{x+21} - 5}$

(31) $\lim\limits_{x\to 3^-} \dfrac{6x - x^2}{x-3}$

(32) $\lim\limits_{x\to -1} \dfrac{3 - \frac{12}{x+5}}{x+1}$

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

(34) $\lim\limits_{x\to 2^-} \dfrac{x^2 - 1}{x-2}$

(35) $\lim\limits_{x\to -3} \dfrac{x+3}{3 - \sqrt{x+12}}$

(36) $\lim\limits_{x\to 4^+} \dfrac{9 - x^2}{x-4}$

(37) $\lim\limits_{x\to -2} \dfrac{2 - \frac{8}{x+6}}{x+2}$

(38) $\lim\limits_{x\to 3^-} \dfrac{2x}{2x-6}$

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

(40) $\lim\limits_{x\to 2^-} \dfrac{3x+4}{x-2}$

(41) $\lim\limits_{x\to 3} \dfrac{2x^2 - 5x - 3}{x^3 - 3x^2 - 4x + 12}$

(42) $\lim\limits_{x\to +\infty} \dfrac{(2-x)(x+3)}{(3x-1)(x+1)}$

(43) $\lim\limits_{x\to 1} \dfrac{x-1}{\frac{1}{4x} - \frac{1}{x+3}}$

(44) $\lim\limits_{x\to -2} \dfrac{x+2}{\sqrt{x+3} - 1}$

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

(46) $\lim\limits_{x\to 3^-} \dfrac{\sqrt{3-x}}{x^2 - 9}$

(47) $\lim\limits_{x\to -2} \dfrac{\sqrt{2x^2+1} + x - 1}{x^4 + 5x^3 + 4x^2 - 3x + 2}$

(48) $\lim\limits_{x\to 5} \dfrac{\frac{1}{4x+7} - \frac{1}{x^2+2}}{x^4 - 4x^3 - 4x^2 - 25}$

(49) Given that $f(x) = \begin{cases} x - 3x^2 & \text{if} \quad x \leqslant 2 \\ \sqrt{x-1} & \text{if} \quad x > 2 \end{cases}$, find:

(a) $\lim\limits_{x\to 2^-} f(x)$ (b) $\lim\limits_{x\to 2^+} f(x)$ (c) $\lim\limits_{x\to 2} f(x)$ (d) $f(2)$

(50) Given that $f(x) = \begin{cases} 3x - 5 & \text{if} \quad x < 2 \\ \sqrt{x-1} & \text{if} \quad x > 2 \end{cases}$, find:

(a) $\lim\limits_{x\to 2^-} f(x)$ (b) $\lim\limits_{x\to 2^+} f(x)$ (c) $\lim\limits_{x\to 2} f(x)$ (d) $f(2)$

(51) Given that $f(x) = \begin{cases} 5x - 1 & \text{if} \quad x > 1 \\ 2 & \text{if} \quad x = 1 \\ 3x^2 + 1 & \text{if} \quad x < 1 \end{cases}$, find:

(a) $\lim\limits_{x\to 1^-} f(x)$ (b) $\lim\limits_{x\to 1^+} f(x)$ (c) $\lim\limits_{x\to 1} f(x)$ (d) $f(1)$

(52) Given that $f(x) = \begin{cases} 11 - x^2 & \text{if} \quad x \leqslant -3 \\ |x+1| & \text{if} \quad x > -3 \end{cases}$, find:

(a) $\lim\limits_{x\to -3^-} f(x)$ (b) $\lim\limits_{x\to -3^+} f(x)$ (c) $\lim\limits_{x\to -3} f(x)$ (d) $f(-3)$

(53) Given that $f(x) = \begin{cases} x^2+3 & \text{if} \quad x < -2 \\ -2x+3 & \text{if} \quad x > -2 \end{cases}$, find:

(a) $\lim\limits_{x\to -2^-} f(x)$ (b) $\lim\limits_{x\to -2^+} f(x)$ (c) $\lim\limits_{x\to -2} f(x)$ (d) $f(-2)$

(54) Given that $f(x) = \begin{cases} \sqrt{x+6} & \text{if} \quad x > 3 \\ 3 & \text{if} \quad x = 3 \\ x^2-6 & \text{if} \quad x < 3 \end{cases}$, find:

(a) $\lim\limits_{x\to 3^-} f(x)$ (b) $\lim\limits_{x\to 3^+} f(x)$ (c) $\lim\limits_{x\to 3} f(x)$ (d) $f(3)$

(55) Given that $f(x) = \begin{cases} |x-1| & \text{if} \quad x \leqslant -1 \\ 2x^2 & \text{if} \quad x > -1 \end{cases}$, find:

(a) $\lim\limits_{x\to -1^-} f(x)$ (b) $\lim\limits_{x\to -1^+} f(x)$ (c) $\lim\limits_{x\to -1} f(x)$ (d) $f(-1)$

(56) Given that $f(x) = \begin{cases} 4x-1 & \text{if} \quad x \leqslant 1 \\ 2-x^2 & \text{if} \quad x > 1 \end{cases}$, find:

(a) $\lim\limits_{x\to 1^-} f(x)$ (b) $\lim\limits_{x\to 1^+} f(x)$ (c) $\lim\limits_{x\to 1} f(x)$ (d) $f(1)$

(57) Given that $f(x) = \begin{cases} \sqrt{x}+2 & \text{if} \quad x \geqslant 1 \\ 1-x+x^2 & \text{if} \quad x < 1 \end{cases}$, find:

(a) $\lim\limits_{x\to 1^-} f(x)$ (b) $\lim\limits_{x\to 1^+} f(x)$ (c) $\lim\limits_{x\to 1} f(x)$ (d) $f(1)$

(58) Given that $f(x) = \begin{cases} x^2-1 & \text{if} \quad x \leqslant -2 \\ 3x+1 & \text{if} \quad x > -2 \end{cases}$, find:

(a) $\lim\limits_{x\to -2^-} f(x)$ (b) $\lim\limits_{x\to -2^+} f(x)$ (c) $\lim\limits_{x\to -2} f(x)$ (d) $f(-2)$

(59) Given that $f(x) = \begin{cases} x^2-x & \text{if} \quad x \leqslant -1 \\ x^3 & \text{if} \quad x > -1 \end{cases}$, find:

(a) $\lim\limits_{x\to -1^-} f(x)$ (b) $\lim\limits_{x\to -1^+} f(x)$ (c) $\lim\limits_{x\to -1} f(x)$ (d) $f(-1)$

(60) Given that $f(x) = \begin{cases} 2x-x^2 & \text{if} \quad x < 3 \\ \sqrt{x+1} & \text{if} \quad x \geqslant 3 \end{cases}$, find:

(a) $\lim\limits_{x\to 3^-} f(x)$ (b) $\lim\limits_{x\to 3^+} f(x)$ (c) $\lim\limits_{x\to 3} f(x)$ (d) $f(3)$

ANSWERS:

(1) (a) -36 (b) 4 (c) 0 (d) $2\sqrt{2}$ (e) $-18a-18a^2$ (f) $4-2t-2t^2$

(2) (a) 0 (b) 0 (c) 3 (d) $1-2\sqrt{2}$ (e) $3+4a-4a^2$ (f) $4-t^2$

(3) (a) $\frac{-4}{15}$ (b) $\frac{-4}{9}$ (c) $\frac{-5}{3}$ (d) $\frac{1-\pi}{3\pi}$ (e) $\frac{2-5a}{15a}$ (f) $\frac{-t}{2+3t}$

(4) (a) -4 (b) $\frac{-3}{2}$ (c) $\frac{3}{2}$ (d) $\frac{3e^2}{1-e^2}$ (e) $\frac{-6a}{1+2a}$ (f) $\frac{3-6t}{2t}$

(5) (a) -21 (b) 13 (c) 0 (d) -1 (e) $\frac{11}{2}$ (f) $3t^2+7$

(6) (a) 2 (b) -15 (c) $\sqrt{2}$ (d) 1 (e) -9.24 (f) $\sqrt{3t^2+2}$

(7) (a) 1 (b) $\frac{2}{3}$ (c) 2 (d) 7 (e) 3.8 (f) $\frac{2}{\sqrt{4t^2+3}}$

(8) (a) 65 (b) -2 (c) 0 (d) 4 (e) -1.89 (f) t^4-3t^2

(9) (a) 5 (b) 0 (c) $\frac{-20}{3}$ (d) -1 (e) $\frac{a^2+5a+6}{2a}$ (f) $\frac{-6a^2+5a-1}{2a}$

(10) (a) $\frac{-2}{3}$ (b) $\frac{-1}{4}$ (c) $\frac{-20}{63}$ (d) $\frac{-2}{5}$ (e) $\frac{2a+1}{4a^2-4}$ (f) $\frac{2-a}{a^2-2a-3}$

(11) (a) $+\infty$ (b) -1 (c) 3 (d) 0 (e) $+\infty$ (f) DNE (g) -3

(12) (a) $-\infty$ (b) 1 (c) 3 (d) $+\infty$ (e) 0 (f) DNE (g) 3

(13) (a) -6 (b) 0 (c) -4 (d) 2 (e) $-\infty$ (f) $+\infty$ (g) 0

(14) (a) 4 (b) -4 (c) -3 (d) $-\infty$ (e) $+\infty$ (f) -6 (g) 0

(15) (a) $-\infty$ (b) 1 (c) 5 (d) $-\infty$ (e) $+\infty$ (f) 2 (g) 3

(16) (a) 1 (b) -3 (c) -3 (d) 5 (e) 1 (f) 4 (g) $+\infty$

(17) (a) 3 (b) $+\infty$ (c) DNE (d) 0 (e) -3 (f) -3 (g) $-\infty$

(18) (a) $+\infty$ (b) 2 (c) DNE (d) $+\infty$ (e) $-\infty$ (f) DNE (g) -3

(19) (a) 0 (b) 2 (c) 0 (d) 5 (e) 0 (f) -4 (g) $-\infty$

(20) (a) 1 (b) -1 (c) 3 (d) -6 (e) 1 (f) DNE (g) $+\infty$

(21) $\frac{-5}{3}$ (22) $\frac{-1}{2}$ (23) 3 (24) $\frac{-2}{9}$ (25) 1 (26) $\frac{-1}{8}$ (27) -2 (28) -2 (29) $+\infty$ (30) 10

(31) $-\infty$ (32) $\frac{3}{4}$ (33) $-\infty$ (34) $-\infty$ (35) -6 (36) $-\infty$ (37) $\frac{1}{2}$ (38) $-\infty$ (39) $+\infty$ (40) $-\infty$

(41) $\frac{7}{5}$ (42) $\frac{-1}{3}$ (43) $\frac{-16}{3}$ (44) 2 (45) $\frac{2}{3}$ (46) $-\infty$ (47) $\frac{-1}{27}$ (48) $\frac{1}{19440}$

(49) (a) -10 (b) 1 (c) DNE (d) -10 (50) (a) 1 (b) 1 (c) 1 (d) DNE

(51) (a) 4 (b) 4 (c) 4 (d) 2 (52) (a) 2 (b) 2 (c) 2 (d) 2

(53) (a) 7 (b) 7 (c) 7 (d) DNE (54) (a) 3 (b) 3 (c) 3 (d) 3

(55) (a) 2 (b) 2 (c) 2 (d) 2 (56) (a) 3 (b) 1 (c) DNE (d) 3

(57) (a) 1 (b) 3 (c) DNE (d) 3 (58) (a) 3 (b) -5 (c) DNE (d) 3

(59) (a) 2 (b) -1 (c) DNE (d) 2 (60) (a) -3 (b) 2 (c) DNE (d) 2