EXERCISE 1.1 [1-16]

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(1) - (10) Reasonable assumption about graphs.

(1) (a) $\lim_{x \to 0^-} g(x) = 3$

(b) $\lim_{x \to 0^+} g(x) = 3$

(c) $\lim_{x \to 0} g(x) = 3$

(d) $g(0) = 3$

(2) (a) $\lim_{x \to 0^-} G(x) = 0$

(b) $\lim_{x \to 0^+} G(x) = 0$

(c) $\lim_{x \to 0} G(x) = 0$

(d) $G(0) = 0$

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

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

(c) $\lim_{x \to 3} f(x) =$ DNE $(-1 \neq 3)$

(d) $f(3) = 1$

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(4) (a) $\lim_{x \to 2^-} f(x) = 2$

(b) $\lim_{x \to 2^+} f(x) = 0$

(c) $\lim_{x \to 2} f(x) = \text{DNE} \quad (2 \neq 0)$

(d) $f(2) = 2$

(5) (a) $\lim_{x \to -2^-} f(x) = 0$

(b) $\lim_{x \to -2^+} F(x) = 0$

(c) $\lim_{x \to -2} F(x) = 0$

(d) $F(-2) = 3$

(6) (a) $\lim_{x \to 0^-} G(x) = 1$

(b) $\lim_{x \to 0^+} G(x) = 1$

(c) $\lim_{x \to 0} G(x) = 1$

(d) $G(0) = 0$

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(7) (a) $\lim_{x \to 3^-} f(x) = -\infty$

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

(c) $\lim_{x \to 3} f(x) = -\infty$

(d) $\lim_{x \to} f(3) = 1.$

(8) (a) $\lim_{x \to 4^-} \phi(x) = +\infty$

(b) $\lim_{x \to 4^+} \phi(x) = +\infty$

(c) $\lim_{x \to 4} \phi(x) = +\infty$

(d) $\phi(4) =$ Unknown.

(9) (a) $\lim_{x \to -2} f(x) = +\infty$ (b) $\lim_{x \to 0^-} f(x) = +\infty$

(c) $\lim_{x \to 0^+} f(x) = 2$ (d) $\lim_{x \to 2^-} f(x) = 2$

(e) $\lim_{x \to 2^+} f(x) = -\infty$

(f) Vertical asymptotes of graph of f

$x = -2$, $x = 0$, $x = 2$.

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(10) (a) $\lim_{x \to -2^-} f(x) = DNE$ (b) $\lim_{x \to -2^+} f(x) = -\infty$

(c) $\lim_{x \to 0^-} f(x) = 0$ (d) $\lim_{x \to 0^+} f(x) = -1$.

(e) $\lim_{x \to 2^-} f(x) = +\infty$ (f) $\lim_{x \to 2^+} f(x) = 3$.

(g) Vertical asymptotes : $x = 2$, $x = -2$

(11)-(12) in complete table

(11) $f(x) = \frac{e^x - 1}{x}$; $\lim_{x \to 0} f(x)$.

x	-0.01	-0.001	-0.0001	0.0001	0.001	0.01
$f(x)$	0.99501662	0.9995002	0.999950002	1.000050002	1.000500167	1.0050167

Limit tends to 1.

(12) $f(x) = \frac{\sin^{-1} 2x}{x}$; $\lim_{x \to 0} f(x)$

x	-0.1	-0.01	-0.001	0.001	0.01	0.1
$f(x)$	2.01357921	2.00013336	2.000001333	2.000001333	2.00013336	2.01357921

Limit tends to 2.

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(13) - (16) (i) Make guess at the limit by evaluating function at specified x-values.

(13) (a) $\lim_{x \to 1} \frac{x-1}{x^3-1}$; $x = 2, 1.5, 1.1, 1.01, 1.001, 0, 0.5, 0.9, 0.99, 0.999$.

x	2	1.5	1.1	1.01	1.001	0	0.5	0.99	0.999
$\frac{x-1}{x^3-1}$	0.1429	0.2105	0.3021	0.3300	0.3330	1.	0.3690	0.3361	0.3337

Limit tends to 0.333.

(b)

x	2	1.5	1.1	1.01	1.001	1.0001.
$\frac{x-1}{x^3-1}$	0.4286	1.0526	6.344	66.3	666.3	6666.3

Limit tends to infinity (positive).

(c)

x	0	0.5	0.9	0.99	0.999	0.9999
$\frac{x-1}{x^3-1}$	-1	-1.7143	-7.0111	-67.001	-667	-6667

Limit tends to infinity (negative).

(14)

x	-0.25	-0.1	-0.001	0.0001	0.001	0.1	0.25
$\frac{\sqrt{x+1}-1}{x}$	0.5359	0.5132	0.5001	0.5000	0.5000	0.4881	0.4721

Limit tends to 0.5000.

(b)

x	0.25	0.1	0.001	0.0001
$\frac{\sqrt{x+1}-1}{x^2}$	8.472	20.48	2000.5	20001

Limit tends to infinity (positive).

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(c) -0.25 -0.1 -0.001 -0.0001

-7.4641 -19.49 -1999.5 -20000

Limit tends to infinity (negative).

(15) (a) -0.25 -0.1 -0.001 -0.0001 0.0001 0.001 0.1 0.25

2.7266 2.9552 $3.$ 3 3 3 2.955 2.727

Limit tends to 3.

(b) 0 -0.5 -0.9 -0.99 -0.999 -1.5 -1.1 -1.01 -1.001

1 1.155 6.216 54.87 541.1 -0.142 -4.54 -53.2 -539.5

Limit DNE.

(16) (a) 0 -0.5 -0.9 -0.99 -0.999 -1.5 -1.1 -1.01 -1.001

1.557 1.0926 1.0033 $1.$ 1 1.0926 1.003 1 1

Limit tends to 1.

(b) -0.25 -0.1 -0.001 -0.0001 0.0001 0.001 0.1 0.25

1.979 2.413 2.5 2.5 2.5 2.5 2.4132 1.979

Limit tends to 2.5.