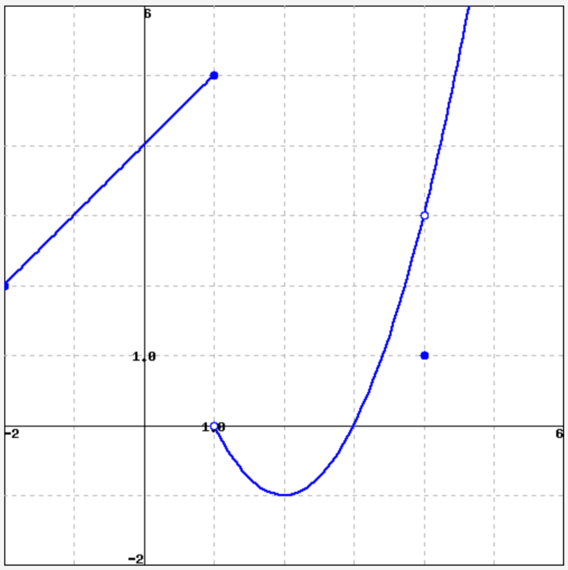
WebWork Assignment 2.2, 2.3, 2.6

Use the given graph of the function f to find the following limits:



1. $\lim_{x \to 1^-} f(x) =$ ☐ help (limits)

2. $\lim_{x \to 1^+} f(x) =$ ☐

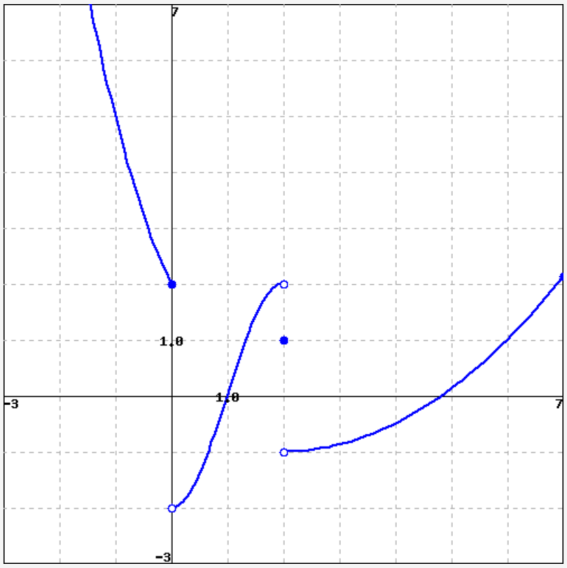
3. $\lim_{x \to 1} f(x) =$ ☐

4. $\lim_{x \to 4} f(x) =$ ☐

5. $f(4) =$ ☐

Note: *You can click on the graph to enlarge the image.*
Note: If a limit does not exist, enter ***DNE***.

Use the given graph of the function g to find the following limits:



1. $\lim_{x \to 2^-} g(x) =$ ☐ help (limits)

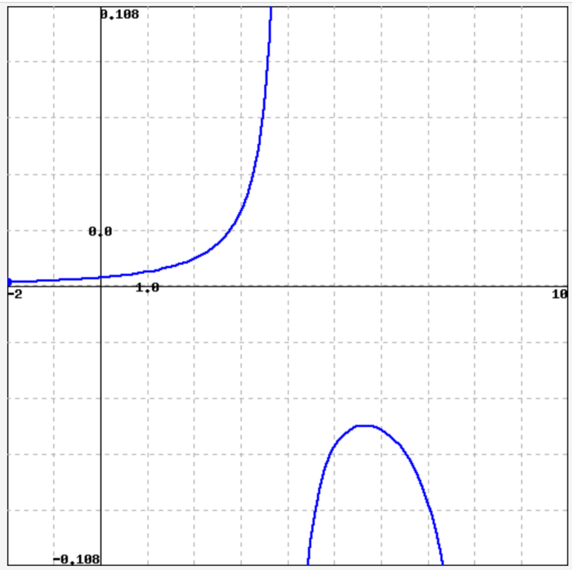
2. $\lim_{x \to 2^+} g(x) =$ ☐

3. $\lim_{x \to 2} g(x) =$ ☐

4. $\lim_{x \to 0} g(x) =$ ☐

5. $g(2) =$ ☐

Note: *You can click on the graph to enlarge the image.*



Evaluate the given limits using the graph of the function $f(x) = \dfrac{-1}{(x-4)(x-9)^2}$ shown above.

Enter **Infinity** for ∞, **-Infinity** for $-\infty$, or **DNE** if the limit does not exist, but is neither ∞ nor $-\infty$.

If you are having a hard time seeing the picture clearly, click on the picture. It will expand to a larger picture on its own page so that you can inspect it more clearly.

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

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

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

d) $\lim_{x \to 9^-} f(x)$ =

e) $\lim_{x \to 9^+} f(x)$ =

f) $\lim_{x \to 9} f(x)$ =

A ball is thrown into the air by a baby alien on a planet in the system of Alpha Centauri with a velocity of 20 ft/s. Its height in feet after t seconds is given by $y = 20t - 24t^2$.

a.) Find the average velocity for the time period beginning when $t_0 = 2$ second and lasting for the given time.

$t = .01$ sec: ☐
$t = .005$ sec: ☐
$t = .002$ sec : ☐
$t = .001$ sec: ☐

b.) Estimate the instantaneous velocity when $t = 2$.

Answer: ☐

NOTE: For the above answers, you may have to enter 6 or 7 significant digits if you are using a calculator.

Fill in the table and guess the value of the limit:
$\lim_{x \to 4} f(x)$, where $f(x) = \frac{x^3 - 64}{x^2 - 16}$

x	$f(x)$	x	$f(x)$
4.002		3.998	
4.001		3.999	
4.0005		3.9995	
4.0001		3.9999	

The limit as $x \to 4$ is ☐

A function f and value a are given. Approximate the limit of the difference quotient, $\lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$, using $h = \pm 0.1, \pm 0.01$.

$f(x) = x^2 + 7x + 2, \qquad a = 0$

When $h = 0.1$, $\frac{f(a+h) - f(a)}{h}$ = ☐
When $h = -0.1$, $\frac{f(a+h) - f(a)}{h}$ = ☐

When $h = 0.01$, $\frac{f(a+h) - f(a)}{h}$ = ☐
When $h = -0.01$, $\frac{f(a+h) - f(a)}{h}$ = ☐

Let $\lim_{x \to a} h(x) = -10$, $\lim_{x \to a} f(x) = -1$, $\lim_{x \to a} g(x) = 0$.

Find following limits if they exist. If not, enter DNE ('does not exist') as your answer.

☐ **1.** $\lim_{x \to a} \sqrt{f(x)}$

☐ **2.** $\lim_{x \to a} h(x) - f(x)$

☐ **3.** $\lim_{x \to a} h(x) + f(x)$

☐ **4.** $\lim_{x \to a} h(x) * g(x)$

☐ **5.** $\lim_{x \to a} \dfrac{h(x)}{g(x)}$

☐ **6.** $\lim_{x \to a} \dfrac{h(x)}{f(x)}$

Evaluate the limit in terms of the constants involved:

$\lim_{t \to -3} (5t - 2at + 3a) =$ ☐

Solution:

Evaluate the limit

$$\lim_{x \to 6} \left(x^3 - 4x + 6\right)$$

Enter **Inf** for ∞, **-Inf** for $-\infty$, and **DNE** if the limit does not exist.

Limit = ☐

Evaluate the limit

$$\lim_{u \to 3} \sqrt{u^4 + 3u + 3}$$

Enter **I** for ∞, **-I** for $-\infty$, and **DNE** if the limit does not exist.

Limit = ☐

What is wrong with the following equation?

$$\frac{x^2+x-6}{x-2} = x+3$$

Choose one of the following and enter the letter below:
(a) There is nothing wrong with this equation.
(b) This equation does not make sense at $x = 2$.
(c) None of the above.

$\square$

Evaluate the limit

$$\lim_{x \to 8} \frac{x-8}{x^2-8x}$$

Enter **DNE** if the limit does not exist.

Limit = $\square$

Evaluate the limit, if it exists. If not, enter *DNE* below.

$$\lim_{t \to -7} \frac{t^2-49}{3t^2+23t+14}$$

Answer = $\square$

Evaluate the limit, if it exists. If a limit *does not exist,* type "DNE".

$$\lim_{x \to -6} \frac{\frac{1}{6}+\frac{1}{x}}{6+x}$$

Limit: $\square$

Evaluate the limit
$\lim_{y \to 81} \frac{81-y}{9-\sqrt{y}} = \square$.

Evaluate the limit below in two steps by using algebra to simplify the difference quotient and then evaluating the limit.

$$\lim_{h \to 0^+} \left(\frac{\sqrt{h^2+10h+3}-\sqrt{3}}{h} \right) = \lim_{h \to 0^+} \left(\square \right) = \square.$$

If $50x - 35x^2 \leq g(x) \leq 24 - 10x^3 + x^4$ for all x, evaluate $\lim_{x \to 3} g(x)$.

Limit: ☐

Use the Squeeze Theorem to evaluate the limit:

$\lim_{x \to 0} x \cos(1/x) =$ ☐

Use the Squeeze Theorem to evaluate the limit:

$\lim_{x \to 0+} \sqrt{2x} \cdot e^{\cos(8\pi/x)} =$ ☐

Evaluate the limit, if it exists. If a limit *does not exist,* type **DNE**.

$$\lim_{x \to -5} \frac{2x + 10}{|x + 5|}$$

Limit : ☐

Evaluate the limits.

$$f(x) = \begin{cases} 3x + 8 & x \leq 1 \\ x^2 - 4 & x > 1 \end{cases}$$

Enter **DNE** if the limit does not exist.

$\lim_{x \to 1^-} f(x) =$ ☐

$\lim_{x \to 1^+} f(x) =$ ☐

$\lim_{x \to 1} f(x) =$ ☐

Let $h(x) = \begin{cases} x & \text{if } x < 0 \\ x^2 & \text{if } 0 < x \le 2 \\ 8 - x & \text{if } x > 2 \end{cases}$

Find each of the following limits. If the limit does not exist, enter **DNE** below.

(a) $\lim_{x \to 0^+} h(x) =$ ☐

(b) $\lim_{x \to 0} h(x) =$ ☐

(c) $\lim_{x \to 1} h(x) =$ ☐

(d) $\lim_{x \to 2^-} h(x) =$ ☐

(e) $\lim_{x \to 2^+} h(x) =$ ☐

(f) $\lim_{x \to 2} h(x) =$ ☐

(a) Find a number n such that $\lim_{x \to -2} \dfrac{3x^2 + nx + n + 3}{x^2 + x - 2}$ exists.

(b) After finding n, what is the value of the limit?

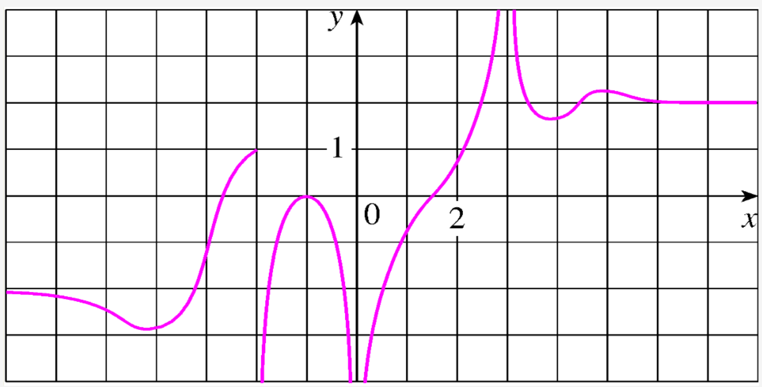
(a) ☐

(b) ☐

For the function g whose graph is given, state the following. (If the answer is positive infinite, type "I"; if negative infinite, type "N"; and if it does not exist, type "D".)

(a) $\lim_{x\to\infty} g(x)$ (b) $\lim_{x\to-\infty} g(x)$ (c) $\lim_{x\to 3} g(x)$
(d) $\lim_{x\to 0} g(x)$ (e) $\lim_{x\to -2^+} g(x)$
(f) The equations of the asymptotes (in increasing order).

(a) ☐ (b) ☐ (c) ☐
(d) ☐ (e) ☐
(f) $x =$ ☐, $x =$ ☐, and $x =$ ☐
$y =$ ☐ and $y =$ ☐



A function is said to have a **vertical asymptote** wherever the limit on the left or right (or both) is either positive or negative infinity.

For example, the function $f(x) = \dfrac{-3(x+2)}{x^2+4x+4}$ has a vertical asymptote at $x = -2$.

Find each of the following limits.

$$\lim_{x\to -2^-} \frac{-3(x+2)}{x^2+4x+4} = \square$$ help (limits)

$$\lim_{x\to -2^+} \frac{-3(x+2)}{x^2+4x+4} = \square$$ help (limits)

$$\lim_{x\to -2} \frac{-3(x+2)}{x^2+4x+4} = \square$$ help (limits)

Evaluate the following limits:

1. $\lim_{x \to 3^+} \frac{2}{x-3} = \square$
2. $\lim_{x \to 0} \frac{1}{x^2(x+7)} = \square$
3. $\lim_{x \to 3^-} \frac{2}{x-3} = \square$
4. $\lim_{x \to 5} \frac{2}{(x-5)^6} = \square$

Find the following limit.

$$\lim_{x \to \frac{\pi}{4}^-} \cot(4x)$$

Limit: $\square$ help (limits)

Find $\lim_{x \to 0} \sin\left(-\frac{10}{x}\right)$.

Enter **I** for ∞, **-I** for $-\infty$, and **DNE** if the limit does not exist.

Answer: $\square$

Let $f(x) = \begin{cases} -\frac{9}{x+2}, & \text{if } x < -2 \\ 3x + 11, & \text{if } x > -2 \end{cases}$

Calculate the following limits.

$\lim_{x \to -2^-} f(x) = \square$ help (limits) $\lim_{x \to -2^+} f(x) = \square$ help (limits) $\lim_{x \to -2} f(x) = \square$ help (limits)

A function is said to have a **horizontal asymptote** if either the limit at infinity exists or the limit at negative infinity exists.
Show that each of the following functions has a horizontal asymptote by calculating the given limit.

$$\lim_{x\to\infty} \frac{-8x}{7+2x} = \square$$

$$\lim_{x\to-\infty} \frac{8x-3}{x^3+10x-11} = \square$$

$$\lim_{x\to\infty} \frac{x^2-7x-10}{6-2x^2} = \square$$

$$\lim_{x\to\infty} \frac{\sqrt{x^2+5x}}{14-15x} = \square$$

$$\lim_{x\to-\infty} \frac{\sqrt{x^2+5x}}{14-15x} = \square$$

Suppose the function $f(x)$ is an odd function and $\lim_{x\to\infty} f(x) = 38$. Use this information to evaluate $\lim_{x\to-\infty} f(x)$.

Answer: $\square$

A tank contains 5000 L of pure water. Brine that contains 30 g of salt per liter of water is pumped into the tank at a rate of 25 L/min. The concentration of salt after t minutes can be shown to be given by:

$$C(t) = \frac{30t}{200+t}$$

What happens to the concentration as $t \to \infty$?

$\lim_{t\to\infty} C(t) = \square$ g/L

Can a graph intersect a vertical asymptote? Answer "y" for yes or "n" for no below.

$\square$

Can a graph intersect a horizontal asymptote? Answer "y" for yes or "n" for no below.

$\square$

Evaluate

$$\lim_{x\to\infty}\left(\sqrt{4x^2+x}-2x\right).$$

Enter **inf** for ∞, **-inf** for $-\infty$, and **DNE** if the limit does not exist.

Limit = ☐

Find the following limit.

Notes: Enter "DNE" if limit Does Not Exist.

$\lim_{x\to\infty} \frac{3-6e^x}{3+4e^x}$ = ☐

Find the following limit.

Notes: Enter "DNE" if limit Does Not Exist.

$\lim_{x\to 0^+} \ln\left(\frac{5}{x^2}\right)$ = ☐

Evaluate the following limits. If needed, enter INF for ∞ and MINF for $-\infty$.

(a)

$$\lim_{x\to\infty}\left(\sqrt{x^2-8x+1}-x\right)=$$

☐

(b)

$$\lim_{x\to-\infty}\left(\sqrt{x^2-8x+1}-x\right)=$$

☐