

Homework 3

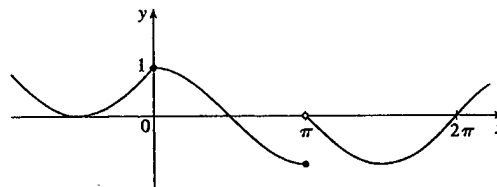
Section 2.2:

6. (a) $h(x)$ approaches 4 as x approaches -3 from the left, so $\lim_{x \rightarrow -3^-} h(x) = 4$.
 (b) $h(x)$ approaches 4 as x approaches -3 from the right, so $\lim_{x \rightarrow -3^+} h(x) = 4$.
 (c) $\lim_{x \rightarrow -3} h(x) = 4$ because the limits in part (a) and part (b) are equal.
 (d) $h(-3)$ is not defined, so it doesn't exist.
 (e) $h(x)$ approaches 1 as x approaches 0 from the left, so $\lim_{x \rightarrow 0^-} h(x) = 1$.
 (f) $h(x)$ approaches -1 as x approaches 0 from the right, so $\lim_{x \rightarrow 0^+} h(x) = -1$.
 (g) $\lim_{x \rightarrow 0} h(x)$ does not exist because the limits in part (e) and part (f) are not equal.
 (h) $h(0) = 1$ since the point $(0, 1)$ is on the graph of h .
 (i) Since $\lim_{x \rightarrow 2^-} h(x) = 2$ and $\lim_{x \rightarrow 2^+} h(x) = 2$, we have $\lim_{x \rightarrow 2} h(x) = 2$.
 (j) $h(2)$ is not defined, so it doesn't exist.
 (k) $h(x)$ approaches 3 as x approaches 5 from the right, so $\lim_{x \rightarrow 5^+} h(x) = 3$.
 (l) $h(x)$ does not approach any one number as x approaches 5 from the left, so $\lim_{x \rightarrow 5^-} h(x)$ does not exist.

10. $\lim_{t \rightarrow 12^-} f(t) = 150$ mg and $\lim_{t \rightarrow 12^+} f(t) = 300$ mg. These limits show that there is an abrupt change in the amount of drug in the patient's bloodstream at $t = 12$ h. The left-hand limit represents the amount of the drug just before the fourth injection. The right-hand limit represents the amount of the drug just after the fourth injection.

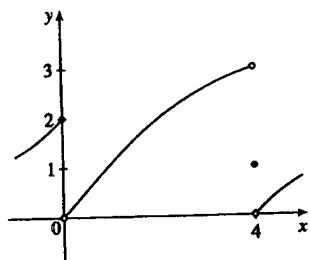
12. From the graph of

$$f(x) = \begin{cases} 1 + \sin x & \text{if } x < 0 \\ \cos x & \text{if } 0 \leq x \leq \pi, \\ \sin x & \text{if } x > \pi \end{cases}$$



we see that $\lim_{x \rightarrow a} f(x)$ exists for all a except $a = \pi$. Notice that the right and left limits are different at $a = \pi$.

18. $\lim_{x \rightarrow 0^-} f(x) = 2$, $\lim_{x \rightarrow 0^+} f(x) = 0$, $\lim_{x \rightarrow 4^-} f(x) = 3$,
 $\lim_{x \rightarrow 4^+} f(x) = 0$, $f(0) = 2$, $f(4) = 1$



24. For $f(x) = \frac{\tan 3x}{\tan 5x}$:

x	$f(x)$
± 0.2	0.439279
± 0.1	0.566236
± 0.05	0.591893
± 0.01	0.599680
± 0.001	0.599997

It appears that $\lim_{x \rightarrow 0} \frac{\tan 3x}{\tan 5x} = 0.6 = \frac{3}{5}$.

30. $\lim_{x \rightarrow -3^-} \frac{x+2}{x+3} = \infty$ since the numerator is negative and the denominator approaches 0 from the negative side as $x \rightarrow -3^-$.

32. $\lim_{x \rightarrow 5^-} \frac{e^x}{(x-5)^3} = -\infty$ since the numerator is positive and the denominator approaches 0 from the negative side as $x \rightarrow 5^-$.

38. (a) The denominator of $y = \frac{x^2 + 1}{3x - 2x^2} = \frac{x^2 + 1}{x(3 - 2x)}$ is equal to zero when $x = 0$ and $x = \frac{3}{2}$ (and the numerator is not), so $x = 0$ and $x = 1.5$ are vertical asymptotes of the function.

