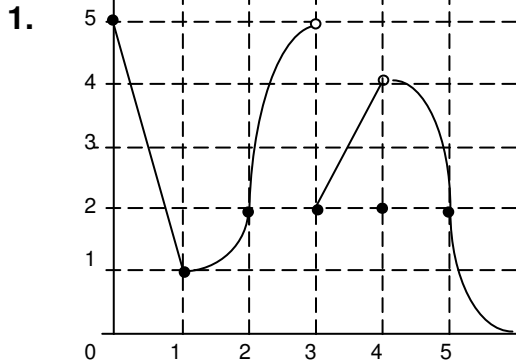
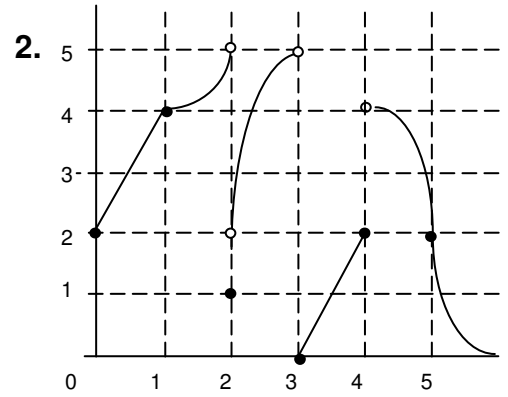


Continuity and Differentiability

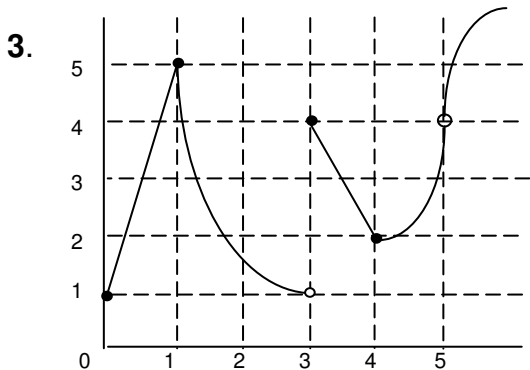
For each function shown, list x-values where the function is discontinuous and x-values where the function is non-differentiable. Also evaluate the indicated limits and function values.



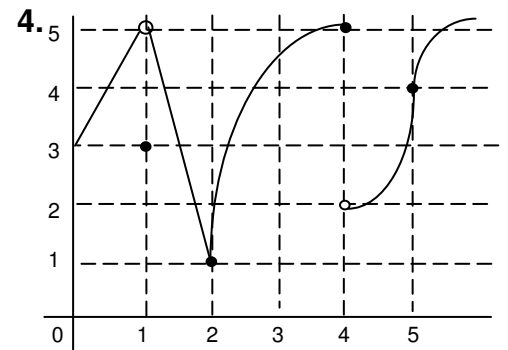
$\lim_{x \rightarrow 3^-} f(x) = \underline{\hspace{2cm}}$ $f(4) = \underline{\hspace{2cm}}$



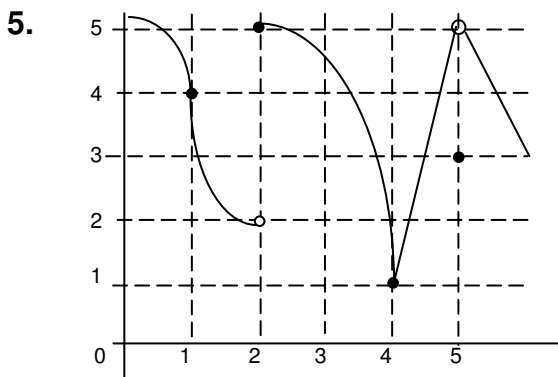
$\lim_{x \rightarrow 3^-} f(x) = \underline{\hspace{2cm}}$ $f(4) = \underline{\hspace{2cm}}$



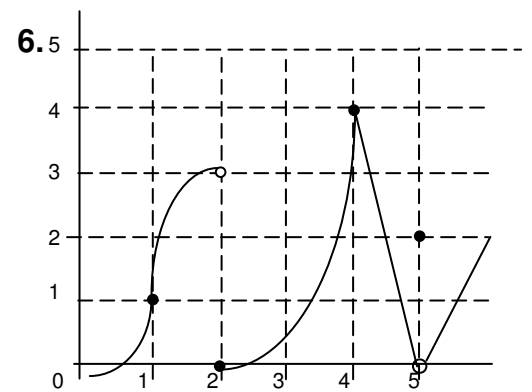
$\lim_{x \rightarrow 5} f(x) = \underline{\hspace{2cm}}$ $f(3) = \underline{\hspace{2cm}}$



$\lim_{x \rightarrow 4^-} f(x) = \underline{\hspace{2cm}}$ $f(4) = \underline{\hspace{2cm}}$



$\lim_{x \rightarrow 5} f(x) = \underline{\hspace{2cm}}$ $f(4) = \underline{\hspace{2cm}}$

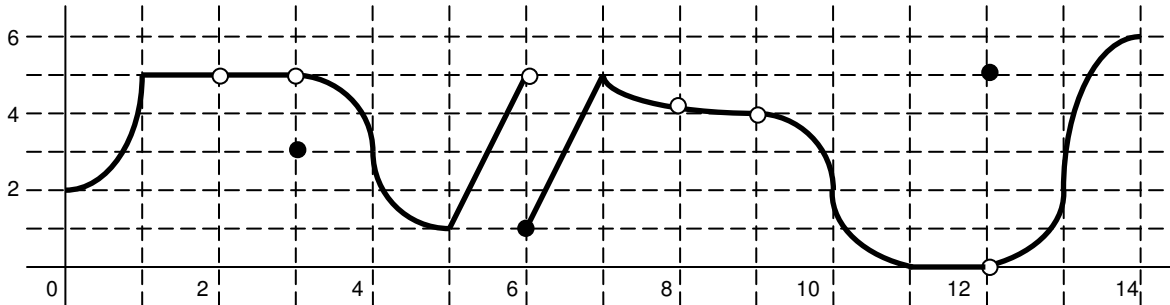


$\lim_{x \rightarrow 4^-} f(x) = \underline{\hspace{2cm}}$ $f(4) = \underline{\hspace{2cm}}$

Continuity and Differentiability

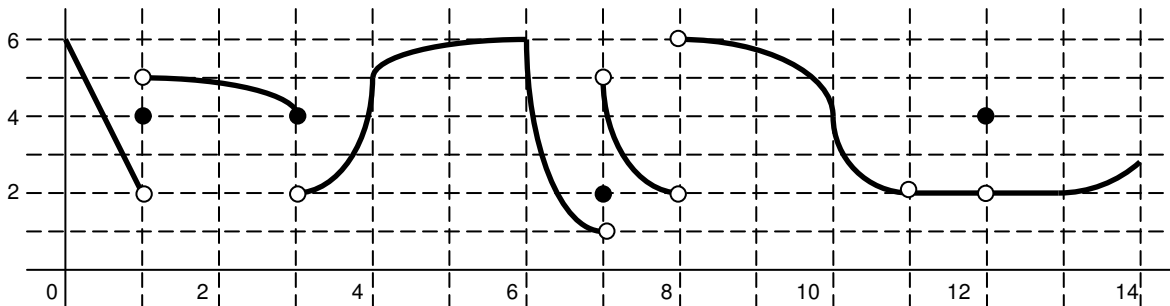
Ch. 3 Sec 1 – 3

7. The function shown is discontinuous at $x =$ _____
 and non-differentiable at $x =$ _____



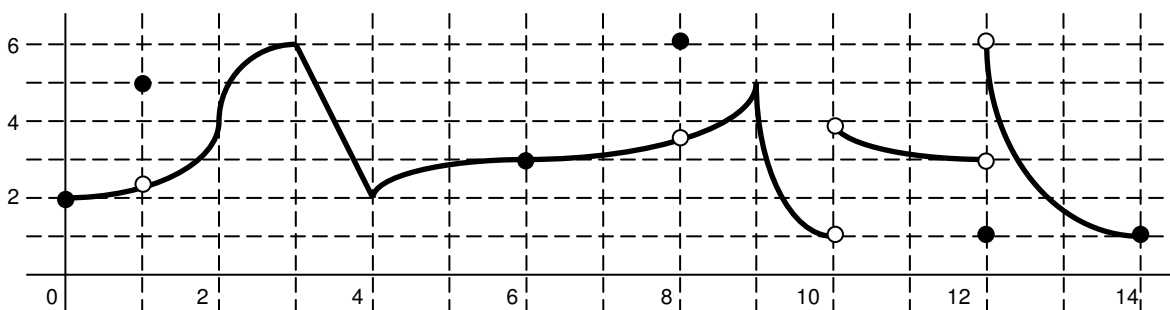
$f(6) =$ ____ $f(3) =$ ____ $\lim_{x \rightarrow 6^-} f(x) =$ ____ $\lim_{x \rightarrow 9} f(x) =$ ____ $\lim_{x \rightarrow 12} f(x) =$ ____

8. The function shown is discontinuous at $x =$ _____
 and non-differentiable at $x =$ _____



$f(1) =$ ____ $f(11) =$ ____ $\lim_{x \rightarrow 3^+} f(x) =$ ____ $\lim_{x \rightarrow 7^+} f(x) =$ ____ $\lim_{x \rightarrow 12} f(x) =$ ____

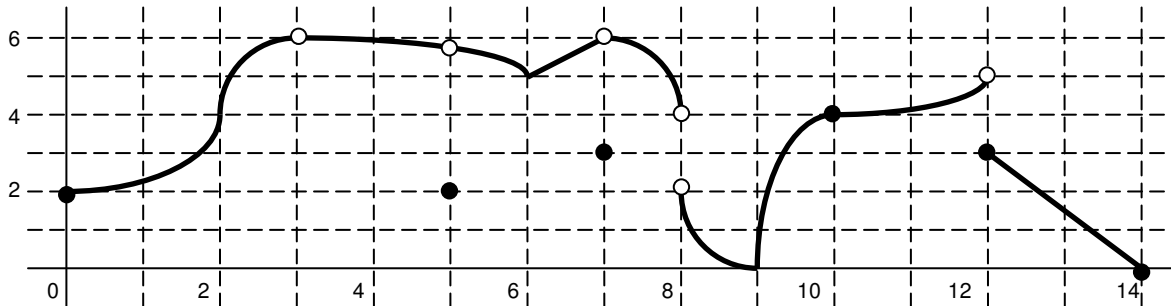
9. The function shown is discontinuous at $x =$ _____
 and non-differentiable at $x =$ _____



$f(6) =$ ____ $f(12) =$ ____ $\lim_{x \rightarrow 3^+} f(x) =$ ____ $\lim_{x \rightarrow 7^+} f(x) =$ ____ $\lim_{x \rightarrow 12} f(x) =$ ____

Ch. 3 Sec 1 – 3

10. The function shown is discontinuous at $x =$ _____
and non-differentiable at $x =$ _____



$f(8) =$ _____ $f(12) =$ _____ $\lim_{x \rightarrow 3} f(x) =$ _____ $\lim_{x \rightarrow 8^+} f(x) =$ _____ $\lim_{x \rightarrow 12} f(x) =$ _____

11. For $f(x) = \begin{cases} x^2 - 4 & , \text{if } x < 3 \\ 5 & , \text{if } x = 3 \\ 8 - x & , \text{if } x > 3 \end{cases}$, $\lim_{x \rightarrow 3^-} f(x) =$ _____ and $\lim_{x \rightarrow 3^+} f(x) =$ _____. Is $f(x)$ continuous at

$x = 3$?

12. For $f(x) = \begin{cases} x^3 + 4 & , \text{if } x < 2 \\ 12 & , \text{if } x = 2 \\ 14 - x & , \text{if } x > 2 \end{cases}$ $\lim_{x \rightarrow 2^-} f(x) =$ _____ and $\lim_{x \rightarrow 2^+} f(x) =$ _____. Is $f(x)$ continuous at

$x = 2$?

13. Suppose $f(x)$, $g(x)$ and $h(x)$ are continuous and increasing functions for all x with integer limits at $x = 4$. Give these limits.

$\lim_{x \rightarrow 4} f(x) =$ _____

$\lim_{x \rightarrow 4} [f(x) \cdot g(x)] =$ _____

$\lim_{x \rightarrow 4} [4 \cdot f(x)] =$ _____

$\lim_{x \rightarrow 4} \sqrt{f(x)} =$ _____

x	$f(x)$	$g(x)$
3.8	14.735	1.2
3.9	15.027	1.7
3.99	15.971	1.89
3.999	15.993	1.98
4.001	16.013	2.03
4.01	16.027	2.17
4.1	16.139	2.89
4.1	17.002	5.62

Continuity and Differentiability

Ch. 3 Sec 1 – 3

14. Suppose $f(x)$, $g(x)$ and $h(x)$ are continuous and increasing functions for all x with integer limits at $x = 4$. Give these limits.

$$\lim_{x \rightarrow 4} f(x) = \underline{\hspace{2cm}}$$

$$\lim_{x \rightarrow 4} [f(x) \cdot g(x)] = \underline{\hspace{2cm}}$$

$$\lim_{x \rightarrow 4} \left[\frac{f(x)}{g(x)} \right] = \underline{\hspace{2cm}}$$

$$\lim_{x \rightarrow 4} \sqrt{f(x)} = \underline{\hspace{2cm}}$$

15. Suppose $f(x)$, $g(x)$ and $h(x)$ are continuous and increasing functions for all x with integer limits at $x = 4$. Give these limits.

$$\lim_{x \rightarrow 4} f(x) = \underline{\hspace{2cm}}$$

$$\lim_{x \rightarrow 4} [f(x) \cdot g(x)] = \underline{\hspace{2cm}}$$

$$\lim_{x \rightarrow 4} \left[\frac{f(x)}{g(x)} \right] = \underline{\hspace{2cm}}$$

$$\lim_{x \rightarrow 4} \sqrt{f(x)} = \underline{\hspace{2cm}}$$

16. Suppose $f(x)$, $g(x)$ and $h(x)$ are continuous and increasing functions for all x with integer limits at $x = 4$. Give these limits.

$$\lim_{x \rightarrow 6} f(x) = \underline{\hspace{2cm}}$$

$$\lim_{x \rightarrow 6} [f(x) \cdot g(x)] = \underline{\hspace{2cm}}$$

$$\lim_{x \rightarrow 6^-} \left[\frac{f(x)}{g(x)} \right] = \underline{\hspace{2cm}}$$

$$\lim_{x \rightarrow 6^+} \sqrt{f(x)} = \underline{\hspace{2cm}}$$

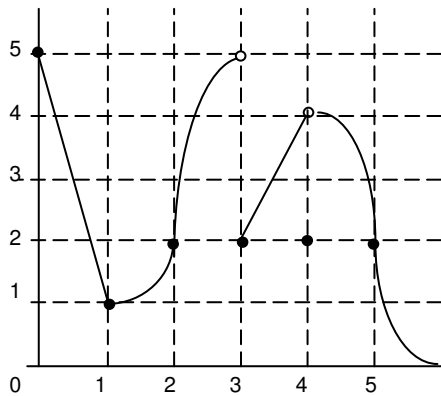
x	f(x)	g(x)
3.8	21	2.7
3.9	22.3	3.8
3.99	24.9	3.99
3.999	24.99	3.995
4.001	25.02	4.003
4.01	25.3	4.12
4.1	27.6	4.7
4.1	29.3	5.2

x	f(x)	g(x)
3.8	31	2.7
3.9	32.3	5.8
3.99	34.9	6.99
3.999	35.99	6.995
4.001	36.02	7.003
4.01	38.3	8.12
4.1	39.6	94.7
4.1	49.3	95.2

x	f(x)	g(x)
5.8	21	2.7
5.9	22.3	3.8
5.99	24.9	3.99
5.999	24.99	3.995
6.001	25.02	4.003
6.01	25.3	4.12
7.1	27.6	4.7
9.1	29.3	5.2

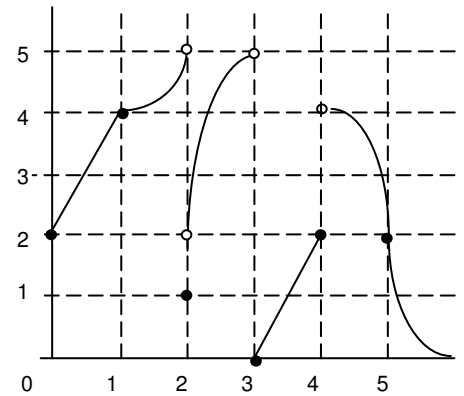
Solutions:

1.



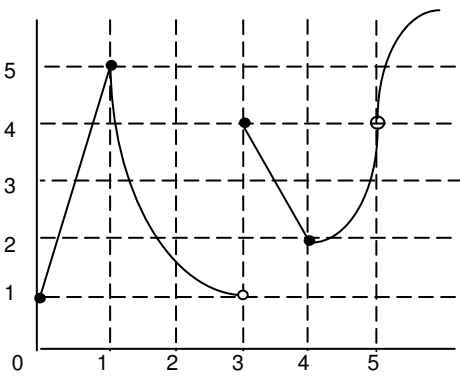
$\lim_{x \rightarrow 3^-} f(x) = \underline{5}$ $f(4) = \underline{2}$

2.



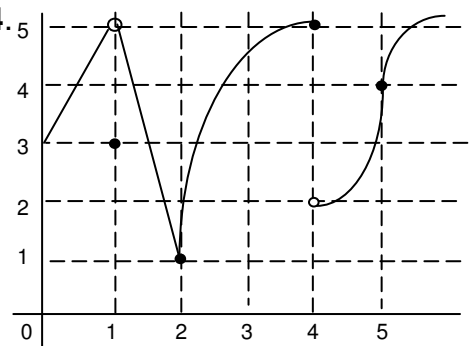
$\lim_{x \rightarrow 3^-} f(x) = \underline{5}$ $f(4) = \underline{2}$

3.



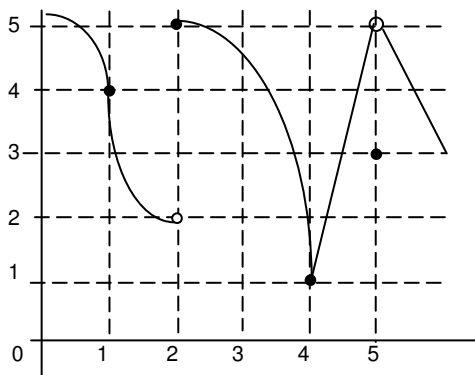
$\lim_{x \rightarrow 5} f(x) = \underline{4}$ $f(3) = \underline{4}$

4.



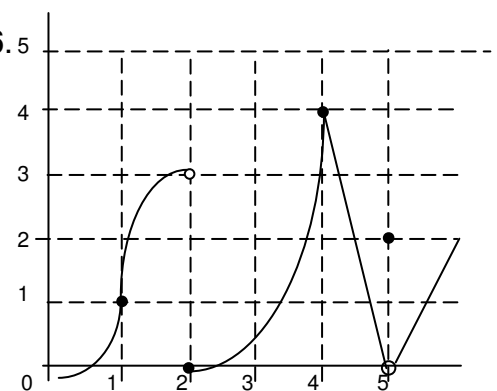
$\lim_{x \rightarrow 4^-} f(x) = \underline{5}$ $f(4) = \underline{5}$

5.



$\lim_{x \rightarrow 5} f(x) = \underline{5}$ $f(4) = \underline{1}$

6.



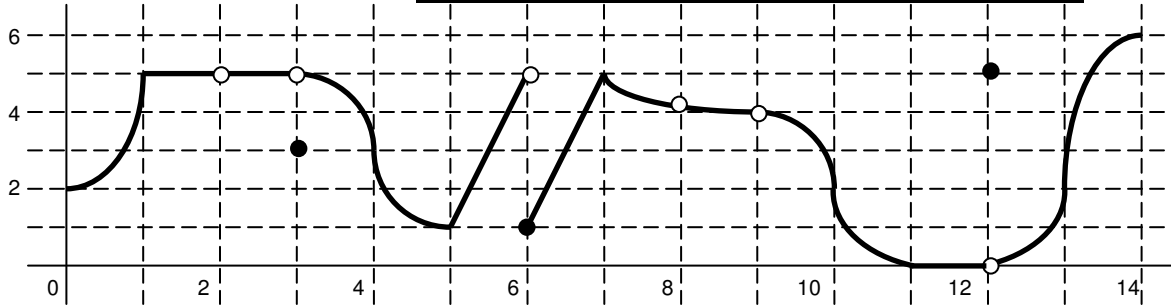
$\lim_{x \rightarrow 4^-} f(x) = \underline{4}$ $f(4) = \underline{4}$

Continuity and Differentiability

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7. The function shown is discontinuous at $x = \underline{2, 3, 6, 8, 9, 12}$

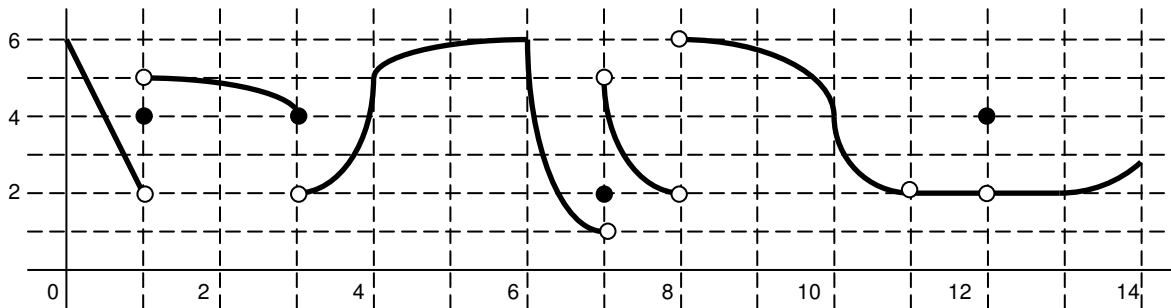
and non-differentiable at $x = \underline{2, 3, 6, 8, 9, 12; 1, 4, 5, 7; 10, 13}$



$f(6) = \underline{1}$ $f(3) = \underline{3}$ $\lim_{x \rightarrow 6^-} f(x) = \underline{5}$ $\lim_{x \rightarrow 9} f(x) = \underline{4}$ $\lim_{x \rightarrow 12} f(x) = \underline{0}$

8. The function shown is discontinuous at $x = \underline{1, 3, 7, 8, 11, 12}$

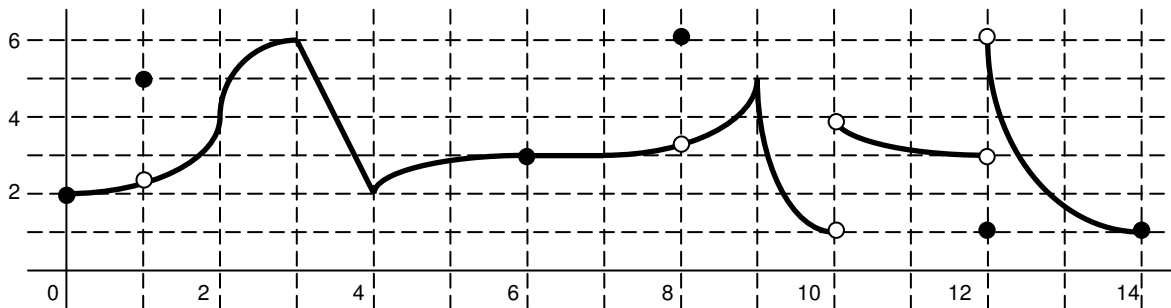
and non-differentiable at $x = \underline{1, 3, 7, 8, 11, 12; 6; 4, 10}$



$f(1) = \underline{4}$ $f(11) = \underline{\text{und}}$ $\lim_{x \rightarrow 3^+} f(x) = \underline{2}$ $\lim_{x \rightarrow 7^+} f(x) = \underline{5}$ $\lim_{x \rightarrow 12} f(x) = \underline{2}$

9. The function shown is discontinuous at $x = \underline{1, 8, 10, 12}$

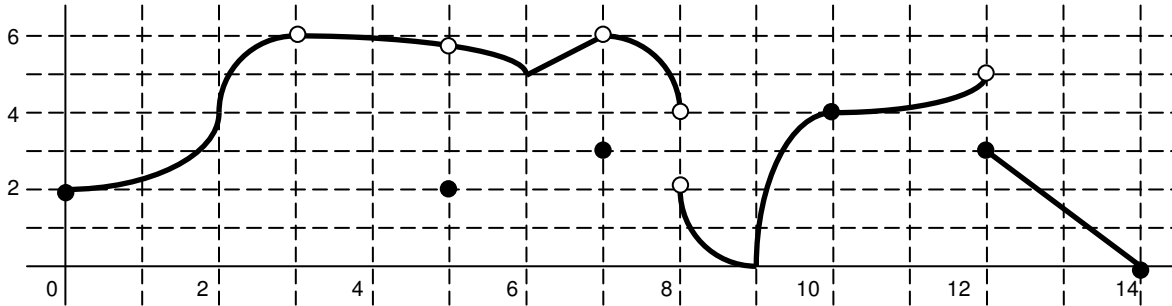
and non-differentiable at $x = \underline{1, 8, 10, 12; 3, 4, 9; 2}$



$f(6) = \underline{3}$ $f(12) = \underline{1}$ $\lim_{x \rightarrow 3^+} f(x) = \underline{6}$ $\lim_{x \rightarrow 7^+} f(x) = \underline{3}$ $\lim_{x \rightarrow 12} f(x) = \underline{\text{undefd}}$

Ch. 3 Sec 1 – 3

10. The function shown is discontinuous at $x = \underline{3, 5, 7, 8, 12}$
 and non-differentiable at $x = \underline{3, 5, 7, 8, 12; 6; 2}$



$f(8) = \underline{\text{undefd}}$ $f(12) = \underline{3}$ $\lim_{x \rightarrow 3} f(x) = \underline{6}$ $\lim_{x \rightarrow 8^+} f(x) = \underline{2}$ $\lim_{x \rightarrow 12} f(x) = \underline{\text{undefd}}$

11. For $f(x) = \begin{cases} x^2 - 4 & , \text{if } x < 3 \\ 5 & , \text{if } x = 3 \\ 8 - x & , \text{if } x > 3 \end{cases}$, $\lim_{x \rightarrow 3^-} f(x) = \underline{5}$ and $\lim_{x \rightarrow 3^+} f(x) = \underline{5}$. Is $f(x)$ continuous at

$x = 3$? Yes

12. For $f(x) = \begin{cases} x^3 + 4 & , \text{if } x < 2 \\ 12 & , \text{if } x = 2 \\ 14 - x & , \text{if } x > 2 \end{cases}$, $\lim_{x \rightarrow 2^-} f(x) = \underline{12}$ and $\lim_{x \rightarrow 2^+} f(x) = \underline{12}$. Is $f(x)$ continuous at

$x = 2$? Yes

13. Suppose $f(x)$, $g(x)$ and $h(x)$ are continuous and increasing functions for all x with integer limits at $x = 4$. Give these limits.

$\lim_{x \rightarrow 4} f(x) = \underline{16}$

$\lim_{x \rightarrow 4} [f(x) \cdot g(x)] = \underline{32}$

$\lim_{x \rightarrow 4} [4 \cdot f(x)] = \underline{64}$

$\lim_{x \rightarrow 4} \sqrt{f(x)} = \underline{4}$

x	f(x)	g(x)
3.8	14.735	1.2
3.9	15.027	1.7
3.99	15.971	1.89
3.999	15.993	1.98
4.001	16.013	2.03
4.01	16.027	2.17
4.1	16.139	2.89
4.1	17.002	5.62

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14. Suppose $f(x)$, $g(x)$ and $h(x)$ are continuous and increasing functions for all x with integer limits at $x = 4$. Give these limits.

$$\lim_{x \rightarrow 4} f(x) = \underline{\quad 25 \quad}$$

$$\lim_{x \rightarrow 4} [f(x) \cdot g(x)] = \underline{\quad 100 \quad}$$

$$\lim_{x \rightarrow 4} \left[\frac{f(x)}{g(x)} \right] = \underline{\quad 25/4 \quad}$$

$$\lim_{x \rightarrow 4} \sqrt{f(x)} = \underline{\quad 5 \quad}$$

15. Suppose $f(x)$, $g(x)$ and $h(x)$ are continuous and increasing functions for all x with integer limits at $x = 4$. Give these limits.

$$\lim_{x \rightarrow 4} f(x) = 36$$

$$\lim_{x \rightarrow 4} [f(x) \cdot g(x)] = 36 \cdot 7 = 252$$

$$\lim_{x \rightarrow 4} \left[\frac{f(x)}{g(x)} \right] = 36/7$$

$$\lim_{x \rightarrow 4} \sqrt{f(x)} = \sqrt{(36)} = 6$$

16. Suppose $f(x)$, $g(x)$ and $h(x)$ are continuous and increasing functions for all x with integer limits at $x = 4$. Give these limits.

$$\lim_{x \rightarrow 6} f(x) = 36$$

$$\lim_{x \rightarrow 6} [f(x) \cdot g(x)] = 252$$

$$\lim_{x \rightarrow 6^-} \left[\frac{f(x)}{g(x)} \right] = 36/7$$

$$\lim_{x \rightarrow 6^+} \sqrt{f(x)} = 6$$

x	f(x)	g(x)
3.8	21	2.7
3.9	22.3	3.8
3.99	24.9	3.99
3.999	24.99	3.995
4.001	25.02	4.003
4.01	25.3	4.12
4.1	27.6	4.7
4.1	29.3	5.2

x	f(x)	g(x)
3.8	31	2.7
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3.99	34.9	6.99
3.999	35.99	6.995
4.001	36.02	7.003
4.01	38.3	8.12
4.1	39.6	94.7
4.1	49.3	95.2

x	f(x)	g(x)
5.8	21	2.7
5.9	22.3	3.8
5.99	24.9	3.99
5.999	24.99	3.995
6.001	25.02	4.003
6.01	25.3	4.12
7.1	27.6	4.7
9.1	29.3	5.2