

University of Calgary
Faculty of Science
Department of Mathematics and Statistics
Worksheet 3 (Limits)
Answers

Calculus 1

Fall 2009

A. Find each of the following limits if they exist. If they do not exist, give reasons for your answers.

$$1. \quad \lim_{x \rightarrow -2} (3x^2 - 2x + 7) = 23$$

$$2. \quad \lim_{x \rightarrow 2} \left(4x^2 - \frac{2}{x} \right) = 15$$

$$3. \quad \lim_{x \rightarrow 2} \left(\frac{x^2 + x - 6}{x^2 + 3x - 10} \right) = \frac{5}{7}$$

$$4. \quad \lim_{x \rightarrow 3} \left(\frac{4x^2 - 7x - 11}{x^2 - 3x - 18} \right) = -\frac{2}{9}$$

$$5. \quad \lim_{x \rightarrow 1} \left(\frac{\sqrt{3x+4} - \sqrt{5x+2}}{\sqrt{2x^2+7x-3}} \right) = \frac{-6}{11\sqrt{7}}$$

$$6. \quad \lim_{x \rightarrow 3} \left(\frac{2x^2 + x - 15}{x^2 + 3x - 18} \right)$$

This limit does not exist since the left and right limits are not equal.

$$7. \quad \lim_{x \rightarrow 2} \left(\frac{4x - 8}{\sqrt{2x+5} - \sqrt{x^2+5}} \right) = -12$$

$$8. \quad \lim_{x \rightarrow 3} \left(\frac{|x-3|}{x-3} \right)$$

This limit does not exist since the left and right limits are not equal..

$$9. \quad \lim_{x \rightarrow 3} \left(\frac{2x^2 - 11x + 15}{x^2 + 3x - 18} \right) = \frac{1}{9}$$

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$$10. \quad \lim_{x \rightarrow 0} \left(\frac{1}{x\sqrt{1+x}} - \frac{1}{x} \right) = -\frac{1}{2}$$

$$11. \quad \lim_{x \rightarrow \frac{3}{2}} \left(\frac{2x-3}{|2x-3|} \right)$$

This limit does not exist since the left and right limits are not equal..

$$12. \quad \lim_{x \rightarrow 2} \left(\frac{2}{x-2} \right)$$

This limit does not exist since the left and right limits are not equal..

$$13. \quad \lim_{x \rightarrow 3} \left(\frac{1}{(x-3)^2} \right) = \infty$$

$$14. \quad \lim_{x \rightarrow 0^-} \left(\frac{1}{x} - \frac{1}{|x|} \right) = -\infty$$

$$15. \quad \lim_{x \rightarrow 0^+} \left(\frac{1}{x} - \frac{1}{|x|} \right) = 0$$

$$16. \quad \lim_{x \rightarrow 1} \left(\frac{x^2-1}{|x-1|} \right)$$

This limit does not exist since the left and right limits are not equal..

$$17. \quad \lim_{x \rightarrow 4} \left(\frac{\sqrt{2x+1}-3}{x^2-16} \right) = \frac{1}{24}$$

$$18. \quad \lim_{x \rightarrow 2} \left(\frac{\sqrt{6-x}-2}{\sqrt{3-x}-1} \right) = \frac{1}{2}$$

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$$19. \quad \lim_{x \rightarrow 4} \left(\frac{\sqrt{2x+1} - x + 1}{x^2 - 16} \right) = -\frac{1}{12}$$

$$20. \quad \lim_{x \rightarrow 2} \left(\frac{2x - \sqrt{5x+6}}{x^2 - 4x + 4} \right)$$

This limit does not exist since the left and right limits are not equal..

B.

1. Find a so that $\lim_{x \rightarrow -2} f(x)$ exists when

$$f(x) = \frac{3x^2 + ax + a + 3}{x^2 + x - 2}$$

Answer: $a = 15$

2. Given that f is defined as given below, find value(s) of k and a so that $\lim_{x \rightarrow -1} f(x)$ exists.

$$f(x) = \begin{cases} \frac{1}{2} + a & x \leq -1 \\ \frac{4kx^2 + (k+4)x + 1}{x^2 - 1} & x > -1 \end{cases}$$

Answer: $a = 1, k = 1.$