Calculus 1 Unit 1 worksheet: Limits by algebra: factoring and rationalizing

Name _____ Date _____ Period _____

1. Evaluate each limit. Substitute first; when you get $\frac{0}{0}$, factor, cancel and substitute again.

(a) $\lim_{x \to 5} \dfrac{x^2 - 2x - 15}{x^2 - 25}$

(b) $\lim_{x \to -2} \dfrac{3x^2 + 5x - 2}{x^2 + 5x + 6}$

(c) $\lim_{x \to 3} \dfrac{x^3 - 27}{x^2 - 2x - 3}$

(d) $\lim_{x \to -3} \dfrac{x^3 + 27}{x^2 + x - 6}$

(e) $\lim_{x \to 2} \dfrac{x^4 - 16}{x^2 - 3x + 2}$

(f) $\lim_{x \to 2} \dfrac{x^3 - 2x^2 - 4x + 8}{x^3 - 4x}$

2. Evaluate each limit. Multiply by a conjugate, and factor what is left if you need to.

(a) $\lim_{x \to 4} \dfrac{\sqrt{x} - 2}{x^2 - 16}$

(b) $\lim_{x \to -1} \dfrac{x + 1}{\sqrt{2x + 6} - 2}$

(c) $\lim_{x \to 5} \dfrac{\sqrt{3x + 1} - \sqrt{x + 11}}{x - 5}$

(d) $\lim_{x \to 3} \dfrac{3 - \sqrt{x + 6}}{x^2 - 3x}$

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3. Expand the numerator, cancel the factor h, and evaluate the limit.

$$\lim_{h\to 0}\frac{(3+h)^2(3-3h)-27}{h}$$

4. Combine the fractions in the numerator, then evaluate each limit.

(a) $\lim_{x\to 2}\dfrac{\frac{x}{x+2}-\frac{1}{2}}{x-2}$ (b) $\lim_{x\to 1}\dfrac{\frac{2}{x^2+1}-1}{x-1}$

5. Evaluate the limit below, and explain why multiplying by one conjugate is not enough.

$$\lim_{x\to 3}\frac{\sqrt{2x+3}-3}{\sqrt{x+13}-4}$$

6. Ava evaluates $\lim_{x\to -2}\dfrac{x^2+3x+2}{x^2+4x+4}$. She factors, cancels one factor $x+2$ to get $\dfrac{x+1}{x+2}$, substitutes, and gets $\dfrac{-1}{0}$. She says: "There is still a zero in the bottom, so I should cancel again."

(a) Explain why there is nothing more to cancel.

(b) Find the limit, or explain why it does not exist.

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